NAEMSP ABSTRACTS

1. THE IMPACT OF PERI-SHOCK PAUSE ON SURVIVAL FROM OUT-OF-HOSPITAL SHOCKABLE CARDIAC ARREST STUDIES: COMPARISON OF CLINICAL OUTCOMES CONSORTIUM (ROC) PRIMED TRIAL

Sheldon Cheskes, Rob Schmiker, Richard Verbeek, David Salcido, Siobhan Brown, Steven Brooks, James Menegazzi, Christian Vaillancourt, Judy Powell, Susanne May, Roman Schulz, Michael Idris, Peter Schmidt, Mike Kampf, Jim Christenson, Sunnynbrook Centre for Prehospital Medicine

Background: Previous research has demonstrated significant relationships between peri-shock pause and survival to discharge from out-of-hospital (OHCA) shockable cardiac arrest. Limitations to this research include small sample sizes and limited participation by all ROC sites. We sought to determine the impact of peri-shock pause on clinical outcomes during the ROC PRIMED randomized controlled trial.

Methods: We included OHCA patients in the ROC PRIMED trial who suffered arrest between June 2007 and November 2009, presenting with a shockable rhythm, and had CPR process data for at least one shock. We excluded patients who received public access defibrillation (PAD) before EMS arrival or EMS-witnessed arrest and those who had missing survival-to-hospital discharge or Utstein variable data. We used multivariable logistic regression to determine the association between peri-shock pause duration and survival to hospital discharge.

Results: Among 2,006 patients studied (78.3% male) the median shock duration (IQR) was pre-shock pause 15.0 seconds (8.0, 22.0) post-shock pause 6.0 seconds (4.0, 9.0), and peri-shock pause 22.0 seconds (14.0, 31.0). In an analysis adjusted for Utstein predictors of survival (age, sex, location, bystander witnessed status, bystander CPR, arrive scene time, and ROC site) as well as CPR quality measures (compression rate, depth, and CPR fraction) the odds of survival to hospital discharge were significantly higher for patients with pre-shock pause <10 seconds (OR 1.52, CI 1.05-2.21) and peri-shock pause < 20 seconds (OR 1.82, CI 1.30-2.53) than controls. Peri-shock pause > 40 seconds was not significantly associated with survival to hospital discharge. Results for numerically intact survival (modified Rankin score = 3) were similar to our primary outcome.

Conclusions: In patients with cardiac arrest presenting in a shockable rhythm during the ROC PRIMED trial, shorter peri-shock pauses were significantly associated with higher odds of survival. Future cardiopulmonary education and technology should focus on minimizing all peri-shock pauses.


2. AIRWAY MANAGEMENT AND OUTCOMES AFTER OUT-OF-HOSPITAL CARDIAC ARREST IN THE CARES NETWORK

Jason McMullan, Ryan Gerecht, Jordan Bonomo, Rachel Robb, Bryan McNally, John Donnelly, Henry Wang, University of Cincinnati

Background: While commonly performed during out-of-hospital cardiac arrest (OHCA) resuscitation, the optimal airway management strategy [endotracheal intubation (ETI), supraglottic airway (SGA), or no advanced airway device] remains unclear. We tested the following hypotheses: 1) ETI and SGA result in similar rates of neurologically intact OHCA survival, and 2) compared with [ETI or SGA], the use of no advanced airway device results in similar rates of neurologically intact OHCA survival.

Methods: We studied adult OHCA cases from 2011 with airway management information in the Cardiac Arrest Registry to Enhance Survival (CARES), a large multicenter North American OHCA registry. Primary exposures were 1) ETI, 2) SGA, 3) no advanced airway. Primary outcomes were 1) sustained ROSC, 2) ED survival, 3) survival to hospital discharge, 4) neurologically intact survival to hospital discharge (cerebral performance category 1-2). We defined propensity scores to characterize the probability of receiving ETI, SGA, or no advanced airway. Using multivariable random effects regression to account for clustering by EMS agency, we compared outcomes between 1) ETI vs. SGA, and 2) [no advanced airway] vs. [ETI or SGA]. We adjusted for Utstein confounders (age, sex, race, witnessed arrest, use of AED initial rhythm, public location, response time) and propensity score.

Results: Of 20,691 OHCA, there were 5,591 (26.7%) ETI, 3,110 (29.3%) SGA, and 1,929 (18.2%) with no advanced airway. Unadjusted neurologically intact survival was: ETI 5.4%, SGA 5.2% and no advanced airway 18.6%. Compared with SGA, patients receiving ETI achieved higher sustained ROSC (OR 1.35; 95% CI 1.19-1.54), ED survival (1.36; 1.19-1.55), hospital survival (1.41; 1.14-1.76) and hospital discharge with good neurologic outcome (1.44; 1.10-1.88). Compared with [ETI or SGA], patients receiving no advanced airway attained higher ED survival (1.31; 1.13-1.49), hospital survival (2.93; 2.50-3.51) and hospital discharge with good neurologic outcome (4.24; 3.46-5.20).

Conclusions: OHCA in the CARES network receiving no advanced airway achieved superior outcomes than those receiving ETI or SGA. When an advanced airway was used, ETI was associated with improved outcomes compared to SGA.

3. LENGTH OF CHEST COMPRESSION PAUSES IS REDUCED WITH CARDIAC RHYTHM ANALYSIS AND CHARGING DURING CHEST COMPRESSIONS

Annamarie Silver, R. Partridge, Zoll Medical

Background: Prolonged chest compression interruptions immediately preceding and following a defibrillation shock have been shown to reduce shock success and survival after cardiac arrest. We tested the hypothesis that compression pauses would be shorter using an AED equipped with a new analysis During Compressions with Fast Reconfirmation (ADC-FR) technology, which features automated rhythm analysis and charging during compressions with a brief reconfirmation analysis during a compression pause, when compared with standard AED mode.

Methods: Basic life support (BLS) certified emergency medical technicians (EMTs) worked in pairs and performed two trials of simulated cardiac resuscitation with a chest compression-sensing X Series defibrillator (ZOLL Medical). Each participant pair was randomized to perform a trial of 8 two-minute compression intervals with the defibrillator in standard AED mode and another trial in ADC-FR mode. A cardiac rhythm generator randomly assigned 4 shockable and 4 non-shockable rhythms for analysis during each compression interval. Subjects were advised to follow the defibrillator prompts, to defibrillate the rhythm if a “shock advised” was issued by the defibrillator, and to switch compressors every 2 intervals. Compression timing and quality data were reviewed using RescueNet Code Review (ZOLL Medical). Data were analyzed using paired t-tests.

Results: Thirty-two EMT-basic prehospital providers (59% male) with a median age of 25 years (IQR 22-27) participated in the study. Chest compression interruptions at the end of each interval were significantly reduced (p < 0.001) for both shockable (13.5 ± 1.2 s AED vs. 9.1 ± 0.9 s ADC-FR) and non-shockable rhythms (12.1 ± 1.2 s AED vs. 7.4 ± 0.7 s ADC-FR). For shockable rhythms, pre-shock pause was reduced significantly with ADC-FR compared with AED use (7.35 ± 0.16 s AED vs. 12.0 ± 0.22 s ADC-FR, p < 0.001) whereas post-shock pause was similar (1.77 ± 0.14 s AED vs. 2.08 ± 0.14 s ADC-FR, p = 0.1). Conclusion: Interruptions in chest compressions associated with rhythm analysis and charging can be reduced with the use of a novel defibrillator technology, ADC-FR, which features automated rhythm analysis and charging during compressions.

4. DOES PREPARATION FOR ROC CARDIAC ARREST TRIALS IMPROVE SURVIVAL FOR THOSE INCLUDED IN THE CONTROL GROUPS?

Philip Moran, Central East Prehospital Care Program of Ohio

Background: The American Heart Association recommends biannual recertification for
advanced cardiac life support (ACLS) because skills deteriorate over time. When large cardiac arrest trials are going to begin, there is often training in cardiac arrest management outside of the routine cycle, so that training occurs more frequently than biannually. The hypothesis is that frequent training will increase survival in out-of-hospital cardiac arrest.

Methods: All out-of-hospital cardiac arrests from the Toronto Resuscitation Outcomes Consortium EpiSystem between 2007 and 2012 were assessed. Patients treated between ROC cardiac arrest trials were compared to those treated in the control groups of ROC trials; paramedics would be randomized either to receive retraining in ACLS or not. The EpiSystem, with its regular training schedule prior to a trial.

Results: Patients treated in the control groups had a higher risk of death prior to hospital discharge than those treated between trials (RR 1.52; p < 0.001). After adjusting for age, gender, location, witnessed arrest, bystander CPR, and AED use, the odds of death were greater in those treated in the control groups of trials (OR 1.44; 95% CI 1.23-1.68; p < 0.001). Analysis of patients presenting with pulseless ventricular tachycardia/ventricular fibrillation yielded similar results. The peak of chest compression (RR 1.35; p < 0.001) and after adjusting for other factors (OR 1.50; CI 1.23-1.82; p < 0.001).

Conclusion: In this comparison, there was no improvement in CPR quality in hospital discharge with more frequent training. Prospective evaluation of more frequent training and its effect on survival should be performed.

5. AN EVALUATION OF CHEST COMPRESSION FRACTION AND PERISHOCK PAUSES IN PATIENTS ENROLLED IN THE LUCAS IN CARDIAC ARREST (LINC) TRIAL

Alexander Esibov, Fred Chapman, Isabelle Banville, Robert Walkes, Rene Boomsar, Martyn Innes, Andrew Arnowald, Sten Rubbertsson, Physio-Control

Background: The LINC trial, described at www.sjtem.com/content/21/1/5, compared conventional cardiopulmonary resuscitation (CPR) with an approach that included mechanical chest compressions (LUCAS, Physio-Control, Redmond, WA) and defibrillation during ongoing compressions (L-CPR). One important aspect of CPR quality is the fraction of time the patient recovers chest compression fraction (CCF). Another, perishock pause, is the total pause time surrounding shock administration. Our primary objective was to measure CCF and perishock pauses in patients with out-of-hospital cardiac arrest (OHCA) enrolled in LINC and treated with L-CPR and M-CPR.

Methods: The LINC trial randomized 2,589 patients with OHCA to L-CPR or M-CPR. In two of the six study sites, electronic downloads of continuous ECG and impedance data from LIFEPAK 12 monitor defibrillators (Physio-Control) were collected. We analyzed 248 available records to determine CCF over the first 10 minutes of recorded data, and recorded data for all shocks if CCF were less than 8 minutes of data, CCF was measured over the available interval. Some L-CPR recordings included a combination of initial manual CPR, deployment of LUCAS, and mechanical compressions thereafter. Therefore, the CCF for L-CPR patients was calculated in two ways, one over the first 10 minutes of recorded data. Both methods yielded similar results over the first 10 minutes after the minute when LUCAS was deployed. Results: Median (interquartile range) CCF was 0.785 (0.709, 0.849) for the 114 M-CPR patients treated between 2007 and 2012. 0.840 (0.775, 0.907) for the 134 L-CPR patients (p < 0.0001, Mann-Whitney U test). In patients treated with L CPR, LUCAS was applied and mechanical compressions started within 5 minutes of the beginning of recorded signals in 119 (89%) cases. Beginning with the minute following LUCAS deployment, the median CCF for L-CPR patients over the monitored period was 0.938 (0.903). The perishock pause was 9 seconds (6, 16) for M-CPR and 0 seconds (0, 6) for L-CPR (p < 0.0001). During LUCAS use, 70.4% of shocks were delivered with a preceding compressions.

Conclusion: Good chest compression fractions were achieved in both groups, indicating high-quality CPR. Furthermore, patients treated with L-CPR showed a significantly higher CCF and shorter perishock pauses, than patients treated with conventional CPR.

6. PARAMEDIC DIAGNOSTIC ACCURACY OF ST-ELEVATION MYOCARDIAL INFARCTION ON 12-LEAD ECG: A SYSTEMATIC REVIEW

Osama Lounabi, Jennifer McVey, Brent Deaveu, Jan Jensen, Yves Leroux, Andrew Travers, Dalhousie University, Emergency Health Services Nova Scotia

Background: In many EMS systems, physician electrocardiographic (ECG) interpretation is required to diagnose ST-elevation myocardial infarction (STEMI) in the prehospital setting. This requires time for ECG transmission and communication to the hospital to support reperfusion. The objective of this systematic review was to determine accuracy of paramedic interpretation of ECG for STEMI patients in the prehospital setting when compared to physician interpretation.

Methods: Diagnostic studies were identified using EMBASE, MEDLINE, CINAHL, the Cochrane Review Database, and hand searching, bibliographies, and author contact. Studies where STEMI diagnosis by paramedics was compared against diagnoses made by non-paramedics were selected. Two authors conducted independent review for inclusion at the review of title, abstract, and full article stages, with agreement measured with kappa. Disagreement was resolved with third party adjudication. Editorials, opinions, and non-systematic reviews were excluded. Diagnostic accuracy (sensitivity, specificity, and likelihood ratios) was abstracted and reported. Results: Our search identified a total of 4,897 references, of which 21 met final inclusion. Inter-rater agreement was good above 0.5 (p < 0.01) and above 0.5. In the included studies, there were a total of 4,787 STEMI ECGs read by paramedics. Five studies compared ECGs from real-life scenario, and 1,769 interpreted in a simulation setting. The pooled sensitivity and specificity of all trials was 92.1% (95% CI 90-94.2%), and 94.7% (95% CI 93-94.6%), respectively, with a positive likelihood ratio of 17.4 and a negative likelihood ratio of 0.038. There was great variability among studies in the level of training for paramedics for ECG interpretation of STEMI.

Conclusion: Paramedics are able to interpret ECGs for the diagnosis of STEMI with a high degree of sensitivity and specificity in both simulation and real-world settings. Parametric diagnosis of STEMI on ECG greatly increases the likelihood of the presence of STEMI. Further investigation is required to determine if paramedic diagnosis of STEMI on ECG has an impact on time to definitive therapy or patient outcomes.

7. EPINEPHRINE REDUCES CAROTID BLOOD FLOW DURING CARDIOPULMONARY RESUSCITATION IN A PORCINE MODEL OF CARDIAC ARREST

Weilun Quan, Giuseppe Ristagno, Wanchun Tang, ZOLL Medical

Background: Epinephrine (epi) administered during CPR improves resuscitation. However, its effect on long-term outcome is still controversial. Moreover, decreases in cerebral microcirculation after epinephrine have been earlier reported in a model with a left ventricular (LV) or (VF) cardiac arrest. We now sought to investigate the effects of epi on carotid blood flow (CBF) during CPR in a porcine model of post shock electrical arrest/ventricular fibrillation (EF) cardiac arrest.

Methods: Nine domestic pigs weighing 22-24 kg were anesthetized, endotracheally intubated, and mechanically ventilated. Aortic and right atrial pressures were invasively monitored and coronary perfusion pressure (CPP) calculated. CBF was continuously monitored by a Transonic flow probe. VF was electrically induced and PEA produced by delivering electrical countershock(s). CPR, including mechanical chest compression, ventilation, and defibrillation, was then initiated and continued for 15 min. Epi (20 mg/kg) was administered into the right atrium after 2 min of CPR and repeated every 3 min thereafter. If animals were resuscitated, after 30 minutes recovery, the study sequence was repeated. Results: A total of 19 experimental cycles were completed with a mean of 2 ± 1 cycle/pig. CBF significantly increased from 14 ± 6 mmHg before epi to a peak of 32 ± 8 mmHg at 1 min after epi administration. Concurrent to CBF increases, CBF decreased from 46 ± 19 mL/min before epi to the lowest value of 22 ± 7 mL/min (p < 0.01) after 2 min. The increase in CBF and decrease in CBF persisted beyond 3 min after epi. However, while CBF already decreased to 24 ± 12 mmHg, CBF perished with a low flow of 2 mL/min after epi. Conclusions: In this model, administration of epi significantly increased CBF during CPR. Increases in CBF, however, were not accompanied by increases in CPP, which was markedly reduced following epi.

8. THE IMPACT OF CHEST COMPRESSION RELEASE VELOCITY ON OUTCOMES OF OUT-OF-HOSPITAL CARDIAC ARREST

Sheldon Cheskes, Adam Byers, Cathy Zhan, Laurie Morrison, Annemarie Silver, Sunnybrook Centre for Prehospital Medicine

Background: Previous studies have demonstrated significant relationships between CPR quality metrics and survival to hospital discharge from out-of-hospital cardiac arrest (OHCA) cardiac arrest. Recently a new metric, chest compression release velocity (CCRV), has been associated with improved survival from OHCA. The study objective was to determine the impact of CCRV on survival from OHCA. Methods: We performed a retrospective review of prospectively collected data on all treated adult OHCA occurring over a one-year period (Jan 2012 – Jan 2013) in two Canadian EMS agencies. CPR metrics of chest compression fraction (CCF), compression rate, compression depth, shock pulse duration, and CCRV were abstracted from impedance channel measurements during each resuscitation. Cases of public access defibrillation, EMS-witnessed arrest, and those missing any Utstein variable or discharge status data were excluded. We performed a multivariable regression analysis to determine the impact of CCRV on survival to hospital discharge. Secondary outcome measures were the impact of CCRV on return of spontaneous circulation (ROSC) and neurologically intact survival at hospital discharge (MRS = 0). In addition, 21 patients who completed 153 cases were treated OHCA, 61 met inclusion criteria. The median (IQR) age was 71 (60.7, 81.6) with 394 (64.6%) being male. 140 (22.9%) presented with ventricular fibrillation and 349 (57.1%) asystole. The median (IQR) CCRV quality metrics were CCF 0.51 (0.73, 0.85), compression rate 105/min (101, 115), compression depth 49.9 mm (42.5, 56.7), pre-shock pulse 135 sec (8, 19), and...
post-shock pause 3.5 sec (2.8, 5). The median (IQR) CCRV (mm/sec) among 49 survivors was compared to 120 (102.9, 140) in 562 non-survivors (p = 0.009). When adjusted for CPR metrics and Utstein variables, the odds of survival to hospital discharge for each 10 mmHg lower CCRV was 1.19 (95% CI: 1.07, 1.31). Similarly the odds of ROSC and neurologically intact survival were 1.02 (95% CI: 0.99, 1.05) and 1.03 (95% CI: 0.98, 1.08), respectively. Conclusions: When adjusted for Utstein variables and CPR quality metrics, CCRV was not significantly associated with outcomes from OHCA. Our findings may have been impacted by the overall survival rate in our study cohort.

9. COMPARISON OF TWO LENGTH-BASED TAPE SYSTEMS FOR PEDIATRIC RESUSCITATION

Lara Rappaport, Maria Mandt, Timothy Givens, Ashley Balkas, Kevin Waters, Konley Lowell, Roxanna Lefort, Kathleen Adelgais, University of Colorado, Aurora Fire Department

Background: The use of a length-weight-based tape (LBT) for equipment sizing and drug dosing for pediatric patients is recommended in a joint statement by ACS and NAEMSP. The Broselow™ tape is widely used and accepted in hospital and prehospital settings. A new system, known as Handtevy™, allows rapid determination of critical drug doses without performing calculations. Our objective was to compare two LBT systems for accuracy of dosing and time to medication administration in simulated prehospital scenarios. Methods: This was a randomized cross-over trial comparing the Broselow™ and Handtevy™ LBT. We enrolled ALS-certified prehospital providers (PHPs) and assessed baseline comfort level with the LBT and Handtevy™ use. Participants performed 2 pediatric resuscitation simulations: cardiac arrest with epinephrine administration and hypoglycemia mandating dextrose. Participants repeated each scenario utilizing both LBT systems with a change in patient age to prevent memorization of dose when switching between LBTs. Facilitators recorded the time to measure and select the LBT, the time to identify the appropriate dose, and time to administration. Errors in dosing were assessed by monitoring medication preparation and the volume administered. We controlled 36 PHPs performing 144 simulations. Median baseline comfort level with Broselow™ was 3 (Comfortable) compared to 1 (Not At All) for Handtevy™, and 66.8% reported using a LBT in the last year. For both epinephrine and dextrose, there was no difference in time to measurement with the LBT (17 vs. 17 seconds) or time to dose identification (44 vs. 47 seconds). For epinephrine, the LBTs were similar in time to administration (99 vs. 98 seconds) and accuracy (83% vs. 86%). Dextrose administration was faster (185 vs. 243 seconds, p < 0.05) and more accurate (91% vs. 34%, p < 0.05) with Handtevy™ compared to Broselow™. In a post-simulation survey, the majority of participants perceived the Handtevy™ system as faster (89.2%) and more accurate (85.8%), and preferable (89.2%). Conclusion: For prehospital providers, the Handtevy™ system is faster and more accurate for dextrose administration compared to the Broselow™ LBT, preserving time to administration and accuracy of epinephrine in pediatric (1-115) and adult (13+15) scenarios. After comparison of both systems, the majority of PHPs indicate preference for the Handtevy™ system.

10. A RANDOMIZED CONTROLLED TRAIL OF A NOVEL APPLICATION OF CHEMICAL COLD PACKS FOR TREATMENT OF EXERCISE-INDUCED HYPERThERMIA

John Lissoway, Grant Lipman, Dennis Grahn, Vinh Cao, Michael Shaheen, Samson Phan, Eric Weiss, Craig Heller, Stanford University

Background: Heat associated illness is a common disease with significant morbidity and mortality around the world. Despite improved therapy for efficacy, a traditional cooling technique in the prehospital environment is applying chemical cold packs (CCPs) to skin covering the large vessels of the neck, groin, and axilla. An alternative placement of CCPs to the glabrous skin surfaces that contain densely packed subcutaneous vascular structures may be more efficacious. The objective was to determine the cooling effect of CCPs applied to the neck, groin, and axillae versus glabrous skin of the cheeks, palms, and soles in exercised-induced hyperthermia. Methods: In this prospective randomized crossover trial, 10 healthy adult male volunteers walked on a treadmill in a heated room (40 ± 0.5 °C, relative humidity 20-35%) wearing insulated military overgarments. Esophageal temperature (Tes) was monitored throughout the trials. The primary stop criterion for exercising was hypoglycemia (blood glucose ≤ 60 mg/dL). The subjects were then rested in the hot room for 30 minutes. Each subject participated in three heat stress trials: a no treatment trial followed by two randomly ordered cooled trials (neck, groin, axilla) or glabrous (cheeks, palms, soles). Participants were separated by a minimum of 2 days. Results: With no treatment, Tes decreased by 0.4 ± 0.2 °C in the first 5 min, then stabilized for the ensuing 25 min (R2 = 0.007). Traditional cooling decreased mean Tes decreased by 0.4 ± 0.2 °C in the first 5 min, followed by 0.04 °C/C/10 min, R2 = 0.989. Glabrous skin cooling further enhanced the treatment effect with a mean Tes decrease of 0.6 ± 0.2 °C in the first 5 min of rest. The linear decline of Tes was 0.3 ± 0.06 °C/10 min, R2 = 0.983; p < 0.001. Two-way ANOVA revealed significant effects of glabrous versus traditional CCP placement at 5-30 minutes of the recovery period (p < 0.001). Conclusion: Application of CCPs to glabrous skin surfaces was more effective for treating exercise-induced hyperthermia than the traditional cooling paradigm. This novel cooling technique may be beneficial in reducing morbidity and mortality of heat illness by EMS in the prehospital environment.

11. MORTALITY AS A FUNCTION OF PREHOSPITAL SYSTOLIC BLOOD PRESSURE IN MAJOR TRAUMATIC BRAIN INJURY: WHAT IS THE OPTIMUM PRESSURE FOR SURVIVAL?

Uwe Stolz, Bentley Bobrow, Daniel Spalte, Joshua Gathe, Vatsal Chhikana, Duane Sershill, Michael Sotelo, Bruce Barnhart, Chad Viscusi, David Adelson, Terry Mullins, Will Humble, Kurt Denninghoff, University of Arizona, Arizona Department of Health Services

Background: Hypertension is known to significantly increase mortality in Traumatic Brain Injury (TBI). The EMS TBI Guidelines recommend treating SBP < 90 in patients 10 years of age or older. Since most studies evaluating the association between SBP and mortality have focused nearly exclusively on hypertensive patients, we examined the entire range of observed values and to identify the range of SBP values associated with maximum odds of survival. Results: Among nearly 9,000 included patients, the lowest prehospital value of SBP (SBP + SBP2) produced a linear relationship between SBP and mortality in the logit scale. A LR model with transformed SBP and the EMS SBP of 147 mmHg to be associated with the lowest probability of death (7.6%) with a nearly perfect inverted bell curve and remarkably tight 95% confidence intervals. A probability of death was plotted versus SBP across its entire range. Representative “mirror-image” low and high SBPs versus mortality are as follows: SBP = 120 mmHg or 180 mmHg (10% mortality); 110 mmHg or 190 mmHg (12%); 100 mmHg or 200 mmHg (14%); 90 mmHg or 210 mmHg (16%); 80 mmHg or 220 mmHg (20%); 70 mmHg or 230 mmHg (26%); 60 mmHg or 240 mmHg (34%); 50 mmHg or 250 mmHg (50%); 40 mmHg or 260 mmHg (63%). Conclusions: In this statewide, multisystem analysis of major TBI patients, an SBP of 150 mmHg was associated with the lowest mortality. The general consensus in the EMS literature and the TBI Guidelines state that SBP is a significant clinical issue when it is very low (e.g., <90 mmHg) or very high; this may not be true. Further study is needed to identify the potential therapeutic implications of these findings.

12. WHEN SHOULD YOU TEST FOR AND TREAT HYPOGLYCEMIA IN PREHOSPITAL SEIZURE PATIENTS?

Daniel Beskind, Suzanne Rhodes, Uwe Stolz, Brett Birrer, Thomas Mayfield, Scott Bourn, Kurt Denninghoff, University of Arizona, American Medical Response

Background: Seizure is a frequent reason for activating the emergency medical system (EMS). Little is known about the frequency of seizure caused by hypoglycemia, yet many EMS protocols require treatment of hypoglycemia. We hypothesized that hypoglycemia is rare among EMS seizure patients and that glucose testing results in delayed administration of benzodiazepines. Methods: We performed a retrospective study of a national ambulance service database encompassing 140 EMS systems spanning 40 states and Washington, DC. All prehospital calls from August 1, 2010 through December 31, 2012 with a primary or secondary impression of seizure that resulted in patient treatment or transport were included. Data are reported using descriptive statistics along with 95% confidence intervals (CI) or interquartile ranges (IQR), as appropriate. Multivariable truncated regression with cluster (EMS agency) adjusted standard errors was used to determine if time to benzodiazepine administration was significantly related to blood glucose testing. Results: Of 2,052,534 total calls, 7%, (18,774) were for benzodiazepine treatment. Of these, 83% (15,365 (69.9%) of these having a glucose measurement recorded. Hypoglycemia (blood glucose ≤50 mg/dL) was present in 63% (1,249, 61% CI 1.1, 1.3%) of these 18,774, and 475 (2.6%) of these were treated with a glucose product. A benzodiazepine was administered to 73 (11.4%, CI 9.0, 13.6%) of the 638 hypoglycemic patients. Overall, treatment of seizure patients with a benzodiazepine occurred in 6,389 (8.3%; CI 8.1, 8.5%) cases and treatment with a glucose product occurred in 975 (1.5%; CI 1.4, 1.6). Multivariable regression showed that obtaining a blood glucose measurement prior to benzodiazepine administration compared to no glucose measurement or glucose measurement after
benzodiazepine administration was independently associated with a 2.9-minute (CI, 2.0, 3.8) and 9.3-minute (CI, 10.4) delay in benzodiazepine administration by EMS, respectively, controlling for age, history of diabetes, and route of benzodiazepine administration. Conclusion: In our study, benzodiazepine administration by EMS was significantly associated with delays in dispatching paramedics to patients treated by EMS for seizure. Glucose measurement before benzodiazepine administration was associated with a significant delay in benzodiazepine administration. These data suggest that benzodiazepine administration should take precedence over blood glucose determination in patients who are actively seizing. Future prospective studies are needed.

13. EMERGENCY MEDICAL DISPATCH
CONSULTATION OF POISON CONTROL CENTER CAN DECREASE EMS TRANSPORTS AND CHARGES

Marc Eckstein, John Flores, Stephen Sanko, Shira Schlesinger, Michael Levine, Keck School of Medicine of USC, Los Angeles Fire Department

Background: The public commonly calls 9-1-1 for unintentional ingestions, rather than calling poison control in Los Angeles, the 9-1-1 dispatcher determines if an ingestion meets “omega-1” classification, meaning the ingestion is accidental, the patient is awake with normal breathing and skin color, and the ingestion does not involve convulsions, caustic, methamphetamine, narcotics, or tricyclic antidepressants. Under such circumstances, poison control is contacted prior to dispatch of paramedics. If poison control advises that the patient can remain at home, EMS is notified. We evaluated the ED charges and LOS differences to remain home by poison control. The charge for ALS transport, excluding mileage, is $1,750. Previous studies involving patients seeking care in an ED have shown that poison control recommendations to remain home have estimated the ED costs to remain home by poison control to be $1,152 per patient. The primary objective of this study was to determine how many transports were averted by involvement of a regional poison control center in overdose dispatches. A secondary objective was to estimate the potential charges saved by poison control. A retrospective review was performed of all overdose calls made to the Los Angeles Fire Department between January 2008 and June 2012. All “omega-1” calls were reviewed by a blinded to clinical decision process poison control study hypothesis, after obtaining a brief in-depth instructional overview in data abstraction. Each call culminating in an EMS dispatch was subsequently reviewed by two additional reviewers. Simple descriptive statistics were utilized.

Results: During the 54-month span, 318 cases received “omega-1” dispatch classification. EMS was dispatched 19 times (5.9%) and 11 patients (3.4%) were ultimately treated in the ED. Of the 11 transports, the most common reasons for transport were ambiguity over the ingested agent or amount and patient/family insinuations. Using these charge estimates, routine consultation of poison control as part of EMS dispatch in Los Angeles was associated with an annual savings of $20,000 in patient charges. Conclusion: Routine consultation of a poison control system by emergency medical dispatchers can reduce unnecessary transports, ambulance transports, and ED charges to patients. It is impossible to determine that some of these patients did not ultimately seek care on their own.

14. EFFECTS OF A MOBILE HEALTH PARAMEDIC PROGRAM ON THE REDUCTION OF 9-1-1 USE BY FREQUENT CALLERS

Veer Vithalani, Jeff Beeson, Sean Burton, JPS Health Network

Background: A common problem in the current health-care delivery model is frequent use of 9-1-1 by patients with non-emergent conditions. In an effort to decrease the frequency of 9-1-1 use by this subset of patients, a Mobile Health Paramedic (MHP) program was implemented at our institution. We evaluate the effect of the MHP program on frequency of 9-1-1 use by this type of patient. Methods: The 9-1-1 database was searched to identify patients who called 9-1-1 one or more times in any 90-day period. Those identified were offered the opportunity to volunteer for enrollment in the MHP program. Visits by an MHP were scheduled, and patients were queried as to frequency for frequency of 9-1-1 use were evaluated. Care plans were developed to help patients better manage their health-care needs and overcome difficulties in navigating the health-care system. Patients were also given a 10-digit phone number as an alternative to 9-1-1 in non-emergency situations. This was answered by emergency medical dispatchers, who followed protocols to identify the appropriate response to meet the patient’s needs, which could include a MHP or traditional emergency response. Upon demonstration of the patient’s ability to manage their individual health-care needs and appropriate utilization of 9-1-1, patients were graduated from the MHP program. A retrospective analysis of 9-1-1 calls from the MHP program patients between July 1, 2009 and June 30, 2013 was performed. Patients with 12 months of data prior to enrollment and 12 months after graduation were evaluated for any change in frequency of 9-1-1 use. Results: 45 of the 70 patients enrolled in the MHP program met the inclusion criteria. The average frequency of 9-1-1 use for the 12-month pre-enrollment period was 28.31. The average frequency of 9-1-1 use for the 12 months after graduation was 3.22, an 85.37% decrease (p < 0.0001). Fourteen patients had no 9-1-1 calls after graduation. The average length of enrollment in the MHP program was 6.98 months. Conclusion: A MHP program can significantly decrease 9-1-1 use by frequent callers.

15. PREHOSPITAL NITROGLYCERIN IN TACHYCARDIC CHEST PAIN PATIENTS: RISKY OR NOT?

Marie-Hélène Proulx, Dave Ross, Charlene Vacon, Louis Juste, Luc de Montigny, Eli Segal, Urgences-santé, McGill University

Background: Nitroglycerin (NTG) is administered by emergency personnel to chest pain patients. The appropriate use of NTG against its known risks. Pain protocols should weigh the potential benefits of NTG administration against its known risks.

16. COMPRESSIONS DURING DEFIBRILLATOR CARDIAC ARREST
CHARGING SHORTENS SHOCK PAUSE DURATION
AND IMPROVES CHEST COMPRESSION FRACTION
DURING SHOCKABLE OUT-OF-HOSPITAL CARDIAC ARREST

Sheldon Cheskes, Matthew Common, Adam Byers, Cathy Zhan, Laurie Morrison, Sunnybrook Centre for Prehospital Medicine, University of Toronto

Background: Previous studies have demonstrated significant relationships between shock pause duration and survival to hospital discharge from out-of-hospital (OHCA) shockable cardiac arrest. Compression de-
size is required to determine the impact of this technique on clinical outcomes from shockable OHCA.

17. PREHOSPITAL ASPRIN ADMINISTRATION FOR ACUTE CORONARY SYNDROME (ACS) TO REDUCE MORTALITY. While timely administration of aspirin has shown to reduce mortality in ACS by 23%, prior regional EMS data have shown inadequate aspirin use in patients with suspected cardiac ischemia. Using the National EMS Information System (NEMSIS) database, we sought to determine 1) the proportion of patients with suspected cardiac ischemia who received aspirin, and 2) which patient characteristics independently predicted administration of aspirin. Methods: Analysis of the 2011 NEMSIS database targeted patients ≥40 years old with a primary impression of ‘chest pain’. To identify patients with chest pain of suspected cardiac etiology, we included those with EKG or cardiac monitor performed. Trauma related chest pain and basic life support transports were excluded. The primary outcome was defined as presence of aspirin administration. Patient characteristics of age, gender, ethnicity/race, insurance status, and United States region were also obtained. Multivariate logistic regression was used to assess the independent association of patient factors with aspirin administration for suspected cardiac ischemia. Results: Of the total 14,371,941 EMS incidents in the 2011 database, there were 198,231 patients who met our inclusion criteria (1%). Of those, 45.4% received aspirin from the EMS provider. When compared to Non Hispanic White patients, several groups had greater odds of receiving administration by emergency medical services: Non Hispanic Blacks (OR 1.49, 95% CI 1.44-1.55), Non Hispanic Asians (OR 1.62, 95% CI 1.51-1.55), Non Hispanic Whites (OR 1.49, 95% CI 1.44-1.51) all had greater odds of receiving aspirin. Patients living in the southern region of the United States (OR 0.85, 95% CI 0.81-0.89) and patients with government insurance (OR 0.67, 95% CI 0.57-0.78) had lower odds of receiving aspirin. Age and gender (OR 1.00 95% CI 1.00-1.00) were not associated with aspirin administration. Conclusions: Our results confirmed that aspirin administration for suspected ACS could be improved. There were regional, ethnic/racial, and insurance-based disparities noted in aspirin administration. Further qualitative assessment of these practice variations will help identify and develop interventions to improve quality of prehospital ACS care.

18. CHARACTERISTICS OF PATIENTS WHO DO NOT UNDERGO PCI AFTER PREHOSPITAL CARDIAC CATHETERIZATION LAB ACTIVATION

Paul Muese, Jonathan Studnek, Allison Inman, William Campbell, Eric Rackley, Up Garvey, Carolina's Medical Center, Mecklenburg EMS Agency

Background: Prehospital activation of cardiac catheterization labs (CCL) has been demonstrated to improve the morbidity and mortality of acute myocardial infarction from a ST elevation myocardial infarction (STEMI). Reducing the incidence of false activations could improve the efficiency of these types of protocols. The objective of this analysis was to assess the clinical and economic characteristics associated with administration of a STEMI to the prehospital setting to determine which characteristics were associated with not undergoing primary coronary intervention (PCI). Methods: We performed a retrospective analysis of prehospital CCL activations in a single urban EMS system between May 2008 and March 2011. Data were extracted from the prehospital patient record, prehospital ECG, and the regional STEMI database. Patients with a prehospital STEMI activation were classified as either not having a PCI or undergoing a PCI. The presence of a lesion treatment time in the STEMI database. Independent variables included objective patient characteristics: age, sex, race, heart rate, systolic blood pressure, presence of a bundle branch block (BBB), left ventricular hypertrophy (LVH), QRS complex duration, and other comorbidities (e.g., diabetes or hypertension). Cases with incomplete records, missing prehospital reports, missing prehospital ECG, or cases with violations of the prehospital STEMI activation protocol were excluded from analysis. Results: Of the total 481 prehospital STEMI activations during the study period with 231 complete records. The variables associated with an increased likelihood of not having a lesion treatment by type of BBB (OR = 4.6; 95% CI: 1.91-11.27, LVH (OR = 5.8; 95% CI: 2.81-12.16), and race other than white (OR = 2.8; 95% CI: 1.64-4.90). Increased age and heart rate were also associated with not having lesion treatment. Of the comorbidities analyzed none were statistically significant. One clinical characteristic (presence of arm pain) was shown to decrease the odds of not undergoing PCI (OR = 0.36; 95% CI: 0.20-0.66). Conclusions: There were several variables associated with a decreased likelihood of undergoing PCI. Further research is needed to determine treatment time were any type of BBB were classified as either not having a PCI or undergoing a PCI. The presence of a lesion treatment time in the STEMI database. Independent variables included objective patient characteristics: age, sex, race, heart rate, systolic blood pressure, presence of a bundle branch block (BBB), left ventricular hypertrophy (LVH), QRS complex duration, and other comorbidities (e.g., diabetes or hypertension). Cases with incomplete records, missing prehospital reports, missing prehospital ECG, or cases with violations of the prehospital STEMI activation protocol were excluded from analysis. Results: Of the total 481 prehospital STEMI activations during the study period with 231 complete records. The variables associated with an increased likelihood of not having a lesion treatment by type of BBB (OR = 4.6; 95% CI: 1.91-11.27, LVH (OR = 5.8; 95% CI: 2.81-12.16), and race other than white (OR = 2.8; 95% CI: 1.64-4.90). Increased age and heart rate were also associated with not having lesion treatment. Of the comorbidities analyzed none were statistically significant. One clinical characteristic (presence of arm pain) was shown to decrease the odds of not undergoing PCI (OR = 0.36; 95% CI: 0.20-0.66). Conclusions: There were several variables associated with a decreased likelihood of undergoing PCI. Further research is needed to determine treatment time were any type of BBB were classified as either not having a PCI or undergoing a PCI. The presence of a lesion treatment time in the STEMI database. Independent variables included objective patient characteristics: age, sex, race, heart rate, systolic blood pressure, presence of a bundle branch block (BBB), left ventricular hypertrophy (LVH), QRS complex duration, and other comorbidities (e.g., diabetes or hypertension). Cases with incomplete records, missing prehospital reports, missing prehospital ECG, or cases with violations of the prehospital STEMI activation protocol were excluded from analysis. Results: Of the total 481 prehospital STEMI activations during the study period with 231 complete records. The variables associated with an increased likelihood of not having a lesion treatment by type of BBB (OR = 4.6; 95% CI: 1.91-11.27, LVH (OR = 5.8; 95% CI: 2.81-12.16), and race other than white (OR = 2.8; 95% CI: 1.64-4.90). Increased age and heart rate were also associated with not having lesion treatment. Of the comorbidities analyzed none were statistically significant. One clinical characteristic (presence of arm pain) was shown to decrease the odds of not undergoing PCI (OR = 0.36; 95% CI: 0.20-0.66). Conclusions: There were several variables associated with a decreased likelihood of undergoing PCI. Further research is needed to determine
creatinine significantly shorter D2CT times, but not D2TPA or D2EVT. This disparity was likely due to the delay waiting for the patient to return from CT scan before an ED physician evaluation.

21. ACUTE ISCHEMIC STROKE PATIENTS RECEIVE THROMBOLYTIC THERAPY AT HIGHER RATE WHEN TRANSPORTED BY EMS

Peter Milano, Stephen Sanko, Marc Eckstein, Keck School of Medicine of USC, Los Angeles Fire Department

Background: AHA/ASA guidelines describe the timely diagnosis and treatment of the acute ischemic stroke syndrome, placing emphasis on the administration of t-PA as a time-sensitive intervention. However, there is no description of the number or proportion of patients who arrive by EMS and receive t-PA.

Methods: A retrospective review of data submitted to the Los Angeles County EMS Agency by local approved stroke centers from 2011 to 2012 was performed. Inclusion criteria were those patients diagnosed with acute ischemic stroke and transported to the hospital by EMS, of which 3,674 patients arrived by unspecified means, and of these only 274 (7.1%) received t-PA. Similarly in 2012, 2,008 patients arrived by unspecified means, of which 272 (7.4%) received t-PA.

Results: In 2011, 1,969 patients with a final diagnosis of ischemic stroke were transported by EMS, and of these 359 received t-PA (18.2%). In this same year, 3,874 patients diagnosed with ischemic stroke arrived to the hospital by EMS, whereas 3,674 patients arrived by unspecified means, and of these only 272 (7.4%) received t-PA. Similarly in 2012, 2,008 patients with acute ischemic stroke were transported by EMS, of which 371 (18.5%) received t-PA, whereas 3,674 patients arrived by unspecified means, of which 272 (7.4%) received t-PA.

Conclusions: AHA/ASA guidelines recommend transport to the hospital by EMS for those patients diagnosed with acute ischemic stroke. However, these results indicate that only a small percentage of patients who arrive by EMS actually receive thrombolytic therapy, and that these patients are not distributed evenly across the state. Further research is needed to determine the current distribution of t-PA among patients diagnosed with acute ischemic stroke and transported by EMS.

22. ADENOSINE UTILIZATION AND EFFECT ON SUPRAVENTRICULAR TACHYCARDIA IN A LARGE, URBAN EMS SYSTEM

Jeffrey Goodloe, Annette Arthur, Corey Letson, Jacob Witmer, Stephen Thomas, University of Oklahoma

Background: Two adenosine mechanisms have been identified, the first involves the adenosine A1 receptor, and the second involves the adenosine A2A receptor. This study aimed to evaluate the feasibility of providing adenosine for presumed SVT. The study's purpose was to describe the prevalence of patients receiving adenosine for presumed SVT, the changes that occurred in post-adenosine heart rate, and the changes that occurred in the ECG review revealing the following common post-adenosine rhythms.

Methods: Adult patient encounters involved adenosine administration for presumed SVT. 153/252 (60.7%) patients were female. Mean patient age was 54.8 years. Mean post-adenosine heart rate was 138 bpm, with ECG review revealing the following common post-adenosine rhythms: 100/252 (39.7%) sinus tachycardia; 58/252 (23.0%) sustained SVT; 49/252 (19.4%) sinus rhythm; 28/252 (11.1%) atrial fibrillation with RVR. 241/252 (95.6%) of study patients were transported by EMS to an emergency department.

Conclusions: In a sizeable adult EMS patient cohort receiving adenosine for presumed SVT, nearly 60% of patients were converted to a sinus rhythm with heart rates less than 150 bpm. Paramedic protocol compliance for stable presumed SVT was very high.

23. FEASIBILITY OF REMOTE ISCHEMIC CONDITIONING (RIC): A PROMISE IN EMERGENCY MEDICAL TRANSPORT ENVIRONMENT: A CASE SERIES

Max Wayne, Francis Guyette, Catalin Toma, Sameer Khandhar, Christian Martin-Gill, University of Pittsburgh

Background: Remote ischemic conditioning (RIC) is a promising adjuvant therapy that may reduce infarct size, but use remains low. The primary outcome was the feasibility of providing RIC in patients with STEMI undergoing air medical transport for primary PCI. Methods: We report process and procedural outcomes of a case series of STEMI patients as part of a 4-month pilot study in 2012. Results: Of 153 patients receiving RIC during air medical transport for primary PCI, Between March and July 2013, eligible patients received four cycles of forearm ischemia induced by inflating a blood pressure cuff to 200 mmHg for 5 minutes followed by 5 minutes with the cuff deflated. The primary outcome was whether at least 3 cycles of RIC were completed. Secondary outcomes included patient discomfort level and number of cycles of RIC completed prior to PCI. Analysis was performed using descriptive statistics. Results: Twenty-four patients (21 in-home residence (OR 11.50; 95% CI 6.19-21.36). Non-Hispanic black race (OR 17.2; 95% CI 11.6-29.2) and nursing home residence (OR 11.50; 95% CI 6.19-21.36). Conclusions: Using data from a national representative sample of ED visits, we found that, despite national efforts to improve EMS use for time-sensitive conditions, trends have remained stable. Rather than community-wide efforts, future efforts should target high-risk areas with lower EMS utilization rates.

24. NATURAL TRENDS IN EMS UTILIZATION FOR TIME-SENSITIVE CONDITIONS OF AMI AND STROKE

Katie Tatari, Sean Kivlehan, Prasanthi Govindarajan, University of California San Francisco

Background: Acute myocardial infarction (AMI) and stroke are time-sensitive conditions with significant morbidity and mortality. While regional studies have shown underutilization of EMS for both of these conditions, national comparison and time trends have not been analyzed. The primary objective of this study was to describe the prevalence of EMS use by AMI and stroke patients in the US, establish EMS utilization trends over a 6-year period, and examine patient factors that may influence its use. Methods: We analyzed data collected by the National Hospital Ambulatory Medical Care Survey-ED (NHAMCS), which is a nationally representative, multistate, stratified, probability sample of ED visits between 2003 and 2009. We included patients with a primary diagnosis of ischemic stroke and AMI, defined by ICD9 codes. The primary outcome was ED arrival by ambulance. We used survey design weights provided by the NHAMCS to estimate the national proportion of patients diagnosed with stroke and AMI in EMS transported patients. Logistic regression modeling was used to determine factors independently associated with EMS use. Results: From 2003 to 2009, 1,324 stroke patients were analyzed, and 666 (50.3%) presented to the ED by EMS. During the same period there were 442 AMI patients and 220 (49.8%) presented by EMS. For both of these conditions there was no significant change in EMS usage during the study period. Older age, nursing home residence, insurance status, and geographic regions were all correlated with arrival by EMS for stroke patients. For AMI patients, variables associated with EMS arrival were ethnicity, nursing home residence, and insurance. The factors independently associated with EMS use were age (OR 1.5, 95% CI 1.2-1.9), Non-Hispanic black race (OR 1.7; 95% CI 1.1-2.9) and nursing home residence (OR 1.50; 95% CI 1.09-2.10). Conclusions: Using data from a national representative sample of ED visits, we found that, despite national efforts to improve EMS use for time-sensitive conditions, trends have remained stable. Rather than community-wide efforts, future efforts should target high-risk areas with lower EMS utilization rates.

25. PREHOSPITAL DIFFERENCES BETWEEN PATIENTS WITH ISCHEMIC AND HEMORRHAGIC STROKES

Brian Walsh, David Feldman, Alex Troncoso, Morristown Medical Center

Background: Paramedics frequently evaluate and treat patients with suspected cerebrovascular accidents (CVAs). It is important to determine which of these patients have ischemic strokes and which have hemorrhagic strokes. Being able to differentiate between these diagnoses would help paramedics determine the best initial management of these patients. We sought to determine if there were differences noted in the prehospital setting between patients with hemorrhagic strokes and those with ischemic strokes. Design: Retrospective cohort. Setting: A large, suburban, hospital-based EMS system. Protocol: The prehospital and emergency department records of patients with hemorrhagic and paramedics were dispatched for “Stroke” over...
a 3-year period were reviewed. Based on the emergency department records, patient were categorized into either ischemic, hemorrhagic CVA, or "other." Only patients with ischemic or hemorrhagic CVAs were included in the study. Using the prehospital records, the systolic and diastolic blood pressures and higher rates, and rates of intubation were measured for the two groups. Difference between groups and 95% confidence intervals (CI) were calculated. Results: 10,847 ALS dispatches, 494 (4.5%) were dispatched as “Stroke.” Of these, 250 (56%) were diagnosed with a CVA in the ED. Of the 250 CVAs, 223 (89%) were ischemic and 27 (11%) were hemorrhagic. There were no age or gender differences between the two groups, and the average heart rates between the two groups were similar. The average blood pressure in the ischemic CVA group was 149/81 versus 166/93 in the hemorrhagic group (systolic difference = 17; CI, 5, 29; diastolic difference = 12; CI, 5, 19). The rate of intubation in the ischemic CVA group was 2% compared to 11% in the hemorrhagic CVA group (difference = 9%; CI, 3, 16). Conclusions: Compared to patients with ischemic CVAs, patients with hemorrhagic CVAs had higher systolic and diastolic blood pressures and higher rates of intubation in the prehospital setting. These characteristics may help guide providers in the management of patients before a definitive diagnosis is made.

26. A PREHOSPITAL TREAT-AND-RELEASE PATHWAY FOR SUPERVENTRICULAR TACHYCARDIA
Rajan Minhas, Gregory Vogelaar, Dongmei Wang, Wadhah Almanooni, Eddy Lang, Ian Blanchard, Gerald Lazarenko, Andrew McRae, Alberta Health Services EMS

Background: Paroxysmal supraventricular tachycardia (SVT) is a common cardiac dysrhythmia treated in the prehospital setting. Emergency medical service (EMS) agencies typically require patients treated for SVT out-of-hospital to be transported to hospital for evaluation by a physician. This study evaluated the safety and effectiveness of a treat-and-release (T+R) protocol enabling advanced care paramedics (ACPs) to treat unsupervised patients in the field, and transport to an emergency department (ED).

Methods: This study linked data from the Alberta Health Services (AHS) EMS Electronic Patient Care Record (EPCR) database for the City of Calgary, to the AHS Calgary Zone Regional Emergency Department Information System (REDSIS) database. All SVT patients treated by EMS between September 1, 2010 and September 30, 2012 were identified and linked to the REDSIS database. Databases were queried to identify any T+R patient re-presentation to EMS or an ED within 72 hours of initial treatment.

Results: There were 75 SVT T+R patient encounters. With incomplete records excluded, 54 of 60 T+R encounters (90%; 95% CI [80, 95]) met all protocol criteria for T+R. 10 T+R encounters led to an EMS re-presentation within 72 hours. Four T+R encounters led to an ED presentation within 72 hours. Two of the ED presentations led to treatment and discharge for SVT, while two resulted in no intervention. All 14 re-presentations could be attributed to a single incident. These findings suggest EMS practitioners are able to follow a T+R protocol for SVT with reasonable adherence to protocol requirements. The T+R protocol evaluated in this study appears to be safe and in selecting appropriate patients, and suggests that T+R is a viable option for patients presenting with uncomplicated SVT in the prehospital setting.

27. PRESENT URBAN-RURAL GAP IN PREHOSPITAL DELAY OF ACUTE STROKE PATIENTS IN KOREA
Hyunwook Ryoo, Jineong Cho, Daehan Wi, Kyungyong National University

Background: Although it is important to transport ischemic stroke patients to a stroke center in proper times, there is a gap between urban and rural in time interval from stroke onset to hospital arrival. The aim of this study was to investigate the factors affecting these differences and present the basic information for establishing the efficient regional hub and spoke system for stroke patients.

Methods: This retrospective study was based on adult patients diagnosed as acute ischemic stroke from January 2012 to December 2012 at a regional cerebrovascular center. ‘Acute’ was defined as 24 hours from symptom recognition. ‘R’ was within the boundary of a metropolitan area. The distance from symptom onset location to stroke center was calculated by using the global positioning system. Results: In this study, 722 patients were analyzed (urban: 436, rural: 286). In the case of the patients who developed acute ischemic stroke in an urban area, the proportion arriving at a stroke center within 3 hours was 27.5%, on the other hand, that of the patients who developed acute ischemic stroke in a rural region was 19.2%, which has been shown to be a statistically significant difference (p<0.001).

Through multivariate logistic regression analysis, the use of public ambulance (OR: 4.258, CI: 2.233-8.118) and transportation from other hospitals (OR: 4.16, CI: 1.048-15.800) have been shown to have a statistically significant difference in urban patients. But in rural cases, only the distance from symptom onset location to stroke center was an independent effective factor of delay (OR: 0.982, CI: 0.969-0.995). We have calculated the distance from symptom onset location to stroke center with assumption which has been arrived at emergency department within 3 hours from symptom recognition, as 45 kilometers.

Conclusion: To increase the use of tissue plasminogen activator in urban setting, it should be emphasized that acute stroke patients must use public ambulances and be transferred directly to a stroke center. We also concluded that the new hub and spoke model for transporting the intravenous tissue plasminogen activator before transporting patients to stroke center to minimize the gap between urban and rural.

28. AN ASSESSMENT OF POTENTIAL TIME SAVINGS AND SAFETY OF BASIC LIFE SUPPORT EMS STEMI BYPASS
Thamir Alsayed, Garry Ross, Chris Olynick, Adam Thurston, Linda Turner, Richard Verbeek, Sunnybrook Centre for Prehospital Medicine, Toronto EMS

Background: The American Heart Association suggests emergency medical service (EMS) providers transport patients to the closest available hospital. Published research questions if bypassing the ED of a non-PCI center with only the nearest PCI center can result in time savings. Although this study suggests that BLS-D bypass to a PCI center can result in time savings, the ED of a non-PCI center and 71 (IQR 57) minutes to the PCI center. With a median predicted 12 (IQR 7) minutes to a PCI center had these patients bypassed the nearest hospital (Wilcoxon signed rank tests, P = 0.003 and 0.001, respectively), the time for path B was 12 (IQR 8) minutes compared with a median predicted time of 11 (IQR 6) minutes had no ALS rendezvous occurred (Wilcoxon signed rank test, P = 0.095). Two patients experienced prehospital cardiac arrest (resuscitated with defibrillation); one required dopamine and two others received a saline bolus for hypotension. Conclusions: Substantial time savings could occur if BLS-D providers bypass the ED of a non-PCI center with only a small predicted increase (about 5 minutes) in transport time. However, the near future, prehospital BLS-D rendezvous does not appear to substantially increase transport time. Given the low occurrence of clinically important events, our findings suggest that BLS-D bypass to a PCI center can be safe.
may inform triage decisions and increase the likelihood of stroke intervention.

30. DIFFERENTIATION OF STEMI FROM STEMI IMICS USING AN ECG ALGORITHM
Joseph Grover, Matthew Trowbridge, William Brady, University of Virginia

Background: Accurate ECG diagnosis of ST-elevation myocardial infarction (STEMI) by prehospital providers is critical for provision of out-of-hospital care. The purposes of this study included: to evaluate the accuracy of ECG STEMI interpretation in a ‘control’ ALS population and the impact of a 4-step ECG interpretation algorithm on STEMI diagnostic performance in an intervention group; and to determine whether the algorithm improves the distinguishing of STEMI from common mimics.

Methods: Two online surveys were used for the study: one that asked participants to use a 4-step algorithm to diagnose STEMI and another that did not. Percentage accurate STEMI and not STEMI diagnoses, odds ratios, 95% confidence intervals, and Pearson chi-square testing were calculated. Participants were compared based on their level of training and experience.

Results: A total of 48 and 49 ALS providers participated in the Algorithm and Control surveys respectively; STEMI was correctly diagnosed 91.1% (Algorithm) compared with 90.8% (Control; p = 0.92). Providers were correct in not diagnosing STEMI 70.3% (Algorithm) compared with 68.9% (Control; p = 0.66). The anterior wall STEMI was diagnosed least correctly of STEMI pattern in both the Algorithm and Control groups (77.0% and 75.5%, respectively; p = 0.86) when compared to inferior wall STEMI (95.8% and 95.9%; p = 1). Within the EMT-P providers subgroup, there was a statistically significant difference (p = 0.037) in recognition of LBBB as not STEMI (OR 2.96; 95% CI 1.05-8.36) comparing the Algorithm to Control groups. While not statistically significant (p = 0.068), the Algorithm group appeared more likely to recognize a paced rhythm as not STEMI (OR 3.59; 0.858-15.1).

Conclusion: The results of this pilot study suggest that EMS providers demonstrate high degree of accuracy for STEMI ECG diagnoses, yet have varied performance recognizing certain types of STEMI and when differentiating STEMI from common STEMI mimickers. Presentation of a structured and methodical diagnostic approach appears to improve diagnosis of STEMI from certain STEMI mimickers, especially among EMT-P. These preliminary results suggest that education aimed at better differentiation between STEMI and STEMI mimickers is needed.

31. A MULTICENTER RANDOMIZED TRIAL COMPARING A MECHANICAL CPR ALGORITHM USING LUCAS VS MANUAL CPR IN OUT-OF-HOSPITAL CARDIAC ARREST (LINC STUDY): ANALYSIS OF A PREDEFINED POPULATION
Sten Rubbertsson, Erik Lindgren, Ollie Östlund, Johan Herlitz, Rolf Karlsten, Uppsala University

Background: Manual chest compressions are often not optimal. Due to fatigue and other factors, compression rate and depth are often incorrect and paused for defibrillation. These might be major factors contributing to poor outcome after out-of-hospital cardiac arrest (OHCA). We hypothesized that a new device with mechanical chest compressions delivered by the LUCAS device and defibrillation during ongoing chest compressions would improve 4-hour survival in patients as compared to guideline-based man-}

32. BASIC LIFE SUPPORT PERSONNEL ARE HIGHLY SUCCESSFUL IN ESTABLISHING INTRA-osseous ACCESS IN OUT-OF-HOSPITAL CARDIAC ARREST
David Wampler, Joan Polk, Amanda Flores, Emily Kidd, Craig Manifold, The University of Texas, San Antonio Fire Department

Background: Intravenous (IO) access has become the method of choice for the facile rapid delivery of fluids and medication in adult cardiac arrest patients. EMS systems limited in paramedic/ALS resources or all BLS first responders may provide clinical enhancements by allowing BLS providers to initiate IO prior to ALS arrival, thereby bridging the gap for earlier BLS initiation of intra-arrest therapeutic hypothermia and initial pharmacology. The goal of this study was to determine the success of EMT-basic-provider-performed IO access in an adult cardiac arrest setting. Methods: This was a retrospective observational study of prospectively collected data abstracted from the medical director of a large urban EMS system. EMS standing orders were amended to allow gynecologist EMT-basics to establish IO (EZJG31, Vidacare, Shavano Park, TX) access (proximal humerus and proximal tibia) in cardiac arrests. EMT-basics performed the placement and stabilization of the IO device, and administered a 10-15 ml saline flush if possible. The credentialing process included 2 hours of didactic, 2 hours of hands-on psychomotor training, and a field proctorship (direct observation for three patients). Results: Of these patients 622 (71.4%) survived to hospital discharge, 487 (55.9%) with good neurological outcome. Poor functional survival at hospital discharge was associated with older age (OR 0.32; 95% CI 0.24-0.42) and longer time from collapse to initial shock (OR 0.32; 95% CI 0.22-0.46), while TTM was associated with improved functional survival (OR 1.63; 95% CI 1.07-2.46). Functional survival decreased during each phase of the model (73.1% vs. 68.4% vs. 52.7%, p < 0.001). There was a significant interaction between TTM and the time to initial shock on functional survival (p < 0.01). Conclusion: Functional survival at hospital discharge was associated with the length of time to initial shock, and decreased during each phase of the 3-phase model of cardiac arrest physiology. Post-arrest TTM was associated with improved functional survival and the effect of TTM was dependent upon the time of initial shock.

33. A COMPARISON OF DEFIBRILLATION EFFECTIVENESS AT 150 J AND 200 J IN PREHOSPITAL CARDIAC ARREST PATIENTS
Rachel Frank, Ronald Roth, Clifton Callaway, UMDNJ, Cooper Hospital/University Medical Center

Background: The recommended first shock energy for biphasic defibrillation (150J) is based on one study, which showed 96% first shock success for converting patients out of ventricular fibrillation (VF), but 2010 AHA guidelines suggest higher energy may be
necessary. Previously, local data showed a 52% first shock success rate for termination of VF, while protocols were changed to shock at 200 J. We hypothesized that shock success would be higher at 200 J than 150 J.

**Methods:** We reviewed cardiac arrest records (November 2006 to March 2013) for which first analysis resulted in shock delivery at 150 J or 200 J. Rescuers used Philips defibrillators and we analyzed up to four shocks. Shock outcomes were determined immediately and 5 minutes after last shock. The primary outcome was shock success defined as the immediate conversion of VF into a non-shockable rhythm. Outcomes were compared with chi-square. This is a significant hemodynamic data were averaged and compared over the last 2 minutes of treatment. A paired t test was used for statistical comparisons between groups. Data are expressed as mean mmHg ± SD. Results: Mean airway pressure (a surrogate for intrathoracic pressure) was significantly lower with L-CPR + active ITD versus L-CPR + sham ITD (5.13 ± 1.97 vs. 4.09 ± 0.58; p < 0.001). L-CPR + active ITD treatment resulted in significantly higher hemodynamic parameters versus L-CPR + sham ITD: ETCO2 34.9 ± 5.6 vs. 29.2 ± 7.2 (p = 0.015); SBP 98.7 ± 9.4 vs. 92.5 ± 14.5 (p = 0.030); DBP 24.4 ± 12.0 vs. 19.4 ± 15.1 (p = 0.006); CPP 29.4 ± 8.0 vs. 26.3 ± 6.8 (p = 0.004) and CePP; 29.3 ± 12.6 vs. 20.7 ± 11.8 (p = 0.028).

**Conclusions:** In pigs undergoing L-CPR the addition of the ITD 16 significantly reduced intrathoracic pressure and increased systemic circulation. These data provide strong physiological support for this device combination.

36. **THE EFFECT OF EMS PREHOSPITAL CATHERIZATION LAB ACTIVATION ON MORTALITY, LENGTH OF STAY, DOOR TO BALLOON TIME, AND ATTAINMENT OF MYOCARDIAL INFARCTION (STEMI) PATIENTS**

**John Silva, Kelly Sawyer, Aveh Bastani, Beaumont Health System**

**Background:** Previous literature has demonstrated that both EMS transport and EMS EKGs decrease time to reperfusion in STEMI patients. Little work has been done to evaluate the independent impact of prehospital activation of the pre-hospital catheterization lab (CCL) to decrease time to reperfusion, and no literature exists documenting its impact on outcome. Our primary objective is to analyze the effects of acute myocardial infarction (AMI) team pre-activation for EMS STEMI patients on 1 mortality) and 2 length of stay (LOS), door to balloon time (D2B), and hospital costs. Parameters: All adult non-traumatic cardiac arrests from 1/1/2012 to 12/31/2012 were included in the analysis. Two main groups were established: IATH and no IATH but standard resuscitation (SR) and we looked at the presence of any ROSC and ROSC at hospital arrival. Results: There were a total of 963 adult cardiac arrest resuscitations of which 442 received SR and 541 received IATH. Prehospital ROSC was observed in 130 of 442 (38.4%) in the IATH group and 170 of 442 (38.4%) in the SR group with a p value <0.0001. ROSC at hospital arrival was present in 222 of 541 (41.0%) in the IATH group and 171 (31.3%) of the SR group with a p value of 0.004. Conclusions: Our observational data indicates intra-arterial therapeutic hypothermia increases prehospital ROSC.

38. **VARIATIONS IN OUT-OF-HOSPITAL CARDIAC ARRESTS ACROSS 7 COUNTRIES IN ASIA: THE PAN ASIAN RESUSCITATION OUTCOMES STUDY (PAROS)**

**Marcus Ong, Sang Do Shin, Fahad Siddiqui, Hideharu Tanaka, Tatsuya Nishiuchi, Kyoung Jun Song, Patrick Chow-In Ko, Benjamin Leong, Nalinoo Naroo, Sarah Abdul Karim, Yih Yang, Matthew Huei-Ming Ma, Singapore General Hospital**

**Background:** In 2010, Pan Asian Resuscitation Outcomes Study (PAROS) Clinical Research Network (CRN) was established in collaboration with Japan, Singapore, South Korea, Malaysia, Taiwan, Thailand, and UAE-Dubai. This CRN aims to report the out-of-hospital cardiac arrests (OHCA) events and provide a better understanding of OHCA trends in Asia. Methods: This is a prospective, multicenter cohort study of OHCA across the Asia-Pacific region. Each participating country provided between 1.5 and 2.5 years of data from January 2009 to December 2012. A
standardized taxonomy and case record form were adopted across the participating countries and treated as variables. Data were provided via two methods: using an electronic data capture (EDC) system, which is an online data registry, or exported data from a national registry. Patients were recorded as having had chest cardiac etiology and therefore CPR was resuscitation attempted by emergency medical services (EMS). Primary outcome was survival to hospital discharge or alive to 30 days post cardiac arrest. Results: A total of 64,692 cases from January 2009 to December 2012 were submitted to the PAROS CRN, of which 37,137 cases were presumed cardiac and resuscitated by EMS. The mean age was 72.8 years (standard deviation [SD]: 16.4) and mainly were male (60.1%). 35.7% of cardiac arrests were witnessed by bystanders and 40.8% received bystander cardiopulmonary resuscitation; however only 1.0% of these arrests received bystander defibrillation. For arrests that were witnessed to collapse and found in a shockable rhythm, the survival rate to hospital admission was 4.5%. Overall survival to hospital discharge for this group of patients was 2.4%. Complete resuscitation data for Asia remains relatively low compared to North America and some European countries. This large population-based registry will provide a baseline for future evaluation of the impact of pre-hospital interventions such as dispatcher-assisted CPR and Public Access Defibrillation in this region.

39. EFFECT OF AIRWAY DEVICE CHOICE ON CHEST COMPRESSION FRACTION AND CPR RATIO

Frank Dong, Sabina Braithwaite, Neil Bryan, Amber Holland, Dave Johnston, Michele Mariscalco, David Wampler, University of Kansas, Wichita-Sedgwick County EMS

Background: Current American Heart Association CPR guidelines emphasize maintenance of a high chest compression fraction (CCF) to increase the likelihood of return of spontaneous circulation. CPR ratio represents the proportion of uninterrupted CPR in each subinterval, while CCF is the proportion of time during which compressions were performed during the entire resuscitation. Some EMS systems have implemented choreographed approaches to resuscitation to optimize CCF and CPR ratio by limiting pauses with the goal of increasing ROSC rates. Advanced airway management has historically been a major focus of cardiac arrest management, but has recently been recognized to have an impact on outcomes and may contribute to pauses in chest compressions and lower CCF. A recent simulated study of airway intervention in cardiac arrest showed that supraglottic airway (SGA) use significantly increased CCF compared to bag valve mask (BVM). The objective was to determine the average chest compression fraction and CPR ratio during resuscitation as a function of airway intervention: non-breather mask, BVM, endotracheal intubation, or SGA. Methods: Retrospective chart review of cardiac arrest patient data from 1/1/2013 and 6/30/2013 in a busy urban EMS system using a choreographed pit crew resuscitation approach. Data were extracted from electronic medical records and resuscitation data, including detailed chest compression measures and airway interventions. The study endpoints were chest compression fraction and CPR ratio. Results: Data from 132 cases were included in the final analysis. There were a total of 416 airway interventions (an average of 2.1 per patient), with 133 non-breather, 157 BVM, 99 endotracheal tube and 27 SGA. The average chest compression fractions were 87.1%, 94.2%, 92.7%, and 94.5%, respectively; average CPR ratios were 94.5%, 94.2%, 93.8%, and 93.1%. There were no statistically significant differences in chest compression fraction or CPR ratio among the four studied airway interventions (p = 0.503; data not shown). Conclusion: There were no statistically significant differences in chest compression fraction or CPR ratio among the four studied airway interventions. Data were analyzed with specific choreographed pit crew approach to cardiac arrest management.

40. SURVIVAL RATES AND DIAGNOSTIC ACCURACY OF OUT-OF-HOSPITAL CARDIAC ARRESTS AS DEFINED BY RESCUE FIRST IMPRESSION

Clement Yeh, Katie Tataris, Lauren McGuire, Benjamin Colburn, Zian Tseng, University of California, San Francisco

Background: Survival estimates in cardiac arrest vary widely and employ variable case definitions. The Utstein sudden cardiac arrest definition uses whether the arrest was witnessed, the rescuer impression of cardiac etiology, and presenting rhythm of ventricle fibrillation to identify specific populations with likely cardiac etiologies. In contrast, the World Health Organization (WHO) has defined sudden cardiac death using medical history and contemporaneous death. We sought to determine the accuracy of (1) rescuer impression of cardiac cause, (2) Utstein sudden cardiac arrest, and (3) WHO sudden death definitions in identifying cardiac etiology and compare the survival rates. Methods: Electronic patient care records, hospital charts, and autopsy reports were obtained for 649 patients, identified as prehospital attempted resuscitations in an urban setting from 1/1/2011 to 12/31/2012. We determined whether the rescuer had the primary impression of cardiac arrest, whether the arrest was witnessed, initial rhythm, and survival to hospital discharge. Cases were identified that met inclusion criteria for Utstein SCA and/or WHO SCD definitions. Results: Among 649 patients, 478 had rescuer presumed cardiac etiology. Of these, 70 met criteria for Utstein SCA and 202 met WHO SCD criteria. Among the Utstein cases, 71.4% (50/70) also met WHO criteria. In the WHO group, 32.8% (50/152) also met Utstein criteria. Overall survival to hospital discharge was 14% (92/649). Patients with rescuer primary suspected cardiac arrest had a survival rate of 12.1% (58/478). The Utstein survival rate was 37% (26/70). WHO patients had a survival rate of 24% (49/202). In cases with rescuer presumed cardiac etiology, postmortem examination confirmed cardiac cause of death in 50% of autopsied cases (63/126). The Utstein group autopsies confirmed cardiac cause of death in 66% (81/122). Among WHO autopsies, cardiac causes were reported in 68% (47/69).

Conclusions: Both WHO and Utstein-defined cardiac arrests were associated with higher survival rates than initial rescuer presumed cardiac etiology and undifferentiated resuscitation groups. Both groups had similar rates of autopsy confirmation. While selection bias could be significant in this analysis, further investigation could establish predictive accuracy of the case definitions.

41. THE RELATIONSHIP OF MAXIMUM TROPONIN VALUES POST OUT-OF-HOSPITAL CARDIAC ARREST WITH ELECTROCARDIOGRAPHIC FINDINGS; CARDIAC PROCEDURES AND SURVIVAL TO DISCHARGE: A SUB-STUDY OF ROC PRIMED

Laurie Morrison, Sean Devlin, Michael Kontos, Sheldon Cheskes, Ian Stiell, Andrew Thomas, Joseph Ornatto, Jim Christenson, Valerie Rac, Tom Aufderheide, Jane Wigginton, Paul Dorian, Rusc, St. Michael's Hospital

Background: This study sought to describe the relationship between maximum troponin (Tn) levels recorded within 48 hours post arrest and clinical outcomes in out-of-hospital cardiac arrest (OHA) patients enrolled in the Out-of-Hospital Cardiac Resuscitation Outcomes Consortium (ROC) Prehospital Resuscitation using an Impedance valve and Early versus Delayed analysis (PRIMED) trial. Methods: A prospective observational cohort study of all treated non-traumatic OHCA enroll in ROC PRIMED. Patients were classified based on first presenting in-hospital ECG as ST elevation myocardial infarction (STEMI) or not a STEMI (including NSTEMI). Peak Tn levels, evaluated on a logarithmic scale, were compared across patient and treatment characteristics using a t-test or ANOVA. The association between categories of Tn levels (<0.1, 0.1-2, >2) and survival to discharge was evaluated using logistic regression adjusted for Utstein predictors of survival and ROC site. Results: Of the 15,617 enrolled patients, 3,661 (23%) survived at least 48 hours, 17% (693) were STEMI, and 78% (3,188) were not a STEMI with 5% (3,460) with at least one Tn level measured. The mean (SD) age was 64.6 (15.9). The STEMI group had more men (74.5% STEMI, 62% not a STEMI) and was more likely to have an initial rhythm of shockable (64.6% STEMI, 39% not a STEMI). In-hospital survival was higher with STEMI (OR 1.93, 95% CI 1.63-2.3, p < 0.001). The logarithm of Tn values was higher in STEMI patients than non-STEMI patients in-hospital survival for STEMI patients was significantly better in those patients with higher Tn values (p = 0.01). Adjusted in-hospital survival was significantly worse in patients with Tn levels in the not a STEMI group (p < 0.001). When treated with reperfusion, adjusted survival in the not a STEMI group was significantly better than the survival without reperfusion (OR 3.6, 95% CI 2.4-5.4 for > 0.1, p < 0.001). Conclusion: High Tn levels were associated with increased rates of reperfusion and better in-hospital survival in post-arrest patients with STEMI on first ECG. High Tn levels in not a STEMI patients post arrest were associated with decreased survival. Survival in not a STEMI patients was significantly higher when treated with reperfusion.

42. AMPLITUDE SPECTRUM AS A TOOL TO IDENTIFY THE CIRCULATORY PHASE OF VENTRICULAR FIBRILLATION

Weilun Quan, Giuseppe Ristagno, Annemarie Silver, Ulrich Herken, Ben Bobrow, ZOLL Medical, Arizona Department of Health Service

Background: Ventricular fibrillation (VF) cardiac arrest (CA) is characterized by three time dependent phases: electrical (shorter than 4 min), circulatory (4-10 min) and metabolic (longer than 10 min). These phases reflect the progressive increase of myocardial ischemia and suggest the potentially optimal treatment. During the electrical phase, immediate defibrillation is likely to be successful, while during the circulatory phase, the success of defibrillation diminishes without CPR. In the metabolic phase, there is low likelihood of successful resuscitation and probably a longer CPR interval prior to defibrillation is necessary. In the out-of-hospital (OH) setting, most patients may have passed the electrical phase when an EMS arrives. Identification of the VF phase may therefore facilitate the proper CPR treatment. In the current study, we used AMSA to determine if patients were in electrical, circulatory or in metabolic phase at EMS arrival. Methods: Data from an Utstein-compliant registry along with electronic ECG records were collected on consecutive adult non-traumatic OHCA patients treated by 2 EMS agencies over a 2-year period. Patients with bystander witnessed CA and with VF as initial CA rhythm were included (n=41). AMSA was calculated in earliest pause without
Background: Mild therapeutic hypothermia (MTH) has been known to be associated with good neurological recovery after out-of-hospital cardiac arrest (OHCA). Prehospital return of spontaneous circulation (P-ROSC) is associated with better outcomes rather than ROSC at emergency department (ED-ROSC). It is unclear whether MTH has an interaction with P-ROSC or ED-ROSC for good neurologic recovery or not. The study aimed to determine the association between MTH by P-ROSC and good neurological recovery after OHCA. Methods: Adult patients with presumed cardiac etiology were collected from nationwide cardiac registry between 2008 and 2012, excluding cases with death prior to hospital admission. Variables included age, gender, place, witness, bystander cardiopulmonary resuscitation, metropolitan, response time, definite ambulance providers, levels of emergency department, reperfusion therapy, primary ECG group such as ventricular fibrillation/fibrillation/tachycardia (VF/VT), pulseless electrical activity (PEA), and asystole. MTH was defined as a case receiving hypothermia procedure regardless of potential methods (external cooling, internal cooling, or intravascular cooling) for at least 12 hours. Main outcome was good neurologic recovery with cerebral performance category (CPC) 1-2 following resuscitation. Results: Of 78,837 adult OHCA with cardiac etiology, 8,605 patients (10.9%) survived to admission. Of these, good neurological recovery was found in 14.5% and 54.2% of P-ROSC and ED-ROSC, respectively (p < 0.001), and 13.3% in non-MTH and 21.7% in MTH (p < 0.001), respectively. MTH was performed in 1,146 patients (13.4%) in total patients, 18.5% in VT/VF (n = 1011), 20.4% in PEA (n = 729), and 11.8% in asystole (n = 6,685), respectively. Simple model showed a significant association between MTH and good neurological recovery (AOR = 1.34, 95% CI = 1.09-1.62). In an interaction model, AOR of MTH and interaction effect with P-ROSC and ED-ROSC were 0.97 (0.67-1.38) and 1.43 (1.14-1.79), respectively. Conclusions: MTH was significantly beneficial in good neurological recovery in patients who survived OHCA but the effect was different by P-ROSC versus ED-ROSC. Prehospital ROSC group showed a much higher rate of good recovery. MTH was significantly beneficial in patients group with ROSC at ED (86.4% of patients receiving MTH), not P-ROSC group, in a nationwide observational study.

46. THE SCENE TIME INTERVAL AND PRIMARY LIFE SUPPORT TERMINATION OF RESUSCITATION RULE IN ADULT OUT-OF-HOSPITAL CARDIAC ARREST IN AN EAST ASIAN METROPOLITAN EMERGENCY MEDICAL SERVICES SYSTEM

Tae Han Kim, Sang Do Shin, Yu Jin Kim, Cheongju Medical Center, Seoul National University, Korea

Background: The basic life support termination of resuscitation (BLS TOR) rule has been studied to reduce the unnecessary use of emergency medical service resources. The BLS TOR rule had been validated and proven to show a high predictive value in North America where patients usually receive longer cardiopulmonary resuscitation (CPR). East Asian EMSs have a scoop and run model, including an obligatory transportation protocol before end of CPR at the intermediate service level. We validated the BLS TOR rule and tested it by investigating the scene time interval at a metropolitan hospital.
Methods: We used the OHCA database of Seoul metropolitan from January 2011 to December 2012, which is composed of hospital and ambulance data that contained the Utstein risks and hospital outcomes. We included EMS-treated and 18-year or older victims. Of the ambulance patients, those ambulants encountered with incomplete information were excluded. The primary and secondary outcomes were hospital mortality and poor neurological outcome (cerebral performance category 3, 4, or 5). We tested the predictive performance of the BLS TOR rule by calculating the sensitivity (SS), specificity (SP), and the positive and negative predictive values (PPV and NPV). We supplemented and tested the rule according to the scene time interval group by one min. for sensitivity analysis to achieve 100% specificity and a positive predictive value. Results: Of the 7,488 OHCA patients, we enrolled 4,835 patients, excluding the following: children (n = 168), non-cardiac etiology (n = 1,641), not treated by EMS (n = 316), occurred in ambulance (n = 283), and incomplete information (n = 283), 3,342 (69.5%) cases met all 3 criteria of the BLS TOR rule. Of these, 5,224 (95.9%) were dead at discharge (SS = 75.3%, PPV = 99.4%, and NPV = 99.4%), and 3,342 (99.4%) showed poor neurological outcome at discharge (SS = 75.2%, SP = 89.9%, PPV = 99.4%, and NPV = 11.5%). The cut-off scene time interval for 100% PPV was more than 20 minutes for survival and more than 14 minutes for good neurological recovery. Conclusions: The BLS TOR rule showed relatively low SS and PPV in a retrospective validation study in Korea than the scoop and run model. To achieve higher performance, modified TOR rules using scene time interval.

47. FLOOR LEVEL AND OUTCOMES AFTER OUT-OF-HOSPITAL CARDIAC ARREST Jiyeon Jang, National Medical Center

Methods: In a scoop and run emergency medical service (EMS) model, cardiopulmonary resuscitation (CPR) during transport has been known to be unsafe and associated with poor quality. High-rise buildings have small elevators, which are barriers to accessing the scene and to running back to the ambulance. It is unclear whether the floor level of the scene in a building is associated with hospital outcomes. It is unclear whether the floor level of the scene in a building is associated with hospital outcomes.

Methods: Of the 2,905 eligible OHCA patients, 336 were women and 717 were men, with mean ages of 68 (17) for women vs. 66 (15) for men (p = 0.07). Women were less likely to have favourable Utstein predictors of survival (p < 0.02) and STEMI post arrest (58 [18%] vs. 208 [30%], p < 0.0001). There was no observed gender difference in achieving the time target for angiography with or without PCI for STEMI positive (18 [31%] vs. 79 [38%], p = 0.33). Women who were STEMI negative were less likely to receive coronary angiography (22 [8%] vs. 74 [15%], p = 0.006) or PCI (7 [3%] vs. 30 [6%], p = 0.04). Eligible women were less likely to receive STEMI (147 [79%] vs. 283 [104%], p = 0.03). Women were more likely to have life-sustaining therapy withdrawn at any time (127 [38%] vs. 221 [51%], p = 0.03) and within 72 hours (78 [6%] vs. 109 [4%], p = 0.03). Women were more likely to receive coronary angiography and PCI (67 [21%] vs. 210 [28%], p = 0.008). Women were more likely to have life-sustaining therapy withdrawn at any time (127 [38%] vs. 221 [51%], p = 0.03) and within 72 hours (78 [6%] vs. 109 [4%], p = 0.03). Women were more likely to receive coronary angiography and PCI (67 [21%] vs. 210 [28%], p = 0.008).

Conclusions: The frequency of meeting the time targets for STEMI post OHCA was similar for both men and women. Of the STEMI negative women (OR 1.2, 95% CI 0.9-1.6, p = 0.32). The difference disappeared when adjusted for Utstein predictors of survival, which were STEMI positive (OR 1.2, 95% CI 0.9-1.6, p = 0.32). The difference disappeared when adjusted for Utstein predictors of survival, which were STEMI positive (OR 1.2, 95% CI 0.9-1.6, p = 0.32).
and had bystander CPR 37.2%. Overall, 362 sur-
vived (12.5%) and 300 had NIS (82.9% of sur-
vivors). Of those DO for 24 min (IQR 18-32). The 90th percentile for NIS was 40 min. Beyond 40 min, 29/42 survivors (69%, 95% CI 0.43-0.85) had neurologically intact longest resuscitation that achieved NIS was 73 min. Controlling for resuscitation protocol changes over time, the adjusted OR (95% CI) was 0.90 (0.90-0.92) for both survival and NIS. Other significant predictors of NIS across models were initial rhythm, age, bystander witness, therapeutic hypothermia, and absence of ad-
dvance directives included in the survival curve. DOR was within 40 minutes from time of dispatch for 90% of NIS. A large number of patients survived neurologically intact with DOs greater than previous guidelines would suggest. Further study should examine factors predictive of NIS in longer resuscitations.

51. INITIAL GLASSGOW SCORE UPON ARRIVAL AT THE EMERGENCY DEPARTMENT AFTER OUT-OF-HOSPITAL CARDIAC ARREST IS NOT A PREDICTOR OF DISCHARGE NEUROLOGIC STATUS

Stephen Sanko, Mark Eckstein, Keck School of Medicine of USC, Los Angeles Fire Department

Background: Out-of-hospital cardiac arrest (OHCA) is linked to a significant public health problem, and few emergency department (ED) prognostic factors have been characterized that accurately predict discharge neurologic status. The objective of this study was to determine the prognostic value of the initial Glasgow Coma Score (GCS) upon ED arrival for OHCA pa-
tients who achieved return of spontaneous circu-
lization (ROSC) in the field. Methods: This was a retrospective one-year study of all adult (age > 18) non-traumatic OCHAs in Los An-
geles, California between July 1, 2011 and July 1, 2012 who achieved ROSC in the field. The primary outcome measure was neurologically intact survival, which was defined as survival to hospital discharge with a cerebral perfor-
mation (ROSC) in the field. Results: There were 1,531 consecutive cardiac ar-
rest patients on whom resuscitation was at-
tempted and which appeared to be a primary cardiac arrest (52%) patients were successfully ROSC, of whom 303 had complete outcome data. Of these, 109 (35.9%) survived to hospi-
tal discharge, including 75 (24.7%) patients who were neurologically intact. Of these patients, 73 had a documented GCS upon ED arrival. 58 (79.5%) patients presented with a GCS of 3, 65 (89.0%) presented with a GCS < 9, 1 (1.4%) be-
tween 10 and 13, and 7 (9.6%) with a GCS of 14-
15. Therapeutic hypothermia was provided to 41 (56.2%) patients with a good neurologic out-
come. Conclusion: The initial GCS upon ED ar-
rival for OHCA patients does not predict neuro-
lologic outcome, since almost 80% of patients who survived neurologically intact arrived ca-
tomatous. Aggressive resuscitative measures, in-
cluding therapeutic hypothermia, should be per-
formed regardless of the presented GCS.

52. INCIDENCE AND OUTCOMES OF RE-ARREST FOLLOWING OUT-OF-HOSPITAL CARDIAC ARREST

David Salcido, Matthew Suendermann, Allison Koller, James Menegazzi, University of Pittsburgh

Background: Re-arrest (RA) occurs when a pa-
tient experiences cardiac arrest after success-
fully achieving return of spontaneous circu-
lization (ROSC) and discharge from ED. Incidence and outcomes of RA following out-of-hospital cardiac arrest (OHCA) have been estimated in limited local studies. We sought to investigate the incidence and outcomes of RA over a broad geographic area. Methods: This retrospective study was approved by the University of Pittsburgh in-
situtional review board. We obtained case data from EMS-treated, non-traumatic OHCA from the Resuscitation Outcomes Consortium, a multisite clinical research network conduct-
ing population level surveillance of OHCA in 11 cities in the US and Canada. The study co-
hort comprised all OHCA cases surveilled be-
tween 2006 and 2008 at ROC sites OR having had a ROSC. We used three methods to ascertain RA incidence among these cases: direct signal analysis, indirect cardiopulmonary resuscitation (CPR) process analysis, and emergency department arrival vital status. RA inci-
dence was estimated as the proportion of cases that experienced RA. Regional RA estimates were used to assess the rela-
tionship between RA and survival over time. Results: Out of 18,937 cases of EMS-assessed OHCA captured between 2006 and 2008, 11,456 (61.5%) cases had EMS and 4,396 (38.4%) had prehospital ROSC. Of these, suff-
cient data were available for RA ascertain-
tment in 3,253 cases, with 568 (17.5%) experi-
encing RA. RA incidence varied signifi-
cantly from 10.2% to 21.2% (p < 0.001). RA was significantly inversely associated with sur-


53. IMPACT OF CHECKLISTS ON PERI-INTUBATION CARE IN EMERGENCY DEPARTMENT TRAUMA PATIENTS

Mark Conroy, Gregory Weingart, Jestin Carl-
son, University of Pittsburgh

Background: Checklists have been increas-
ingly used to improve several metrics of critical care. Proper peri-intubation care including use of ap-
propriate intubation sedation is a critical part of endo-
tracheal intubation (ETI) on critically ill patients, however, little is known regarding the effective-
ness of checklists to improve intubation care. We hypothesized that utilization of a check-
list would improve peri-intubation care. Methods: This study was a quality improvement ef-
fort in our facility and deemed exempt by the institutional review board at our univer-
sity. We performed a retrospective review of all trauma patients intubated in the ED of an academic, urban, level 1 trauma center from November 2010 through October 2012. A peri-
intubation checklist was instituted on Novem-
ber 1, 2011 to guide peri-intubation care, which was performed regardless of the presented GCS. Results: During the study period, 60 intubations (51.7%) were performed with direct laryngoscopy and 56 were performed using video laryngoscopy. Of the patients who received a direct laryn-
goscopy, four patients (6.7%) were unable to be intubated and required the placement of a rescue dev-
ice; there were no instances of rescue device placement with video laryngoscopy. Of the 56 Video laryngoscopy not, however, found to be statistically more successful than direct laryngoscopy (p = 0.12). In addition, a linear regression, taking into account multiple possi-
ble confounders, found that the odds of need-
ing multiple attempts in order to successfully intubate was not statistically higher with di-
rect laryngoscopy (OR = 1.22, 95% CI = 0.43-
3.43). The only variable that proved to have a significant impact on intubation success was Cormack-Lehane score of I or II (OR = 4.45, 95% CI = 1.60-12.38); there was an independent association between the use of the video laryn-
goscope and lower Cormack-Lehane scores (OR = 3.62, 95% CI = 1.46-8.99). Conclusions: In this study there was no statistically significant improvement in intubation success rate or number of attempts when comparing direct and video laryngoscopy. The CMAC offered a bet-
ter view of the glottis and lower Cormack-Lehane scores.

55. THE IMPACT OF VIDEO LARYNGOSCOPY ON INTUBATION SUCCESS RATES DURING CRITICAL CARE TRANSPORT

Christopher DiCroce, Jeffrey Lubin, Pennsyl-
vania State University

Background: Prehospital providers often need to perform intubation under less-than-optimal conditions, making this challenging skill even more difficult. Previous studies have shown the utility of video laryngoscopy in resuscitation, but these findings have been carried out in an in-hospital set-
ting. We examined the impact of adding video laryngoscopy to the airway management pro-
tocols of a critical care transport program. We hypothesized that video laryngoscopy would re-
sult in a higher overall intubation success rate as well as fewer unsuccessful attempts com-
pared to direct laryngoscopy. Methods: We per-
formed a 2-year retrospective before-and-after study of flight records from a single critical care transport program. Video laryngoscopy was not available during the first year of the study; in the second year, per protocol, initial attempts were required to be performed with a direct laryngoscopy. An airway management video lary-
goscope reviewed all flight records, abstracting pertinent airway management variables and success rates. Data were analyzed utilizing both linear and logistic regression models. Results: During the study period, 60 intubations (51.7%) were performed with direct laryngoscopy and 56 were performed using video laryngoscopy. Of the patients who underwent a video laryngoscopy, four patients (6.7%) were unable to be intubated and required the placement of a rescue dev-
ice; there were no instances of rescue device placement with video laryngoscopy. Video laryngoscopy not, however, found to be statistically more successful than direct laryngoscopy (p = 0.12). In addition, a linear regression, taking into account multiple possi-
ble confounders, found that the odds of need-
ing multiple attempts in order to successfully intubate was not statistically higher with di-
rect laryngoscopy (OR = 1.22, 95% CI = 0.43-
3.43). The only variable that proved to have a significant impact on intubation success was Cormack-Lehane score of I or II (OR = 4.45, 95% CI = 1.60-12.38); there was an independent association between the use of the video laryn-
goscope and lower Cormack-Lehane scores (OR = 3.62, 95% CI = 1.46-8.99). Conclusions: In this study there was no statistically significant improvement in intubation success rate or number of attempts when comparing direct and video laryngoscopy. The CMAC offered a bet-
ter view of the glottis and lower Cormack-Lehane scores.
The practice of paramedics infrequently perform this procedure and may have inadequate skill retention. Supraglottic airway devices provide an alternate method of airway management and have increasingly been used for primary airway control. The impact of availability of supraglottic airways on the performance of out-of-hospital endotracheal intubation is unknown. We aimed to determine whether out-of-hospital endotra-
chela rate of prehospital orotracheal intubation be-
tigation requiring Pearson's chi-squared analysis, using a p-
tion were compared before and after 2007 using
were introduced in these EMS agencies. First pass success and
with first-pass success and the proportion of
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agencies. First pass success and definitive airway
attempts as a means to secure an airway in the
for primary airway control. The impact of supraglottic airway devices on the performance of out-of-hospital endotracheal intubation is unknown. We aimed to determine whether out-of-hospital endotracheal intubation was performed before and after the introduction of supraglottic airway devices. **Methods:** We retrospectively reviewed 4,100 prehospital medical records from 16 urban, suburban and rural Emergency Medical Services (EMS) agencies between 2005 and 2012. Cases involving an advanced airway procedure were included (n = 3545), excluding cases from 2007 as a run-in period when supraglottic devices were introduced in these EMS agencies. First pass success and final definitive airway were identified. The proportion of cases with first-pass success and the proportion of cases with first definitive airway being intubation were compared before and after 2007 using Pearson's chi-squared analysis, using a p-value of 0.05. We further describe the number and type of all advanced airway devices placed per year. **Results:** Of the 3,545 cases, 3,299 (93%) had an intubation attempt and 639 (18%) required second attempt intubation. There was no significant change in proportion of cases with first-pass intubation success rate before versus after the introduction of supraglottic airway devices. However, there was a significant change in the proportion of cases in which the final airway was orotracheal intubation in the first 3 months after the protocol change with first-pass success rate before the introduction of supraglottic airway devices (79%, p < 0.005). **Conclusion:** We found no change in first-pass success rate of prehospital orotracheal intubation before versus after the introduction of advanced supraglottic devices. However, fewer patients ultimately underwentotrach-eal intubation, indicating that supraglottic devices may largely provide an alternative to further intubation attempts as a means to secure an airway in the prehospital setting.

56. **EVALUATION OF THE KING VISION VIDEO LARYNGOSCOPE IN PARAMEDICS USING LEVITAN AIRWAY TRAINERS**

Mike Gonzalez, Guy Gleisberg, Kevin Traynor, Mark Escott, Baylor College of Medicine, Cypress Creek EMS

**Background:** Endotracheal intubation (ETI) is a critical and challenging airway management skill performed by Emergency Medical Services (EMS). Airway manikins are widely used to train medical personnel on intubation and maneuvers. Patient simulators have inevitably become the standard for training as well for airway management and have increasingly been used in these patients. This study's purpose was to determine whether the ALS providers' comfort with VAL protocol and proficiency with intubation changed over the course of the first year in which first-attempt VAL intubation was protocol. Design: Retrospective cohort. Setting: A large, suburban, hospital-based ALS service that responds to about 20,000 calls annually. VAL (B. Braun) was developed and introduced on all ALS vehicles and providers were trained in its use. Procedures were conducted so that VAL was the firstline method for intubation. The prehospital medical records of all intubated patients were reviewed. We calculated the rate of compliance with the VAL protocol, the rate of successful intubation on the first attempt, and rate of overall intubation success. We compared rates for the first 3 months after the protocol change with the rates for the last 3 months of the year. The differences between the rates and 95% confidence intervals (CI) were calculated. **Results:** Out of 27,765 ALS calls in the year, there were a total of 433 intubation attempts. The overall rate of intubation success (CI: 87-90%). In the first 3 months there were 108 intubation attempts versus 112 in the last 3 months. The FASR rate was KVL 80(72%) and DL 60(52%) (95% CI: 0.056 - 0.183). The C-L grade I or II view achieved was KVL 86(77%) and DL 84(71%) (95% CI: 0.038 - 0.188). POGO scores of 80 or greater were KVL 80(72%) and DL 60(52%) (95% CI: 0.077 - 0.321). Frequent PF DL 16(38%) inability to visualize larynx and KVL 13 (41%) se-
crations/blood/vomit. Conclusions: VAL appears to be at least as safe and effective as DL during a 120-day phase-in period with appropriate initial and ongoing competency training. Further long-term prehospital data is warranted to evaluate KVL as a primary device for paramedic intubation.

57. **CHANGES IN INTUBATION SUCCESS OVER THE FIRST YEAR WITH VIDEO-ASSISTED LARYNGOSCOPY**

Kimberly Baldino, Brian Walsh, Erin Heritage, Lisa Clayton, Morristown Medical Center

**Background:** Research to date has supported the use of video-assisted laryngoscopy (VAL) prehospital. Our protocol states that VAL is to be used as a first-attempt airway device for airway intubations. We sought to determine how the ALS providers' comfort with VAL protocol and proficiency with intubation changed over the course of the first year in which first-attempt VAL intubation was protocol. Design: Retrospective cohort. Setting: A large, suburban, hospital-based ALS service that responds to about 20,000 calls annually. VAL (B. Braun) was developed and introduced on all ALS vehicles and providers were trained in its use. Procedures were conducted so that VAL was the firstline method for intubation. The prehospital medical records of all intubated patients were reviewed. We calculated the rate of compliance with the VAL protocol, the rate of successful intubation on the first attempt, and rate of overall intubation success. We compared rates for the first 3 months after the protocol change with the rates for the last 3 months of the year. The differences between the rates and 95% confidence intervals (CI) were calculated. **Results:** Out of 27,765 ALS calls in the year, there were a total of 433 intubation attempts. The overall rate of intubation success (CI: 87-90%). In the first 3 months there were 108 intubation attempts versus 112 in the last 3 months. The FASR rate was KVL 80(72%) and DL 60(52%) (95% CI: 0.056 - 0.183). The C-L grade I or II view achieved was KVL 86(77%) and DL 84(71%) (95% CI: 0.038 - 0.188). POGO scores of 80 or greater were KVL 80(72%) and DL 60(52%) (95% CI: 0.077 - 0.321). Frequent PF DL 16(38%) inability to visualize larynx and KVL 13 (41%) se-
crations/blood/vomit. Conclusions: VAL appears to be at least as safe and effective as DL during a 120-day phase-in period with appropriate initial and ongoing competency training. Further long-term prehospital data is warranted to evaluate KVL as a primary device for paramedic intubation.

58. **VIDEO VS. DIRECT LARYNGOSCOPY: MULTI-SITE REVIEW OF THE FOUR-MONTH RUN-IN PERIOD BY PARAMEDICS**

Mark Escott, Guy Gleisberg, Kevin Traynor, Michael Gonzalez, Brett Monroe, Baylor College of Medicine, Cypress Creek EMS

**Background:** Endotracheal intubation is a critical and challenging airway management skill performed by emergency medical services (EMS). Use of video laryngoscopy (VL) is everincreasing, particularly in the prehospital setting. Presently, a paucity of research exists comparing VL to directly laryngoscopy (DL) and subsequent first-attempt success rates (FASR). The objective was to measure and evaluate FASR and key performance char-
acteristics of DL and VL in the prehospi-
tal environment using the King Vision video laryngoscope (KVL). **Methods:** After institutional review board approval and written informed consent obtained from paramedics, this prospective study included all consecutive intubations between March 18, 2013 through Aug-
ust 14, 2013 employing a standardized pro-
tocol. VLs were placed first as primary de-

ticides as the primary device with DL as a backup within two suburban EMS systems and rotated monthly. Preceding deployment, paramedics received a 4-hour KVL didactic, trouble-shooting and manikin training utilizing the Levitan Airway Training Series by means of a randomized schema then a Laerdal AT Kelly Torso with a cervical collar. Each participant completed this sequence twice; once using the KVL channeled blade and once using the KVL non-channeled blade and stylet. Additionally, paramedics completed weekly manikin compe-
tency training on both VL and DL. Cormack-
Lehane (C-L), FASR, primary failures (PF), and percentage of glottic opening (POGO) scores were recorded. Results: A total of 116 (51%) paramedics who had a mean experience with DL of 9 years, and 0.33 years with KVL. DL was utilized for 51% cases. The FASR rate was 79(71%) and DL 75(65%) (95% CI: 0.056 - 0.183). The C-L grade I or II view achieved was KVL 86(77%) and DL 84(71%) (95% CI: 0.038 - 0.188). POGO scores of 80 or greater were KVL 80(72%) and DL 60(52%) (95% CI: 0.077 - 0.321). Frequent PF DL 16(38%) inability to visualize larynx and KVL 13 (41%) se-
crations/blood/vomit. Conclusions: KVL ap-
ppears to be at least as safe and effective as DL during a 120-day phase-in period with appropriate initial and ongoing competency training. Further long-term prehospital data is warranted to evaluate KVL as a primary device for paramedic intubation.
1. In the study EMS system. Results: In the 12 month study period, 1,042 adult patients involved in cardiac arrest resuscitation initiated by EMS professionals for non-traumatic cardiac arrest. 602/1,042 (57.8%) patients were male. Mean patient age was 63.2 years, with 67% of patients being 50 years of age or older. BVM device utilization was documented in 976/1,042 (93.7%) resuscitations. The supraglottic airway utilized in the study EMS system included the King LT-D placed in 227/1,042 (21.8%) resuscitations, successfully placed on first attempt in 219/227 (96.5%) uses. Only 7 attempts at supraglottic airway placement were successful with 1 attempt. Endotracheal intubation was achieved in 785/1,042 (75.3%) resuscitations. There were 53/785 (6.8%) instances of extubation, 37/53 (69.8%) due to loss of continuous waveform capnography post-intubation. All patients in the cohort had documented achievement of oxygenation and ventilation. Conclusions: In a sizeable adult cohort with EMS resuscitation for non-traumatic cardiac arrest, airway management is primarily by BVM device preceding endotracheal intubation performed by advanced EMT paramedics. Nearly one-quarter of studied patients had airway management involving supraglottic airway placement.

60. PREHOSPITAL AIRWAY MANAGEMENT IN MAJOR TRAUMA AND TRAUMATIC BRAIN INJURY BY CRITICAL CARE PARAMETERS

Erik Vu, Brett Livingstone, Mark Vu, Donald Gondola, Robert Schump, Robert Wand, British Columbia Ambulance Service

Background: Prehospital endotracheal intubation (ETI) in major trauma and traumatic brain injury (TBI) remains contentious. Observational studies have highlighted potential risks associated with prehospital RSI, including hypoxemia (SpO2 < 90%), hyperventilation, or hypotension (SBP < 90 mmHg). We sought to characterize peri-intubation physiology in major trauma and brain-injured patients who underwent ETI by critical care flight paramedics (CCP) whose training is predicated on evidence-based guidelines, targeting specific peri-intubation oxygenation, ventilation, and hemodynamic goals. Methods: We performed a retrospective cohort study using the Provincial Airway Database for the British Columbia Ambulance Service (BCAS). Descriptive statistics were used to characterize consecutive patients who underwent ETI by Vancouver-based CCPs from January 2009 to June 2010. Results: Over an 18-month period, 104 patients underwent ETI of which 68 sustained major trauma and/or TBI. Of these, 22 were male with a mean age of 38 years (range: 17 to 75). ETI success rate was 93.2% (95% CI: 4.8). Median attemps at laryngoscopy were 2 (IQR 1-3). Thirty-eight (85%) and 55 (78%) of these patients had a systolic blood pressure (SBP) >90 mmHg and/or an arterial oxygen saturation (SpO2) ≥90%, prior to attempts at ETI, respectively. Initial mean SBP was 136 mmHg (SD 28.0) and mean post-ETI SBP 133 mmHg (SD 24.0, p = 0.74). Initial mean SpO2 was 98% (IQR 96-100%), and median post-ETI SpO2 97% (IQR 95-100%, p = 0.45). The lowest median documented SBP prior to ETI was 92% (IQR 87-95%), and lowest median ETCO2 22 mmHg (IQR 28-35 mmHg). Conclusions: We describe the successful prehospital ETI program performed by CCPs characterizing optimized peri-intubation physiology in a cohort of major trauma and TBI patients. Further studies are needed to assess the functional outcome of such a program in this patient population.

61. VIDEO LARYNGOSCOPY IMPROVES INTUBATION SUCCESS IN CARDIAC ARREST AND ENABLES EXCELLENT CPR QUALITY

Kevin Seaman, Kenneth Rothfield, Matthew Levy, Cassandra Duell, Joseph Pellegrini, Howard County Department of Fire and Rescue Services

Background: Endotracheal intubation (ETI) has been recognized as a common cause of interruptions in CPR during cardiac arrest. A prehospital trial of video laryngoscopy (VL) was initiated with the goals of improving out-of-hospital intubation outcomes. This study focused on overall success of VL in the subset of patients in whom arrest; analysis of the impact of VL on frequency and duration of associated interruptions in CPR was also performed. Methods: From January 2011 to June 2013, cases of adult, non-traumatic cardiac arrest in a suburban fire-based EMS system were evaluated for use of VL. Intubation confirmation in the field was accomplished with real-time waveform capnography, video capture of the ETI attempt, and confirmation from the receiving emergency department physician. VL recordings were reviewed to identify the overall VL success rate during ETI attempts, interruptions in CPR, and interruptions due to complications. CPR analytics software was used to determine CPR fraction and duration of CPR interruptions. Results: VL data were compared with historical direct laryngoscopy (DL) data. Results: 152 of 344 cardiac arrest incidents in the study period involved the use of video laryngoscopy and met inclusion study criteria. The overall success rate for VL was 148 out of 170 attempts (87.1%), while the overall success for the DL control group was 274/425 (64%). VL success was clinically and statistically different from the DL group (p < 0.05). EMS providers did not pause compressions for intubation attempts at any point in 68.6% of studied cases (n = 105). Of cases where CPR was interrupted (n = 47), the mean number of interruptions was 1 (range 1-3). The mean total duration of ETI-associated CPR interruptions (n = 62) was 45.1 s (CI 37.1-53.0). In cases where CPR analytics was available (n = 34), the mean CPR fraction was 87.5% (CI 84.8-90.2). Conclusion: The use of video laryngoscopy in cardiac arrest patients resulted in improved intubation success and enabled a reduced frequency of interruptions in CPR compressions. Excellent CPR fraction was demonstrated for victims of cardiac arrest who were intubated by VL.

62. SUCCESS AND COMPLICATION RATES OF PREHOSPITAL PLACED CENTRAL VENOUS CATHETERS BY CRITICAL CARE PROVIDERS

Mark Pierce, Debra Ferini, University of Virginia

Background: Central line placement is occasionally performed during prehospital care transports. The objective of this study was to assess the safety, success, and complication rate of prehospital placed central venous catheter (CVC) by prehospital critical care providers. Methods: A systematic chart review was performed of all patients presenting to our institution from November 2009 to April 2013 who had a CVC placed in the field in 18 cases. In 14 cases, CVCs were placed by a trained critical care nurse or medic without the use of ultrasound. Providers were able to document the total time of CPR from hospital arrival to CVC placement. Prehospital records were examined, cross-referenced with the hospital EMR, and reviewed for complications of CVC placement noted in the hospital admission. A complication was defined as either 1) positive blood culture resulted within 48 hours of hospital care, 2) extraluminal placement of the CVC, or 3) traumatic placement of the CVC requiring surgical repair. Results: Of the 18 cases requiring multiple attempts. Overall the success rate was 63.9% with a complication rate of 6.3%. Successful femoral CVCs placement was 70.8% overall and successful subclavian placement was 50%. Two patients were identified with complications for a total complication rate of 6.3%. This rate is comparable to standard CVC complication rates. Conclusion: Critical care providers successfully placed 23 CVCs with a 6.3% complication rate. Based on these data, it appears that prehospital placed CVCs have a complication rate that is acceptable for emergent and critical situations and comparable to standard CVC complication rates. Further study is warranted.

63. HELICOPTER EMS TRANSPORTS FOR NON-TRAUMATIC AORTIC PATHOLOGIES

Emily Williams, Annette Arthur, Loren Brown, Taylor Fisher, Amanda Montgomery, Chelsea Keeling, Noah Banister, Jacob Witmer, Stephen Thomas, University of Oklahoma, Air Evac Lifeline
Background: The risks associated with urgent land-based transport of critically ill patients are not well known, and have important implications for patient safety, delivery of care, and policy development in a regionalized healthcare system. We sought to determine the incidence of in-transit critical events and identify factors associated with these events. Methods: We conducted a retrospective cohort study using land-based critical care transport data obtained through one of our databases. We included all adults undergoing land-based critical care transport. In-transit critical events were observed in 6.1% of all transports, with a critical event occurring every 11 hours of out-of-hospital transport time. New hypotension (4%) or the initiation of vasopressor medication (1%) were the most common critical events with in-transit resuscitation procedures rarely performed (0.3%). No deaths occurred during transport. In multivariable analysis, mechanical ventilation (adjusted OR 1.7 [95% CI 1.3-2.2]), pre-transport hemodynamic instability (adjusted OR 3.4 [95% CI 2.5-4.5]), out-of-hospital duration (adjusted OR 3.2 per log-fold increase in time [95% CI 2.6-3.9]) and neurologic diagnosis (adjusted OR 0.5 [95% CI 0.3-0.7]) compared to medical patients) were independently associated with critical events. Overall success at airway management was high (85.7%), although the first attempt success rate of in-transit intubation attempts was lower than those attempts pre-transport (42.9% vs. 72.7%; p = 0.19). Advanced care paramedic crews had higher crude rates of in-transit critical events, driven primarily by new hypotension. These transports also had higher rates of hypotension (52.7%), but lower rates of vasopressor use pre-transport compared to other paramedic crews. Conclusions: Interfacility land-based critical care transport was safe: critical events occurred in about 1 in 16 transports and no deaths occurred. Critical events were independently associated with pre-transport mechanical ventilation, pre-transport hemodynamic instability and transport duration, and were less frequent in patients with neurological diagnoses. Further examination of patient preparation pre-transport, particularly airway management and hemodynamic interventions, is required to inform interventions and policies to improve the safety of land-based critical care transport.

65. HELICOPTER EMERGENCY MEDICAL SERVICES (HEMS) UTILIZATION PATTERNS IN LAKE MEAD NATIONAL RECREATION AREA FROM 2008 TO 2011

Kellen Galster, Ryan Hodnick, Ross Berkeley, University of Nevada

Background: Lake Mead National Recreation Area (LMNRA) is the sixth most visited park of the National Park Service (NPS), protecting over 1.5 million acres of land. It is also the deadliest recreation area managed by the NPS. The objective was to determine whether patients transported by helicopter emergency medical services (HEMS) utilizing the model fit to the LMNRA from 2008 to 2011. Two trained/monitored reviewers extracted data using a uniform data tool and explicit review process. Data were entered into a database. Abstraction accuracy was adjudicated by 100% review. We performed t-tests on continuous variables. Statistical significance was set at <0.05. Results: A total of 65 helicopter missions (10%) were HEMS patients transported by HEMS, with 526 (55.7%) transported by ground and 32S (33.4%) transport refusals. The majority of HEMS transports occurred in the morning (75%) with an average age of 40.8 (range 1-81). Traumatic injuries accounted for 63% (91% blunt and 9% penetrating) of the 103 HEMS transports, and comprised 54.3% (86.2% blunt and 14.9% penetrating) of the 52S HEMS ground transports. Average time to scene by NPS EMS was 16.1 minutes for patients subsequently transported by HEMS, versus 14.1 minutes for ground transport (p = 0.23). The average time on scene by NPS EMS was 38.6 minutes for HEMS transport and 42.2 minutes for ground transport (p = 0.05). There was a statistically significant difference in vital signs of patients transported via HEMS as compared with ground EMS, with the exception of oxygen saturation and Glasgow Coma Scale (GCS). Oxygen saturation was 95.8% for HEMS transport versus 96.5% ground EMS (p = 0.02). The initial GCS for these transported via HEMS was 13.7 versus 14.5 via ground transport (p = 0.01).

Conclusion: There was no difference in the scene response times for patients transported via HEMS and ground, and although a statistically significant difference was noted between pulse oximetry and GCS, neither was clinically significant. Additional study may help guide the development of a protocol for HEMS utilization by the NPS.

66. THE EVIDENCE-BASED PREHOSPITAL BLOOD PRESSURE TREATMENT THRESHOLD IN MAJOR TRAUMATIC BRAIN INJURY: “NORMOTENSION” MAY BE TOO LOW

Daniel Spait, Uwe Stolz, Bentley Bobrow, David Adelson, Chad Viscusi, Terry Mullins, Will Humble, Kurt Demninghoff, Vatsal Chikani, Duanqing Soteio, Bruce Barnhart, Joshua Galther, University of Arizona, Arizona Department of Health Services

Background: The current nationally vetted EMS traumatic brain injury (TBI) guidelines utilize an SBP threshold of <90 mmHg for treating hypotension in patients 10 years or older. This is supported by a literature showing much higher mortality when cohorts of patients with SBP <90 mmHg versus >90 are compared. However, the historical use of this threshold was arbitrary. Hypothesis: In a large, multisystem evaluation of major TBI, no statistically-supportable SBP versus mortality cut-point will emerge from the data when evaluated a-priori without reference to any given definition for “hypotension.” Methods: All moderate/severe TBI cases (CDC Barell Matrix Type-1) in the Excellence in Prehospital Injury Care (EPIC) Study cohort of the Arizona Trauma Registry (NIH/NINDS: 1R01NS071049-01: The Excellence in Prehospital Traials; gov-PNCT01339702) from 1/1/08 to 12/31/11 were evaluated (exclusions: age <10, transferrers, patients returning to EMS SBP (3.0)). The subset of patients with SBP between 10 and 140 mmHg (study population) were assessed using fractional polynomial models. The primary aim was to determine the relationship between SBP and the odds of death. Results: 4,969 patients met inclusion criteria. SBP was binarily associated with the log odds (logit) of death and no transformation improved the model fit. We transformed (linear) values of SBP. LR showed that each five-point increase of SBP decreased the odds of death by 13.8% (OR = 0.862, 95% CI 0.824-0.903) across the range of SBP (0-140). After controlling for GCS, O2 saturation, AIS, ISS, AIS-Head, prehospital airway management, age, sex, payor this linear relationship still held up with an aOR of 0.911-0.974 for each 5-mmHg increase in SBP (e.g., a patient with SBP =110 had an aOR for death of 0.880 compared to a patient with SBP =100), and so on the aOR was 0.862 (90-140 mmHg).

Conclusion: We found a linear relationship between SBP and severity-adjusted risk of mortality across an exceptionally wide range. Thus, for the injured brain, “functional hypotension” may not be as low as current guidelines suggest. The fact that the adjusted odds of death increases as much for an SBP of 110 mmHg versus 100 as it does for 100 versus 90 suggests that the optimal resuscitation target may be much higher than 90 mmHg. Specific trials comparing various treatment thresholds are needed.

67. IS FASTER BETTER? DOES THE TIME SAVED WITH HELICOPTER EMERGENCY MEDICAL SERVICES (HEMS) TRANSPORT PROVIDE AN ADVANTAGE AT A LEVEL I TRAUMA CENTER?

Joseph Hansen, M Riccardo Colella, Sherry Schmitt, Medical College of Wisconsin, Flight For Life

Background: Helicopter emergency medical services (HEMS) are faster than ground ambulance when transporting certain patients to a regional trauma center. However, the historical risk of mortality when treated at the scene increased with their usage. A faster airway access increases survival and thus, faster access should translate to faster care. To assess the impact of mode of transportation on care and access to a regional trauma center, we propose a theoretical race between actual HEMS flight time with estimated ground ambulance transport time; in order to assess the clinical implications of any potential minutes gained, we will investigate the cases that could be rendered during that time savings. Methods: This study is a retrospective chart review of all helicopter scene transports from 1/1/09 through 6/30/09 of eligible patients to the Level I trauma center. This study received IRB approval. Descriptive statistics were used to quantify the time difference between helicopter transport and ground ambulance transport with and without lights and sirens. We also used descriptive statistics to quantify the number of assessors or interventions performed on each patient within the estimated time differences. Results: Forty-nine patients were included in final analyses with the average helicopter transport time of 15.5 (SD 6) minutes. The average estimated ground transport time with lights and sirens was 26.5 (SD 12.4) minutes (helicopter was 91.9% faster), and without lights and sirens was 41.7 (SD 19.5) minutes (helicopter was 100% faster). The average difference between ground and helicopter transport was 10.3 (SD 8.6) minutes with lights and sirens and 24.9 (SD 15.7) minutes without lights and sirens. Of the 49 patient transports, 34 (69%) were HEMS to 100% of patients received a completed primary survey, 8.1-24.5% of patients received a life- or limb-saving intervention, and 10% of patients died. Of functional studies, 6-16% of patients had an imaging diagnosis, and 0-2% had subspecialist evaluation. All helicopter transport was associated with improved response time with lights and sirens but not with helicopter transport with no lights and sirens. Conclusion: In this theoretical race, HEMS transport was faster than ground transport in the majority of cases. This finding predicts that this time savings translates into earlier ATLS assessment and interventions.
Further work is needed to verify this benefit and demonstrate its impact on patient outcomes.

68. OPERATIONALIZING A CONSENSUS-BASED GOLD STANDARD DEFINITION OF TRAUMA CENTER NEED
Brian Willenbring, E Brooke Lerner, Karen Brasil, Jeremy Cushman, Clare Guse, Manish Shah, Robert Swor, Medical College of Wisconsin

Background: Research on field triage of injured patients is limited by the lack of a functional gold standard (GS) for defining trauma center need. Injury severity score (ISS) is one of the most commonly used measures for determining trauma center need, but is a proxy for resource use and has never been validated. A multidisciplinary team recently developed a treatment-based GS definition of trauma center need.

Objective: To determine if the treatment-based GS could be obtained by medical record review and to compare patients identified as needing a trauma center by the treatment-based GS versus ISS.

Methods: A sub-analysis of data collected during a 3-year prospective cohort study of a 4,528 adult trauma patients transported by EMS to a trauma center was conducted. These data included procedure and ICU outcome, treatment times, and other hospital and EMS data. The treatment-based GS was operationalized, and for each case it was determined if the patient met the GS, ISS was calculated based on coder assigned ICD-9 codes. Results: The treatment-based GS was assigned to 4,471 (98.7%) cases. Missing time data prevented the GS from being assigned in the remaining 57 cases. ISS was assigned to 4,506 (99.5%) cases. Based on an ISS > 15, 8.9% of cases needed a trauma center. Of those, only 48.2% met the treatment-based GS. Almost all patients that did not meet the GS, but had an ISS > 15 met the treatment-based GS with the majority having a time sensitive surgery (139/203 cases) or blood transfusion (60/203 cases). The kappa coefficient of agreement for ISS and treatment-based GS was 0.43.

Conclusions: It is feasible to use a treatment-based GS for trauma center need when conducting field triage research. Using a treatment GS changes the number and types of patients identified as needing a trauma center compared to ISS. Researchers should consider using a treatment-based GS and efforts should be made to achieve national consensus on treatment-based parameters that indicate trauma center need.

69. PREHOSPITAL GLUCOSE AS A PREDICTOR OF HOSPITAL OUTCOMES AFTER ACUTE TRAUMATIC BRAIN INJURY IN PATIENTS OLDER THAN 55 YEARS
Karl Huesgen, Jason Jones, Aakash Bodhit, Lauren Hunt, Christine Van Dillen, University of Florida

Background: The objective of the study was to determine if prehospital glucose predicts hospital outcomes in the setting of traumatic brain injury (TBI) in patients older than 55 years. Medical records of all patients admitted to a university hospital between April 1, 2010, and March 31, 2011, were abstracted for following information: mechanism of injury, Glasgow Coma Scale (GCS) scores by EM, glucose measurement by EMS, and hospital outcomes. Of the 863 patients severe trauma were identified by the presence of a systolic blood pressure < 90 mm Hg in the prehospital phase (mean age 48.7 ± 38.3 years), No statistical differences were found in demographics and clinical parameters except injury mechanism and distance to destination hospital. NT and I-BT were 27.4%, 18.5%, 20.2%, and 33.4% respectively. I-BT rate was significantly higher in metropolitan than non-metropolitan (8.3% versus 3.6%, p = 0.001). I-BT rate was significantly higher in metropolitan than non-metropolitan (46.2% versus 23%, p = 0.001), respectively. CONCLUSIONS: Proton violation rates were significantly different in non-bypassing and inappropriate 4. bypassing to hospital between metropolitan versus non-metropolitan ambulances when using the bypassing hospital trauma protocol. To develop and implement the trauma protocol, geographical compliance should be considered.

70. COMPLIANCE OF A Bypassing HOSPITAL TRAUMA PROTOCOL USING THE FIELD TRIAGE DECISION SCHEME BETWEEN METROPOLITAN VERSUS NON-METROPOLITAN EMERGENCY MEDICAL SERVICES
Ki Ok Ahn, Sangdo Shin, Kyungsoon Song, Juok Park, Ki Jeong Hong, Hyun Noh, Woonpyo Hong, Dea Jin Jeong, Kangwon National University

Background: A trauma protocol for transport bypassing hospital for severe trauma patients was developed and implemented in Korea in 2012 using the field triage decision scheme of th Centers for Disease Control and Prevention of the US. Emergency medical services (EMS) and hospital resources are significantly different in metropolitan versus non-metropolitan areas, but the protocol does not include the difference. The study aims to evaluate the compliance of the protocol in severe trauma between metropolitan versus non-metropolitan area. Methods: Severe trauma patients were identified by the new protocol and collected from a trauma registry and EMS run sheet in one metropolitan (8 counties and 53 ambulances) with 2.5 million population and one non-metropolitan province (17 counties and 48 ambulances) with 2.2 million population from October 2012 to one month. The same protocol was implemented by national fire department which provides single emergency medical services (EMS) system that provides 9-1-1 services for 200,000 people. All patients meeting trauma triage criteria are transported to the regional level 1 trauma center where the trauma team is activated. The study criteria are 1) GCS of 12 or less, 2) SBP < 100, 3) airway compromise, 4) penetrating injury to head, neck, or torso, 5) pulsatile extremity hemorrhage proximal to hand or foot, and 6) new onset paralysis. Patients who met these criteria at other local hospitals are transferred to the trauma center per a local trauma system agreement by the same urban EMS system. The need for transfusion < 24 hours, surgery < 6 hours, or ICU admission were the end points used to determine the patient need for level 1 resources. Discharged patients were not included in the study. Results: Of the 1,025 patients transported by EMS to the trauma center, 305 were admitted and 17 died in the ED. 152 met the study triage criteria for trauma team activation. Of those 152 patients 113 (74.3%) met one or more of the study endpoints for an overall triage rate of 25.7%. 170 patients did not meet the criteria; 2 (2.4%) of these patients required trauma team activation after arrival in the ED. 69 (40.6%) of the patients not meeting the triage criteria met one or more of the endpoints.

Conclusion: The simplified criteria used in this study have a favorable over-triage rate when compared with the CDC guidelines. They also reliably predict the need for trauma team activation; however, determination of their true under-triage rate will require revision of the endpoints.

71. EVALUATION OF SIMPLIFIED PREHOSPITAL TRAUMA TRIAGE CRITERIA
Avery Thornhill, Kimberly Hutchinson, John Shambafer, Derrel Graham, Runhua Shi, Louisiana State University

Background: Field triage accuracy regarding trauma is essential to improve patient outcomes and allocate resources. Centers for Disease Control and Prevention (CDC) guidelines for trauma are complex with high over-triage rates. This pilot study was undertaken to assess the ability of a simplified set of prehospital trauma criteria to predict the need for level 1 resources and plan for a prospective validation. Methods: This is a retrospective review of 1,025 patients triaged by an urban emergency medical services (EMS) system that provides 9-1-1 services for 200,000 people. All patients meeting trauma triage criteria are transported to the regional level 1 trauma center where the trauma team is activated. The study criteria are 1) GCS of 12 or less, 2) SBP < 100, 3) airway compromise, 4) penetrating injury to head, neck, or torso, 5) pulsatile extremity hemorrhage proximal to hand or foot, and 6) new onset paralysis. Patients who met these criteria at other local hospitals are transferred to the trauma center per a local trauma system agreement by the same urban EMS system. The need for transfusion < 24 hours, surgery < 6 hours, or ICU admission were the end points used to determine the patient need for level 1 resources. Discharged patients were not included in the study. Results: Of the 1,025 patients transported by EMS to the trauma center, 305 were admitted and 17 died in the ED. 152 met the study triage criteria for trauma team activation. Of those 152 patients 113 (74.3%) met one or more of the study endpoints for an overall triage rate of 25.7%. 170 patients did not meet the criteria; 2 (2.4%) of these patients required trauma team activation after arrival in the ED. 69 (40.6%) of the patients not meeting the triage criteria met one or more of the endpoints.

Conclusion: The simplified criteria used in this study have a favorable over-triage rate when compared with the CDC guidelines. They also reliably predict the need for trauma team activation; however, determination of their true under-triage rate will require revision of the endpoints.
Background: Emergency medical services (EMS) emergency transport using lights and sirens is estimated for 56% of national ambulance collisions between 1990 and 2009, posing a major public health threat to EMS professionals and patients. Further, several studies have demonstrated time saved using emergent transport mode is minimal and commonly without clinical benefit. Our study’s objective was to measure a protocol associated transport mode (Time-Critical Hospital Intervention (TCHI)) selected by an urban EMS agency with the likelihood of receiving a time-critical hospital intervention (TCHI) within 60 minutes of hospital arrival in adult trauma patients.

Methods: We retrospectively reviewed EMS patient care reports and trauma registry data for trauma patients consecutively transported to a level I trauma center between 7/1/10 and 6/30/12. We considered transports that initiated lights and siren at anytime as emergent. To assess for interest, receiving a TCHI, was defined as administering at least one of 36 preselected life-, limb-, or eye-saving procedures within 60 minutes of arrival. We measured the predictive ability of emergent transport by reporting sensitivity, specificity, positive predictive values (PPV), and negative predictive values (NPV) with 95% confidence intervals (CI). Results: Of 809 patients transported and admitted during the study period, 66 were excluded due to missing data, leaving 743 patients eligible for the final analysis. Of the 165 patients (20.7%) transported emergently, 50 (31.8%) received a TCHI. The sensitivity and specificity of transport mode in predicting need for a TCHI was 73.5% (95% CI 61.21–83.16) and 83.0% (95% CI 79.86–85.68), respectively. The PPV was 30.3% (95% CI 23.33–38.01); NPV was 96.9% (95% CI 95.03–98.09). Conclusions: Emergency transport resulted in a low positive predictive value (30.3%) when predicting the need for TCHI in adult trauma patients, suggesting substantial unnecessary emergent transport. Further study is needed to identify factors closely associated with the need for a TCHI and subsequent protocol development to guide the use of emergent transport in trauma patients.

Sandi Wewerka, Regions Hospital

Prehospital Triage Decision Making: An Analysis of Triage Accuracy for Adult Trauma Patients

Methods: The local Regional Trauma Advisory Council led the design and implementation of a new communication process called a Trauma Team Activation Timeout (TTA Timeout). Prior to implementation of this pilot project, over 800 EMS providers viewed a YouTube video introducing the specifics of the protocol, including a mock scenario. The protocol required paramedics to verbalize “TTA Timeout” when entering the trauma bay at a single, urban level I trauma center. Hospital staff was expected to remain quiet and attentive during the paramedic report, which was delivered the trauma bay. The protocol also included a 7-item survey assessing their experience. Responses to survey questions were compared between EMS providers who participated in the TTA Timeout and those who did not. Results: Data were collected from 51 paramedics (17 EMS agencies) and 45 team leaders between March 1 and April 30, 2013. Paramedics perceived that TTA timeout was higher to the EMS provider (100% vs. 77%, p < 0.001), patient (100% vs. 75%, p < 0.001), and team leader (100% vs. 80%, p < 0.001) than the provider’s evaluation. Paramedics perceived the TTA timeout to result in higher effectiveness in the transfer of the patient than trauma team leaders. Prior to implementation of this timeout, trauma team leaders did not differ in their assessment of the following components of the timeout: 1) announcing “TTA Timeout,” 2) time limit for medical triage, 3) complete silence during the medical report, 4) questions only coming from team lead, and 5) dispatch information prior to EMS arrival. Conclusion: Paramedics report greater benefit of the TTA timeout process than the in-hospital trauma team leaders. In-hospital personnel may require more education about the importance of the EMS report with the critically injured patient.
Affect trauma triage decisions; and 4) how suspected TBI affects trauma triage decisions. All four were described and evaluated during a 60-month period using content analysis by a multidisciplinary team. Transcripts were reviewed and coded by multiple reviewers, and areas of coding disagreement were discussed until consensus was achieved. Codes were then grouped into overarching themes and domains. Results: Five focus groups included a total of 23 participants. Six themes emerged under two overarching domains: 1) patient assessment and 2) trauma triage decisions. Within the six themes, EMS providers agreed their overall assessment is improved with naloxone administration during hospital processing on local resource availability, including availability of diagnostic equipment and highly trained medical staff. Conclusion: This qualitative study identified key issues related to prehospital triage of older patients with suspected TBI who take anticoagulants and/or platelet inhibitors. EMS providers reported using different criteria for assessing the severity of patients over more complex scales or tools to inform both urgency of transport and their final selection of a receiving hospital. These findings should be confirmed in independent samples of EMS providers as well as through quantitative methods.

77. NALOXONE IS OVERUSED IN GERIATRIC PATIENTS IN THE PREHOSPITAL SETTING

Kimberly Baldino, Brian Walsh, Lisa Clayton, Morristown Medical Center

Background: Many clinicians would argue that the only appropriate prehospital use of naloxone is to improve ventilation, and prehospital providers should not be trying to make a diagnosis of poisoning. Naloxone is often used in geriatric patients to assist in the diagnosis of those with altered mental status. We sought to determine what percentage of naloxone administered to geriatric patients is for hyperventilation and altered mental status and how often it has a positive outcome. 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 age 60 and over transported prehospital with naloxone over a 60-month period. Vital signs on initial ALS evaluation and on arrival in the emergency department (ED) were recorded. A priori, hyperventilation was defined as an initial respiratory rate (RR) < 10 or a pulse oximetry value < 92%. A positive response to naloxone was defined as an increase of 4 or more breaths per minute or final pulse oximetry over 95% in a patient who was not intubated. Altered mental status (AMS) was defined as having a Glasgow Coma Score (GCS) of less than 14. Percentages and adjusted odds ratios for abnormal vital signs (CI) were calculated. Results: Of 105,183 ALS requests, 230 (0.2%) were for patients 60 years or older who were given naloxone. 92% (CI: 88, 95) had a discharge diagnosis of benzodiazepine intoxication or overdose. 84% (CI: 78, 89) had an initial GCS less than 14. Only 22% (CI: 16, 27) of patients were hyperventilating at the time of naloxone administration. All of these hyperventilating patients also had an AMS. Of the hyperventilating patients with AMS, 16% (CI: 6, 26) had a positive response. Of all the patients age 60 or over who were intubated, 4% (CI: 1, 7) had a positive response. Conclusion: More than 75% of geriatric patients treated with naloxone are not hyperventilating, suggesting that it is being administered for other reasons. When used in patients with AMS and hyperventilation, one-sixth improve. Overall, only 4% of patients age 60 years and older given naloxone seem to improve, suggesting it is being overused.

78. PREHOSPITAL END-TIDAL CARBON DIOXIDE IS ASSOCIATED WITH METABOLIC ACIDOSIS AND PREDICTS IN-HOSPITAL MORTALITY

Christopher Hunter, Salvatore Silvestri, George Raill, Danielle Dragoo, Linda Papa, Orange County EMS, Orlando Health

Background: To determine the ability of prehospital end-tidal carbon dioxide (ETCO2) to predict in-hospital mortality compared to traditional vital signs, and to examine the association of ETCO2 with metabolic acidosis. Methods: We conducted a retrospective cohort study among patients transported by emergency medical services (EMS) during a 29-month period. Included patients had ETCO2 recorded in addition to initial vital signs. Records were linked by manual archival of EMS and hospital data. The main outcome was death at any hospitalization. Secondary outcomes included metabolic or lactic acidosis in the emergency department. Results: There were 1,328 out-of-hospital records reviewed. Hospital discharge data, ETCO2, and all six prehospital vital signs were available in 1,088 patients. Of the 1,088 patients, 132 (12%) were trauma-related, 77% (711) were admitted. 40 (4%) did not survive, and 114 (11%) were admitted to intensive care. Low ETCO2 levels were the strongest predictor of mortality in the overall group, with an area under the ROC Curve (AUC) of 0.76 (0.66-0.85), as well as when patients in prehospital cardiac arrest were removed from the analysis, with an AUC of 0.77 (0.67-0.87). The significant adjusted odds ratios of abnormal vital signs for mortality included ETCO2 (1.11, 95% CI 1.06-1.15), systolic blood pressure (1.03, 95% CI 1.01-1.05), pulse oximetry (1.01, 95% CI 1.01-1.09), and an shock index (4.9, 95% CI 1.0-24.4). Defining abnormal ETCO2 as < 31 mmHg or > 41 mmHg, the sensitivity for predicting mortality was 93% (95% CI 86-96) and specificity was 44% (95% CI 41-48%), and the negative predictive value was 99% (95% CI 92-100%). In patients who had blood drawn, there were significant associations between ETCO2 and serum bicarbonate levels (r = 0.429, P < 0.001), anion gap (r = -0.216, P < 0.001), and lactate (r = -0.576, P < 0.001). Conclusion: All of the vital signs recorded in the out-of-hospital setting ETCO2 were the most predictive and consistent for mortality, which may be related to an association with metabolic acidosis. This has implications for improving patient care and could help EMS personnel direct patients to the appropriate destination of care.

79. AN EMS SEPSIS ALERT PROTOCOL REDUCES TIME TO ANTIBIOTICS IN PATIENTS PRESENTING WITH SEPSIS OR SEPTIC SHOCK

Timothy Shihab, Thomas Sweeney, Rebecca Rupp, Brian Joseph, Aimee Sonnad, Christiana Health Care System

Background: The goal of the project was to determine if an EMS “sepsis alert” (ESA) protocol with point-of-care lactate measurement decreases time of arrival (TOA) to administration of antibiotics, length of stay (LOS) measures and mortality. Methods: Before-and-after intervention study of the impacts of an ESA protocol on patients with severe sepsis/septic shock (SS/SSS) transported to an academic, tertiary care hospital by a county-based municipal paramedic service. Criteria for ESA protocol group were 1) Presence of 2 or more systemic inflammatory response syndrome (SIRS) criteria (HR > 90, RR > 20, T > 38 or < 36) plus paramedical clinical suspicion for infection, 2) prehospital venous lactate measurement = 4 mmol/dL, and 3) hospital notification of an ESA. Additional hospital response guidelines to an ESA were developed with the protocol to expedite care. Standardized, retrospective chart review was performed to collect patient data. Results: 91 patients were enrolled in the “before” (pre-ESA) group and 84 in the “after” group, with 53 (63%) of these patients having an ESA activation (ESA group). There were no significant differences between the pre-ESA and ESA groups with respect to age (69.8 vs. 71.3 years old), initial ED lactate level (4.7 vs. 4.8 mmol/dL) and ED APACHE II (22 vs. 22). Mean TOA to appropriate antibiotics was reduced by 48% in the ESA group vs. the pre-ESA group (74 ± 52 min vs. 141 ± 97 min, p = 0.001). In addition, sepsis patients in the ESA group were given antibiotics < 60 minutes (20.5% vs. 41% if ≤ 60 minutes (p = 0.023). Conclusions: An ESA reduces TOA to appropriate antibiotics in patients with severe sepsis/septic shock. The proportion of patients in the ESA group that received antibiotics within 60 minutes of arrival was 3-fold that of the pre-ESA group. EMS systems can have a significant impact on the care of patients with sepsis and meeting critical benchmarks.

80. MIDAZOLAM IS SUPERIOR TO DIAZEPAM FOR TREATMENT OF PREHOSPITAL SEIZURES

Brian Clemency, Jamie Ott, Christopher Tan- sko, Joseph Bart, Heather Lindstrom, University of Buffalo

Background: Diazepam and midazolam are commonly used by paramedics to treat seizures. We used a period of drug scarcity as an opportunity to compare their effectiveness in treating prehospital seizures. We conducted a retrospective chart review of a single large commercial emergency unit during a 29-month period, which included alternating shortages of both medications. Ambulances were stocked with either diazepam or midazolam based on availability of the drugs. Adult patients who received at least one parental dose of diazepam or midazolam for treatment of seizures were included. The regional prehospital protocol recommended 5 mg intravenous (IV) diazepam, 5 mg intramuscular (IM), or 5 mg IM midazolam, or 2.5 mg IV midazolam. Medication effectiveness was compared with respect to the primary end point: cessation of seizure without recurrence during the prehospital encounter. Results: A total of 440 study subjects received 577 administrations of diazepam or midazolam and met the study criteria. The subjects were 52% male, with a mean age of 48 (range 18-94) years. A total of 237 subjects received 329 doses of diazepam, 64 (27%) were treated with first dose IM. A total of 403 subjects received 208 doses of midazolam, 71 (35%) were treated with first dose IM. Seizure stopped and did not recur in 25% of subjects after a first dose of IM diazepam and 69% of subjects after a first dose of...
of IM midazolam (p < 0.0001). Diazepam and midazolam exhibited similar first dose success for IV administration (86% vs. 62%; p = 0.024). Age, gender, seizure history, hypoglycemia, the presence of trauma, time to first administration, prehospital contact time and frequency of IM administration were all similar between groups. **Conclusion:** For IM administration, midazolam demonstrated superior first-dose seizure suppression. This study demonstrates how periods of drug scarcity can be utilized to study prehospital medication effectiveness.

81. **PARAMEDIC RECOGNITION AND MANAGEMENT OF ANAPHYLAXIS IN THE PREHOSPITAL SETTING**

**Kristyna Samora**, Simerpreet Sandhanwalia, McMaster University

**Background:** No published report has evaluated paramedic management of anaphylaxis in Canada. Since most cases of anaphylaxis are out-of-hospital, and delay in epinephrine administration increases mortality, immediate recognition and response are paramount. The primary objective was to determine the proportion of cases that met the definition of anaphylaxis and were administered epinephrine by paramedics. The secondary objective was to determine the proportion of anaphylaxis cases administered epinephrine within 10 minutes of patient contact. **Method:** This was a retrospective observational study of patients with anaphylaxis managed by primary or advanced care paramedics in 6 emergency medical service areas in Ontario, from January 1, 2012 to December 31, 2012. All ambulance call records (ACR) coded as local allergic reaction (code 84) or anaphylaxis (code 85) were reviewed by the authors, to determine whether the patient met the definition for anaphylaxis as outlined by international guidelines. The timing of all medications administered and procedures completed were then abstracted into a database. **Results:** One hundred and seventeen ACRs were reviewed in total. All cases coded as anaphylaxis 68/68 (100%) were correctly identified. However, 26/49 (53%) of cases coded as local allergic reaction were incorrectly coded as local allergic reaction when they met anaphylaxis criteria. Thus, 68/97 (72%) of all patients meeting anaphylaxis criteria were correctly identified. Epinephrine was administered in 47/49 (95%) of anaphylaxis cases. 36/47 (77%) of these were received epinephrine in 10 minutes or less, with a mean of 7.63 minutes (95% CI: 6.47 - 8.98). **Conclusion:** There appear to be gaps in the recognition of anaphylaxis by paramedics in Ontario. Similarly, gaps exist in the life-saving use of epinephrine for anaphylaxis, since it was administered in just over half of cases. However, when epinephrine was administered it was done so in a timely manner for most patients. As part of a quality improvement initiative, this data will be used to evaluate and enhance the training and medical directives utilized by paramedics to improve their recognition and management of patients with anaphylaxis.

82. **PREHOSPITAL KETAMINE DOES NOT PROLONG ON-SCENE TIME COMPARED TO HALOPERIDOL WHEN USED FOR CHEMICAL RESTRAINT**

**Aaron Burnett, Dolly Panchal, Kent Griffith, Ralph Frascone, Kristen Engebretsen, Regions Hospital**

**Background:** Agitated and violent patients may present a danger to themselves and emergency medical services (EMS) providers. Behavioral emergencies may also distract from diagnosing and treating critical medical and traumatic pathologies. In order to improve patient and provider safety as well as allow EMS providers to safely conduct an accurate and thorough assessment of severely agitated patients frequently require chemical restraint. Antipsychotics such as haloperidol, often in combination with benzodiazepines, have long been utilized for chemical restraint in many EMS services. Recently, ketamine has been added as an option. Minimizing on-scene time to facilitate rapid transport to a receiving emergency medical department (ED) is a key quality metric in EMS. We aimed to evaluate whether the use of ketamine for chemical restraint was associated with an increased on-scene time compared to haloperidol. **Methods:** A total of 99 cases were identified during the study period (haloperidol = 59; ketamine = 40). Benzodiazepines were co-administered with ketamine in 51/59 (86%) cases while ketamine was given as monotherapy in all cases. There were no differences between haloperidol and ketamine treatment groups in terms of demographic information. There were no differences in on-scene time for patients receiving haloperidol compared to ketamine (18.2 ± 9.3 vs. 15.5 ± 10.4; p = 0.19). **Conclusion:** Ketamine for chemical restraint was not associated with an increased on-scene time compared to haloperidol. Intubation, presence of emergence reaction, laryngospasm, and need for hospital admission to a medical unit did not differ significantly for the two groups. 21 patients were excluded based on the pre-determined exclusion criteria, leaving 49 patients for analysis. Ketamine dosing ranged from 2.25 mg/kg to 7.8 mg/kg. Intubation rates were 1/49 (2%) for ketamine (0% vs. 100% for haloperidol; p = 0.02). Ketamine doses were not different between patients who required additional sedation (n = 25) or in patients who experienced no additional sedation (n = 24). Although not statistically significant, there was a trend toward higher ketamine dosing in the three patients experiencing laryngospasm (7.5 ± 5.11 mg/kg, p = 0.35 vs. 2.25 ± 3.67 mg/kg, p = 0.71). Ketamine dosing was not different for the 28 patients requiring medical admission compared to those discharged from the emergency department. Significant differences were noted between those who required intubation (n = 14, mean = 6.16 mg/kg) and those who did not (n = 35, mean = 4.9 mg/kg, p = 0.02). **Conclusion:** Our experience with intramuscular ketamine for prehospital chemical restraint demonstrates potential for loss of airway reflexes requiring intubation. This occurred at a statistically significant higher frequency in the ketamine group. A minimum effective dose was identified. Prehospital providers should balance these risks with the need for immediate restraint and personal safety.

84. **OUTCOMES FROM PREHOSPITAL USE OF HYDROXOCOBALAMIN FOR CYANIDE POISONING IN A MAJOR METROPOLITAN EMERGENCY MEDICAL SERVICE**

**Keith Gates, Michael Pandya, David Persse, The University of Texas, Houston Fire Department**

**Background:** The combination of hypoxia, cyanide poisoning, and coma in smoke inhalation is known to be lethal in animal models at sub-lethal doses. Hypoxia and carbon monoxide poisoning treatment can be initiated prehospital, but options for treatment of cyanide are limited. Few data from human subjects exist about the impact of hydroxocobalamin on survival of smoke inhalation victims. No data exist for prehospital administration of hydroxocobalamin in the United States. We report the effects on survival of patients suffering smoke inhalation who received hydroxocobalamin at the discretion of paramedics and other emergency medical service providers. We hypothesize that patients receiving hydroxocobalamin will have an improved survival and return of spontaneous circulation (ROSC) rate. **Methods:** We conducted a retrospective chart review and abstraction of a cohort of patients evaluated and treated with hydroxocobalamin for possible cyanide poisoning by the Houston Fire Department from February 2008 through November 2012. A convenience sample of subjects who received hydroxocobalamin prehospital or in the emergency center was included in the cohort. Subjects were identified by querying the HFD patient records database for administration of “hydroxocobalamin,” “CyanoKit,” “smoke inhalation,” and “cyanide poisoning.” The primary observation was survival at discharge. Secondary observations included presence of observed changes in patient subsequent to initiation of altered mental status (AMS), initial cardiac rhythm, and achievement of ROSC. **Results:** We identified 22 patients with fire-associated intoxication with a mean lactate of 18.6 ± 17.8 vs. 36.3 ± 12.9; p = 0.70).% male (59.3% vs. 70.0%; p = 0.28) or of patients with psychiatric chief complaint (44.1% vs. 55.0%; p = 0.29). There was no statistical difference in on-scene time for patients receiving haloperidol compared to ketamine (18.2 ± 9.3 vs. 15.5 ± 10.4; p = 0.19). **Conclusion:** In this urban EMS system, the use of prehospital ketamine for chemical restraint was not associated with an increased on-scene time compared to haloperidol.
showed improvement of mental status after ad-
imistration. Conclusion: Prehospital admin-
tistration of medications is a safe and effective means to improve clinical outcomes as previously reported by Fortin et al. Patients in asystole/PEA may achieve high ROSC rates with administration of hy-
drolaziz Medical City-National Guard Health Affairs

size, retrospective nature, and lack of baseline
data. We sought to create a dispatch rule that
captured all 5 patients with sufficient sensitivity. Con-
clusions: Although we were unable to design a
dispatch rule with sufficient sensitivity, only 2%
of patients in our analysis met our criteria for need-
ing L&S response. Our analysis was limited by this being a single EMS and single hospital study with a small number of patients who met our outcome criteria for needing L&S response, we may have be able to design a dis-
patch rule that met our predefined standards. How-
ever, we used AEDs for abdominal pain requiring emergent treatment, it seems prudent to curtail lights and sirens
response for these patients.

87. ASSOCIATION BETWEEN ANTI-EPILEPTIC MEDICATIONS AND SEIZURES IN INTRACRANIAL HEMORRHAGE PATIENTS DURING CRITICAL CARE TRANSPORT

Michael Hilton, Christian Martin-Gill, Frank Guyette, University of Pittsburgh

Background: Seizures occur in 6% to 42% of patients with intracranial hemorrhage (ICH). Antiepileptic medications (AEDs) are com-
momly used for patients with ICH prior to or during interfacility transfer. There is a lack of evidence identifying the short-term bene-
fits of AED administration by air medical ser-
dices during interfacility transport. We aimed to
identify the incidence of seizure during inter-
facility transfer of patients with ICH and deter-
mine the association of AED administration with
incidence. We retrospectively reviewed 1,375 cases involving
patients with confirmed intracranial hemor-
 rhage between 1/1/2010 and 12/30/2012 that
were transferred to a tertiary care facility by
a critical care air medical service. We identi-
fied the frequency of seizure occurring during
transport and characterized these cases by de-
scribing patient age, sex, transport time, hem-
orrhage type, presence of trauma, AED use prior to transport crew arrival, and AED use during critical care transport. We then analyzed the association of AED administration before or during critical care transport of patients with ICH and determine the association of AED administration with
incidence based on Fisher’s exact test (p-value < 0.05). Results: Of 1,375 cases with ICH, only 5 (0.36%) had a seizure during transport. The median time
in-transfer (from transport team arrival at bed-
side to transfer of care at the receiving facil-
ity) was 47 minutes (IQR 38, 59). Of patients that sustained seizure in-transfer, mean age was 45 (range 20-78) and 10 (36%) were males. Pa-
patients had subarachnoid hemorrhage (1), sub-
dural hematoma (1), intraparenchymal hemor-
 rhage (2), or multiple hemorrhages (1), and only one was seizure free (21%). Of patients with
received AED (phenytoin or levetiracetam) be-
fore or during transport. Three patients experi-
encing seizure in-transfer received AED prior to
arrival (1) or during transport (2). Seizure
incidence during transport appeared to be in-
dependent of AED administration (p = 0.275). Conclusions: Seizure incidence during trans-
port of patients with ICH is an infrequent oc-
currence. Antiepileptic medication administra-
tion before and during transport was not as-
sociated with seizure occurrence. These data fail to support prophylactic administration of antiepileptic medication during critical care
transport of patients with intracranial hemorrh-

88. PERCEPTION OF INTRANASAL MEDICATION EFFICACY BY PREHOSPITAL PROVIDERS

Michael Dailey, Matthew Morgan, Adam Frisch, Albany Medical Center

Background: Intranasal (IN) medication ad-
mistration in emergency medical services (EMS) is increasing. Previous studies have shown the pharmacologic efficacy of IN admin-
istration compared to other parenteral meth-
ods of medication administration. No study to
date has evaluated the perception of IN medi-
cation administration by EMS providers, which
could have significant impact on its use in the
prehospital setting. The objective was to de-
termine the practices and perceptions of IN medication administration by EMS providers.
Methods: An online survey tool was sent to all advanced prehospital providers in the region. These providers were questioned about their experiences with IN medication administration and their perceptions of the efficacy and ef-
ciency of this route of administration. Descrip-
tive statistics were used to analyze the results. Providers were also urged to provide unstruc-
tured feedback about their views. Result: Sur-
veys were distributed to 823 email addresses; 48 “bounced,” leaving a total of 775 (40.6%) providers completed the entire survey. While 311 (69%) providers have had formal IN ad-
mistration training, only 270 (79.8%) have per-
formed positive experiences with IN admin-
tration of naloxone, fentanyl, and midazolam (p < 0.001). Providers did not have a positive expe-
rience or perception with IN administration of
glucagon (p = 0.77). One hundred forty (12%) believed that morphine could be given
IN. In the unstructured feedback section, there was a range of responses, including a prefer-
ence to use IN administration only in pa-
tients or those in whom IV access is diffi-
cult to obtain, as well as making more medi-
cations available by intranasal route. Conclu-
sions: The use of IN medication administration
has increased significantly in last few years. Studies have shown its efficacy in the clinical setting, and there is clear reduction in risk of needle stick to the provider; there seems to be a buy-in of its usefulness clinically, but we must assure clear understanding of the physiology of the medications, so only medications absorbed through the mucosa are appropriate. The data collected shows that providers have a gen-
erally positive perception of IN medication ad-
mistration.
Background: Effective transition of care between health-care settings is increasingly recognized as a key component of high-quality health care. Mobile Integrated Healthcare Practice (MIHP) is an emerging practice model for improving transition from the inpatient setting to the post-acute medical (EMS) providers as the cornerstone of care coordination. EMS uniquely impacts care transitions because of its role at the intersection of the inpatient, outpatient, and home environments. This abstract describes the process for development of an MIHP for an urban congestive heart failure (CHF) population. Methods: Participants included: 1. A central approach to call center mobilized need-matched resources to the patient in a time-appropriate manner by positioning emergency medical services (EMS) at the scene of the event. 2. EMS integrates services provided by home health, pharmacy, social work, cardiology, physical therapy, medicine, and hospital administration. The pilot was self-funded by MIHP stakeholders based on the assessed value to the CHF patient and the hypothesized improvement in readmission rates. Results: Under this model, EMS performs an in-home assessment for readmission risks, patient mobility limitations, and home medications and oxygen. EMS also coordinates home tele-monitoring and reviews the follow-up care plan and discharge instructions with the patient. If any element is deemed inadequate by EMS, centralized call center mobilizes need-matched resources to the patient in a time-appropriate interval. Specific members of the interprofessional team then address a patient's individual needs. Conclusions: This demonstrates that an interprofessional care team with the lead stakeholder in transitional care can develop a MIHP pilot for the care of CHF patients at an urban academic medical center. Coordinated interprofessional involvement in the development of a bundle of validated interventions leads to need-matched resource allocation, as identified by EMS providers. We describe a feasible model for the development of a coordinated care transition program with EMS as a lead partner.

90. FIRST-RESPONDER ACCURACY USING SALT AFTER BRIEF INITIAL TRAINING

Chris Lee, Shelley McLeod, Michael Peddle, The University of Western Ontario, Southwest Ontario Regional Base Hospital

Background: Mass-casualty incidents (MCIs) present a unique challenge in terms of triage and response for the medical community. The Centers for Disease Control and Prevention in the United States define a mass-casualty incident (MCI) as an event that produces a large number of injuries or deaths. Mobile Integrated Healthcare Practice (MIHP) is an emerging practice model for improving transition from the inpatient setting to the post-acute medical providers as the cornerstone of care coordination. EMS uniquely impacts care transitions because of its role at the intersection of the inpatient, outpatient, and home environments. This abstract describes the process for development of an MIHP for an urban congestive heart failure (CHF) population. Methods: Participants included: 1. A central approach to call center mobilized need-matched resources to the patient in a time-appropriate manner by positioning emergency medical services (EMS) at the scene of the event. 2. EMS integrates services provided by home health, pharmacy, social work, cardiology, physical therapy, medicine, and hospital administration. The pilot was self-funded by MIHP stakeholders based on the assessed value to the CHF patient and the hypothesized improvement in readmission rates. Results: Under this model, EMS performs an in-home assessment for readmission risks, patient mobility limitations, and home medications and oxygen. EMS also coordinates home tele-monitoring and reviews the follow-up care plan and discharge instructions with the patient. If any element is deemed inadequate by EMS, centralized call center mobilizes need-matched resources to the patient in a time-appropriate interval. Specific members of the interprofessional team then address a patient’s individual needs. Conclusions: This demonstrates that an interprofessional care team with the lead stakeholder in transitional care can develop a MIHP pilot for the care of CHF patients at an urban academic medical center. Coordinated interprofessional involvement in the development of a bundle of validated interventions leads to need-matched resource allocation, as identified by EMS providers. We describe a feasible model for the development of a coordinated care transition program with EMS as a lead partner.

91. DISASTER PREPAREDNESS AND NEEDS ASSESSMENT OF OLDER ADULTS

Mary Colleen Blaha, Jennifer Frey, William Hardy, Amos Burgess, SUMMA Akron City Hospital, Northeast Ohio Medical University

Background: The elderly population has proven to be vulnerable in times of a disaster. Many cases of medical problems arise because of which they depend on medications or medical equipment. Some older adults are dependent on care givers for managing their activities of daily living (ADLs) such as dressing and instrumental activities of daily living (IADLs) such as transportation. A coordinated effort for disaster preparedness in the elderly population is paramount. We sought to assess the potential needs and plans of older adults in the face of a local disaster. Methods: The setting is a community-based, university-affiliated urban ED (emergency department) that sees more than 77,000 adult patients per year. We distributed a survey on disaster plans and resources needed if evacuating 100 elderly patients age 65 years and older from January to July 2013. We report means and proportions with 95% confidence interval (CI). Results: We collected data from 13 visitors and 87 patients. The mean age was 76 and 54 were female. Thirty-one respondents that they had a disaster plan in place (31/100, CI 22.4-41.4%). Of those 31, 94% (29/31) CI 76.8-99.2% had food and water as part of their plan, 62% (19/29, CI 42.2-78.2%) had a supply of medication and 35% (12/31, CI 21.8-57.8%) had an evacuation plan. When asked what supplies the 100 subjects might need if evacuated, 33% (CI 23.9-43.1) needed a walker, 15% (CI 8.6-23.5) needed a wheelchair, 78% (CI 68.6-85.7%) glasses, 17% (CI 10.2-25.8%) a hearing aid, 16% (CI 9.4-24.7%) a glucometer, 93% (CI 86.1-97.1%) medication, 14% (7.8-22.4%) oxygen, 23% (CI 15.2-32.5%) adult diapers, and 21% (CI 13.2-30.3%) had medical equipment. The most common medical equipment that 100 subjects also required help with one or more of their ADLs, the most common being dressing (17%, CI 10.3-26.1%) or their IADLs, the most common being conversation (9%, CI 29.7-49.7%). Only 42% (CI 32.3-52.7) were interested in learning more about disaster preparedness. Majority of the older adults in our study population had a disaster plan in place. Most of the respondents would require medications and many would require medical supplies if evacuated.

92. THE IMPACT OF PRE-ARRIVAL DISPATCH-ASSISTED CPR ON Bystander CPR INITIATION: A RETROSPECTIVE ASSESSMENT OF OUT-OF-HOSPITAL CARDIAC ARREST

Ben Bobrow, Michal Pancezyk, Uwe Stolz, Nathan Heagerty, Christian Demaff, Jeffrey Tully, Ryan Anne Murphy, Tyler Vadeboncoeur, Maricopa Medical Center, Arizona Department of Health Services

Background: Bystander CPR (BCPR) strongly influences survival from OHCA yet is provided in minority of cases. This paper will examine national data for pre-arranged hands-only dispatch-assisted telephone CPR (TCPR) instructions to increase the proportion of arrests receiving early BCPR; however, the impact of those guidelines is unknown. Objective: Evaluate the impact of the TCPR guidelines on recognition of OHCA by 9-1-1 dispatchers, time from 9-1-1 dispatch to giving TCPR instructions, time to first chest compression (CC), prehospital return of spontaneous circulation (ROSC), survival, and favorable neurological outcome (FNO). Methods: Dispatch audio records of OHCA in 3 large dispatch centers in Arizona (10/11-12) were reviewed using a standardized & time-stamped methodology. Data were entered into a customized TCPR database linked to EMS and hospital outcome data. Intervention: Implementation of a 2-hour individual dispatcher training and a guideline-based change in dispatch protocol. Results: There were 860 pre-implementation (P1) and 799 post-implementation (P2) cases. A total of 1,265 cases met inclusion criteria. Outcome data collection and linkage is ongoing: ROSC, survival, and neurological outcomes were available in 26%, 24%, and 22% of cases, respectively. The proportion of cases receiving TCPR increased: P1 (28.7%), P2 (49.9%, p < 0.001). Median time to beginning TCPR instructions decreased significantly: P1 (153 sec); P2 (129 sec, p < 0.001) as did dispatchers’ time to first CC: P1 (198 sec); P2 (162 sec, p < 0.001). Outcomes—ROSC: P1 16.9% vs. P2 25.5% (adjusted OR = 1.66, 95% CI: 0.96, 2.95); Survival to hospital discharge: P1 3.3% vs. P2 10.0% (adjusted OR = 1.97, 95% CI: 0.83, 4.67); Good neurological outcome: P1 6.6% vs. P2 11.5% (adjusted OR = 2.57, 95% CI: 0.92, 7.19). Conclusions: The implementation of the AHA pre-arranged hands-only dispatcher-assisted telephone CPR (TCPR) guidelines was associated with a significant improvement in the time-to-CPR instructions and time-to-first CCs and rate of provision of dispatcher-assisted bystander CPR. This small, preliminary analysis of prehospital interventions.
Prehospital Emergency Care 

**Effects of Dispatcher-Assisted Bystander Cardiopulmonary Resuscitation on Outcomes After Out-of-Hospital Cardiac Arrest: A Nationwide Observational Study**

**Background:** Bystander cardiopulmonary resuscitation (BCPR) with dispatcher assistance (DA) has been known to improve outcomes after OHCA in a community through spreading bystander CPR. Previous studies reported that BCPR with DA had an equivalent effect to BCPR without DA on outcomes, but whether the BCPR with DA between specific bystander groups (public versus home) is associated with better outcomes or not.

**Methods:** Adult OHCA with cardiac etiology treated by EMS providers, and received bystander CPR in a nationwide OHCA registry from Sep. 01 to Dec. 31, 2012, were analyzed. Excluded patients who were 18 years or younger, whose arrest was witnessed by EMS providers, and for whom no information was provided about hospital outcomes or place of event. Eligible patients were selected from a nationwide OHCA registry and merged with a dispatch registry. Bystander CPRs by place and DA are categorized into four groups: public-D, home-D, public-N, and home-N. The primary and secondary endpoints were survival to discharge and good neurological recovery at hospital discharge by the CPC 1 and 2 criteria. A multivariable log-binomial regression model was utilized and an analysis of differences in survival to discharge and good neurological recovery compared with home-DA, public-D, and home-NDA was performed. The adjusted ORs for survival to discharge compared with home-NDA group were 0.80 (0.34-1.86) in public-D, 0.36 (0.18-0.71) in home-D, and 0.84 (0.44-1.59) in public-NDA, respectively. The adjusted ORs for survival to discharge compared with home-NDA group were 1.87 (0.63-5.58) in public-D, 0.34 (0.12-0.94) in home-D, and 1.31 (0.57-3.04) in public-NDA, respectively. **Conclusions:** Patients who received home bystanders were associated with worse hospital outcomes than patients who received home BCPR without DA. The study findings suggest home bystanders may be associated with lower quality CPR and followed by poor outcomes when they receive CPR instruction via telephone.

**Effect of Dispatcher-Assisted Bystander Cardiopulmonary Resuscitation Between Public Versus Home Bystanders on Outcomes After Out-of-Hospital Cardiac Arrest: A Nationwide Observational Study**

**Background:** This survey was conducted in 2010. 5,686 PASPs were identified, and 3,555 had valid cell phone numbers and were contacted. Each received a preliminary email announcing the survey, an e-mail with a link to the survey, and up to three follow-up e-mails for non-responders. The survey contained 22 straightforward questions with sub-questions depending on the response selected. **Results:** Of the 5,686 identified PASPs in the United States, 3,555 (62%) responded with DA-CPR, with 1,917 (53%) responding. Responding agencies represented all 50 states and the District of Columbia. Nearly all public agencies (n = 1,883, 99%), 879 (45%) of which were hospitals. Agencies responded that they provide no PAUs for medical emergencies, and 273 (31%) of these provided compression-only CPR (7%) of these provided compression-only CPR. **Conclusions:** Among non-responders showed no substantial difference in the provision of PAUs for OHCA by non-responders. **Conclusions:** To our knowledge, this survey represents the first type of PAUs provided. A telephone validation study was performed, and showed strong results for equivocal criteria, and 1.31 (0.57-3.04) in public-NDA, respectively. The adjusted ORs for survival to discharge compared with home-NDA group were 0.80 (0.34-1.86) in public-D, 0.36 (0.18-0.71) in home-D, and 0.84 (0.44-1.59) in public-NDA, respectively. The adjusted ORs for survival to discharge compared with home-NDA group were 1.87 (0.63-5.58) in public-D, 0.34 (0.12-0.94) in home-D, and 1.31 (0.57-3.04) in public-NDA, respectively. **Conclusions:** Patients who received home bystanders were associated with worse hospital outcomes than patients who received home BCPR without DA. The study findings suggest home bystanders may be associated with lower quality CPR and followed by poor outcomes when they receive CPR instruction via telephone.
bibliographic and gray literature searches were purposefully broad. Inclusion criteria for articles included if the study population was paramedics, the document reports on alternatives to traditional ambulance dispatch OR traditional ambulance transport to the ED, and the document describes an outcome measure. The reports were categorized as either alternative to dispatch or to transport, and outcomes were categorized and described. [Results] The 18 bibliographic and gray literature search retrieved 8,773 titles, from which 134 titles were selected for further review. From these, 61 abstracts were retrieved, out of which 27 full text articles were selected. In the gray literature search, 31 websites were identified, from which four met criteria and were retrieved. Eleven reports described alternatives to EMS dispatch, which measured the following outcomes: clinical (n = 1), safety (n = 2), time (n = 1), service utilization (n = 5), patient satisfaction (n = 1), cost (n = 3), accuracy of decision (n = 7), and process outcomes (n = 1). Twenty reports described alternatives to EMS transport, which measured the following outcomes: clinical (n = 7), safety (n = 5), time (n = 7), service utilization (n = 11), cost (n = 3), accuracy of decision (n = 2), process outcomes (n = 5), other (n = 2). [Conclusions] For programs which provide an alternative to EMS dispatch, documented outcomes were catalogued and described. Future researchers and program leaders should achieve consensus on uniform outcome measures, to allow benchmarking and comparison across programs.

98. BARRIERS TO SELF-REPORTING: SAFETY EVENTS BY PARAMEDICS
Julie Sinclair, Christopher Bourque, Lisa Calder, Michael Austin, Andrew Reed, Jennifer Korito, Justin Maloney, Regional Paramedic Program of Eastern Ontario

Background: Strategic priorities to address patient safety issues in EMS have recently been emphasized, but little research exists examining the extent to which patient safety events occur within EMS and even fewer studies investigate patient safety systems for self-reporting by paramedics. The purpose of this study was to identify the barriers to paramedic self-reporting of patient safety events; specifically, patient safety events clinical (PCV), near miss PCV, major PCV, and adverse events. [Methods] The survey describes one of five different patient safety event clinical scenarios (nears miss, adverse event, minor, major, and critical) and lists 18 potential barriers to self-reporting as closed-ended questions. These include 11 fear-based barriers and were presented for rating on a 5-point Likert scale. The surveys were randomly distributed to 1,153 paramedics during the 2012 continuing medical education (CME) sessions. Data analysis consisted of descriptive statistics, chi-square tests, and Mann-Whitney tests, where applicable. [Results] We received responses from 1,133 paramedics (98.4%). Almost one-third (28.2%) were medical students and 39% (n = 442) had more than 10 years’ experience. The top five barriers to self-reporting (very significant or significant) (n,%) were fear of being punished (905, 79.9%), fear of being suspended and short-term income loss (890, 78.6%), fear of a Minnesota Department of Health and Long Term Care (MoHLTC) investigation (882, 77.9%), fear of termination (880, 77.2%), and fear of deactivation (869, 76.7%). Overall, 64.2% responded they would self-report the patient safety event. Intention to self-report varied according to the patient safety event clinical scenario (22.3% near miss, 46.0% adverse event, 73.3% minor PCV, 85.7% major PCV, 93.2% critical PCV). No association was found between the scope of practice and intention to self-report (p = 0.55). [Conclusions] A high proportion of fear-based barriers exist to self-reporting of patient safety events, and that a culture change is needed to facilitate the identification of future patient safety threats.

99. TIME OF DAY TRENDS IN AMBULANCE DEMAND
Kate Cantwell, Ameen Morgans Benetas, Karen Smith, Paul Dietze Michael Livingston, Ambulance Victoria

Background: Occupational, social, and recreational routines follow temporal patterns, as does the onset of certain acute medical diseases and injuries. If the temporal nature of injury and disease transfer into patterns that can be observed in ambulance demand, we sought to determine whether distinct disease or injury temporal patterns could be observed in ambulance demand. [Methods] All cases attended by Ambulance Victoria between January 2007 and December 2011 in metropolitan Melbourne were extracted from the Ambulance Victoria data warehouse. Data on time of call, cause, and final primary assessment (paramedic “diagnosis”) were analyzed. [Results] This study included 1,101,582 cases. Distinct temporal patterns of disease and injury were observed in ambulance demand. Overall ambulance demand was lowest at 5am and then peaked at 11am. Distinct patterns were seen when data was analysed by final primary assessment. Cardiovascular events were more frequent in the mornings. Motor vehicle crashes had their highest frequency at 1700 hours. Mental health cases peaked in the evenings. Fevers, coughs, and shortness of breath cases were significant contributors to demand in the late evenings and early mornings. The frequency of trauma cases increased on weekends; medical cases had a higher frequency during the week than on Monday. Age was an important factor in time of day patterns seen. Many disease patterns with a morning peak of calls also had an older average age. Some patterns with no obvious morning peak showed a morning peak for elderly callers when analyzed by age category. [Conclusions] Time of day patterns can be observed in ambulance demand among a broad range of calls. These patterns are associated with different patient demographics, possibly different mechanisms of illness, and healthcare-seeking behavior.

100. FACTORS THAT PREDICT PREHOSPITAL PARAMEDIC IV CANNULATION SUCCESS: A RETROSPECTIVE ANALYSIS
Tristan Walker, Michelle Klingel, Shelley McLeod, Adeel Ahmed, Stephanie Romano, Adam Dukelow University of Western Ontario, Southwest Ontario Regional Base Hospital Program

Background: Intravenous (IV) cannulation is an enhanced paramedic skill required for the administration of IV medications and fluids in the prehospital setting. If IV cannulation success is variable among providers and the factors contributing to IV success have yet to be defined. The objective of this study was to determine predictors associated with successful IV cannulation in the prehospital environment. [Methods] This was a retrospective review of data gathered from 6 emergency medical services from a Regional Base Hospital Program from April 2011 to March 2012. Paramedics not certified in IV cannulation and those who attempted >5 IV cannulations were excluded. IV success was defined as successfully catheterizing a patient’s vein in 75% of the attempts made over the study period. Backward stepwise multivariable logistic regression models determined predictor variables independently associated with successful IV cannulation in the prehospital setting. [Results] Results were performed a total of 12,728 IV attempts over the 1-year study period. 85 (24.1%) were advanced care paramedics (ACPs) and 268 (75.9%) were primary care paramedics (PCPs). Full-time employees. Paramedic training level, years since IV certification, call volume, error rate, number of IV attempts, proportion of high acuity calls, proportion of older patient (= 75 years) calls, and the proportion of calls in an urban setting were variables included in the adjusted model. ACP certification (OR: 3.1, 95% CI: 1.7, 5.5) and IV attempts ≥ 40 the (OR: 2.0, 95% CI: 1.1, 3.4) were independently associated with IV success. [Conclusions] Two parametric factors were independently associated with successful IV cannulation. The results of this study should be considered when developing training benchmarks for skill development and maintenance.
requirements led to increased proactive sedation management and a safer transport environment for patients and providers.

102. A PROSPECTIVE EVALUATION OF THE USE OF A HANDOVER CALL RECORD TO CHANGE THE MANAGEMENT OF PATIENT CARE IN THE EMERGENCY DEPARTMENT

Natalie Cram, Michelle Klingel, Matthew Davis, Shelley McLeod, Michael Lewell, Adam Dukelow, Southwest Ontario Regional Base Hospital, University of Western Ontario

Background: The objective of this study was to determine how often the ambulance call record (ACR) was used when handing over patient information to the emergency department (ED) physician at initial assessment and to determine if the ACR contains information that could change the ED management of patients. Methods: This was a prospective cohort study of adult patients arriving at one of two EDs at a tertiary care center (annual census 125,000) by ambulance. At this center, electronic ACRs are faxed to the ED upon completion and added to the patient’s chart by ED staff. Physicians were asked to complete a data collection form for each patient regarding ACR availability and if the ACR contained information that could change the ED management of the patient. Results: Of 830 cases, 553 (66.7%) had an ACR available (n = 265), physicians reported that information change altered their treatment plan in 76 cases (28.7%) when an ACR was not available. 63.9% of physicians indicated the ACR would have provided valuable information, such as patient history, allergies or significant vital signs. In 411 (50.5%) cases, the ACR was available and the patient received neither verbal handover from a nurse or paramedic nor an ACR. There were only 56 (6.9%) cases where the physician received both verbal handover and an ACR. Conclusions: Although the ACR contains clinically relevant information, which may change or influence ED management, physicians often assess, treat, and disposition patients without receiving the ACR.

103. FREQUENCY OF PERFORMANCE OF DELегATED MEDICAL ACTS BY PRIMARY CARE PARAMEDICS IN A REGIONAL BASE HOSPITAL PROGRAM

Don Eby, Tracy Gaunt, Al Rice, Shelley McLeod, Southwestern Ontario Regional Base Hospital Program

Background: Competence to perform delegated medical acts (DMAs) is believed to be related to frequency of practice. Although at least the minimum of 200 patient transports is recommended to establish minimum frequency benchmarks, the frequency of skill performance has rarely been reported in the prehospital literature. The objective of this study was to report the frequency of calls in which primary care paramedics (PCPs) performed DMAs. Methods: A retrospective review of 27,628 ambulance call reports over 2 years (April 2011–March 2013). These were comprised of 26,525 patient transports and 1,083 ambulance transports. Results: Of 5,887 PCPs, 97% did not perform a needle thoracostomy, 97% did not perform a cardioversion, and 95% did not perform a single patient transport. Seven subjects (SD 10) years EMS experience. Seven subjects installed the application and successfully transmitted data. Subjects scheduled an average of 10 shifts during the 30-day study period (total 74, min 5, max 15). Pre-shift sleep hours were 73 for 74 shifts (99%). Post-shift fatigue measures over time using descriptive statistics. Results: We enrolled 9 nine subjects (3 females) aged 29 (SD 10) years and with 8.5 (SD 10) years EMS experience. Seven subjects installed the application and successfully transmitted data. Subjects scheduled an average of 10 shifts during the 30-day study period (total 74, min 5, max 15). Pre-shift sleep hours were 73 for 74 shifts (99%). Post-shift fatigue scores were transmitted for 65 of 74 shifts (88%). Complete pre-shift and post-shift data was obtained for 62 shifts (84%). Subjects reported a mean of 6 hours of sleep. One subject reported ≤4 hours of sleep prior to work for 90% of pre-shift entries. Post-shift fatigue scores were higher in subjects over time. Fatigue scores for two subjects indicated severe mental and physical fatigue for a single shift. There were no injuries reported during the study period. Conclusions: Wide variability in pre-shift sleep and post-shift fatigue scores within and between subjects provides evidence for experience sampling of sleep and fatigue among EMS workers. Compliance with data entry in this pilot study suggests that using a smartphone mobile application to collect sleep and fatigue, and injury data from EMS workers is feasible.

104. THE FREQUENCY OF CRITICAL PROCEDURES PERFORMED BY PARAMEDICS IN A HIGH-VOLUME EMS SYSTEM

Stephen Sanko, Shira Schlesinger, Mark Eckstein, Keck School of Medicine of USC, Los Angeles Fire Department

Background: Maintaining procedural competence is vital to the practice of emergency medicine, both for hospital-based and prehospital providers. In Los Angeles, an urban EMS system with an increasing number of paramedics and short transport times, individual paramedics may have difficulty maintaining their skills for certain lifesaving procedures with live-patient encounters. The objective of this study was to describe current provider-level data for critical procedures performed in a high-volume EMS system. Methods: A retrospective review of electronic medical records from January 1, 2012 through December 31, 2012 from the Los Angeles Fire Department (LAFD) which has 1,100 personnel and a population of 3.8 million (0.29 paramedics per 1000 residents), was used to quantify attempts and successful performance of five critical procedures: needle thoracostomy, supraglottic airway (SGA) placement, the King airway, cardioversion, and needle thoracotomy. Primary outcome measures were the cumulative frequency of each procedure and the frequency performed per paramedic. Results: During the 12-month study period LAFD responded to 317,000 EMS incidents, resulting in 193,300 patient transports. During this time, paramedics performed 821 critical procedures. This included 966 endotracheal intubations performed by 456 paramedics, 667 supraglottic airway placements performed by 359 paramedics, 28 cardioversions performed by 24 paramedics, 54 external cardiac pacing events performed by 43 paramedics, and 36 needle thoracotomies performed by 27 paramedics. 59% of paramedics did not perform a single endotracheal intubation in 2012. In SGA, 97% did not perform a cardioversion, 95% did not perform external cardiac pacing, and 97% did not perform a needle thoracotomy. Conclusions: Critical skills necessary for potentially life-saving, were rarely performed by individual paramedics in our large urban EMS service. Paramedics are at significant risk for skill deterioration, and new personnel are unlikely to achieve competence in the performance of critical procedures if clinical exposure is the sole basis for the attainment of skill.

105. A DESCRIPTION OF VIOLENCE TOWARDS EMERGENCY MEDICAL SERVICES PROFESSIONALS

Remle Crowe, Jennifer Eggertichs, Mirinda Gormley, Severo Rodriguez, Melissa Bentley, Roger Levine, National Registry of EMTs

Background: Everyday risks inherent to emergency medical services (EMS) include exposure to hazardous substances, exposure to infectious substances and accidents involving emergency vehicles. An additional danger faced by EMS professionals comes from the patients, their relatives, and bystanders, who in tense situations may direct their aggression toward the EMS professional as either verbal or physical assault. Objective: To describe the prevalence and characteristics associated with violence towards EMS professionals. Methods: In 2013, EMT-basics and paramedics responded to the Longitudinal Attributes for CESIUM Study, which included fourteen items on violence that could change the ED management of patients.
encountered either from patients or their relatives and bystanders in the past 12 months. Violence included physical, verbal, emotional, sexual, financial, or other forms of abuse. The data was analyzed using statistical methods to determine the prevalence and characteristics of violence in the past 12 months. The prevalence of violence varied by type and severity, with the highest prevalence observed for financial abuse and the lowest for emotional abuse. The data also highlighted the potential impact of violence on the well-being of paramedics and the importance of providing support and resources to address this issue.

109. FREQUENCY OF PERFORMANCE OF Potentially LIFE-THREATENING delegated MEDICAL ACTS BY ADVANCED CARE PARAMEDICS IN A REGIONAL BASE Hospital PROGRAM

Background: The objective is to analyze the frequency and characteristics of potentially life-threatening delegated medical acts (MDAs) performed by advanced care paramedics (ACPs) in a regional base hospital program. Methods: Data was collected from the Regional Base Hospital Program over a one-year period, starting from January 1, 2010, to December 31, 2010. The data included the type of delegated act, the specific medical act, the time of day, and the outcome of the act. Results: A total of 24,506 ambulance transports were reviewed, and 4,066 times, or in 16.6% of all missions, at least one potential life-threatening delegated medical act was performed. The most common delegated acts were related to acute cardiac arrest (2,579/4,066 (60.8%) individuals, with 1,780 reporting having worked in EMS in the last year. 2,579/4,238 (60.8%) individuals, and 1,780 reporting having worked in EMS in the last year. Over two-thirds (68.0%) reported having experienced violence in the past 12 months. Of these individuals, 70.3% were male, 17.8% were volunteers, and 57.0% worked in urban communities (≤25,000 people). Private agencies employed the highest percentage of those who experienced violence (41.5%), followed by fire departments (29.2%). The mean weekly call volume was 17.7 (95% CI 16.9-18.5) for those who experienced violence compared to 17.9 (95% CI 17.3-18.6) for those who did not. All variables reported were statistically significant. Findings: More than two-thirds of EMS professionals reported having experienced violence in the past 12 months. Further research is needed to identify predictors of violence by type (verbal and physical) and ways to prevent violence in the prehospital environment.

110. USE OF LIGHTS AND SIREN: IS THERE ROOM FOR IMPROVEMENT?

Background: The objective is to analyze the use of L&S during transport to the hospital by the prehospital severity status of the patient and the time saved by the time of day of the mission. Methods: We searched the Public Health Services data of a Swiss state from January 1 to December 31, 2010. All primary patient transports within the state were included (24,718). The data collected were the use of L&S, patient demographics, time and duration of transport, the type of mission (trauma vs. non-trauma), and the severity of condition according to the National Advisory Committee for Aeronautics (NACA) score assigned by the paramedics and/or emergency physician. We excluded 212 transports because of missing data. Results: 24,506 ambulance transports met the inclusion criteria. L&S were used 4,066 times, or in 16.6% of all missions. Forty percent of these were granted L&S. For nighttime runs alone, the mean time saved for receiving information from paramedics decreased from 11.09 min (CI 10.84-11.34) with L&S to 12.84 min (CI 12.72-12.96) without. The difference was 1.75 min (105 sec) (p = 0.27). Conclusions: The present use of L&S would assist or hinder them in answering calls. Paramedic and physician participants anticipated that the prototype would be helpful in improving their role in quality of care, efficiency, and the relationship between paramedics and medical control. They highlighted the need for system integration and use of the additional features of the prototype to field deployment in a simulated clinical environment and may provide a model for the development and testing of other new technologies in EMS and emergency medicine.
seems questionable given the severity status or NACA score of transported patients. Our research is the implementation of more specific regulations for L&S use during transport to the hospital, taking into consideration certain physiological criteria of the victim as well as time of day of transport.

**111. ELECTRONIC PCR INTEGRATION INTO HOSPITAL RECORDS: A 1980S SOLUTION TO A 21ST-CENTURY PROBLEM**

Marc Passo, Tyler Constantine, David Cone, Adam Landman, J Brent Myers, Yale University, Wake County EMS

**Background:** Electronic EMS patient care reports (ePCRs) have the potential to improve communication and transfer of care between prehospital and hospital providers. However, many EMS systems anecdotally report difficulty integrating ePCRs with hospital electronic health records (EHR), potentially resulting in loss of clinically important information. A national survey was conducted to characterize this problem.

**Methods:** Purposive sampling was conducted of three groups: the NAEMSP Rural Affairs Committee (small, rural systems), smaller cities 125,000-325,000 (mid-size systems), and the Metropolitan Municipalities EMS Medical Directors Consortium (“Eagles”, large, urban systems). The survey consisted of 22 questions assessing various aspects of ePCR use and integration with the hospital, was developed by the authors, pilot-tested for usability, and revised before IRB approval, conversion to Survey Monkey, and dissemination via e-mail. Simple descriptive statistics were used to analyze responses. Results: Responses were received from 64/111 (58%) rural, 14/25 (56%) mid-size, and 19/33 (58%) urban systems (n = 97; overall response rate 57%). The medical director completed the survey in 71 cases (73%), with agency directors and IT personnel completing most of the rest. Seventy-five systems (77%) use ePCRs only, 8 use written PCRs only, and 10 use a combination. Twenty-nine systems print ePCRs to hand in to ED staff, 13 manually fax printed ePCRs to the hospital, and another 26 digitally fax from the ePCR computer to the hospital. Thirty-one systems have provisions to alert their data analysts for retrieval of ePCRs. Only six systems (five rural, one urban) can directly transmit ePCRs into the patient’s hospital EHR, and no systems use direct EHR information exchange to transfer ePCRs to the hospital. Of the 58 systems reporting that the ePCR is ultimately incorporated into the patient’s EHR, 36 (62%) report that it is done by hospital staff manually scanning a printed copy of the ePCR. Conclusions: Despite the high prevalence of ePCRs in our sample, the ability to electronically integrate ePCRs into the patient’s hospital EHR is rare across systems of all sizes. There is an opportunity to improve EMS electronic health information exchange given the current high degree toward increase.

**112. A MULTIDISCIPLINARY APPROACH TO EFFECTIVELY REDUCE THE STREAM OF AMBULANCE ABUSE**

Jiun-Wei Chen, Matthew Huei-Ming Ma, Kah-Meng Chong, Sot Shih-Hung Liu, Wen-Chu Chiang, Yu-Wen Chen, Mao-Wei Liao, Perry Shen, City Fire Department, National Taiwan University Hospital

**Background:** The number of public EMS ambulance services in a metropolitan area has continuously increased up to 10 percent yearly, which presents a potential shortage of EMS resources. We demonstrate a multidisciplinary approach to improve the rise and assess its impact and the degree on EMS services reduction.

**Methods:** EMS authority implemented a multidisciplinary approach to study the annual growth of ambulance services, including 1) a new charge policy for non-emergency condition transports, 2) repeated media advocacy and on-route leaflet for charge policy of misuse at least a half year prior to launching, 3) regular interviews with the target group who overused or misuse EMS ambulance in two previous years, 4) combined assessment by health, mental health, and social health-care officials to the target group, 5) provision of alternative public transport assistance for those with disability, and 6) a joint committee to regularly inspect the legitimacy of charge for every non-emergency transport in consensus process. A metropolitan public EMS provides free services for 2,685 million population within 272 square kilometers. The number of EMS ambulance services for three years before intervention as controlled and that for two years after launching are compared using regression analysis for statistics. Results: The average annual number of EMS services before intervention was 125,038 (SD: 12,152) runs and the annual increase was 12.3% (95% CI: 10.2-14.4%) (annual growth: 11.0%, 95% CI: 9.3-12.6%). The annual increase for the first and second years after the multidisciplinary intervention are minus 11,320 runs (minus 8.8%, 95% CI: 10.7-6.0%) and minus 23,960 runs (minus 16.3%, p < 0.05), respectively, significantly less than the estimated number. Among the target overuse group, the reduction rate reaches 18.8%. Only 0.03% of EMS transports need to be charged. Conclusions: We demonstrate a multidisciplinary approach including target group multidimensional assessment, which may effectively stimulate the stream of EMS ambulance abuse and the tendency toward increase.

**113. UTILIZATION OF 24-HOUR ONLINE MEDICAL CONTROL: A PRELIMINARY REPORT OF CALL VOLUME AND OVERVIEW OF CONSIDATIONS**

Danielle Dragoo, George Ralls, Salvatore Silvestri, Christopher Hunter, Orange County EMS

**Background:** To determine and characterize the utilization pattern of this medical control in a large emergency medical services (EMS) system. Methods: We conducted a prospective observational study among all online medical control encounters, which may effectively streamline the EMR EMT-1s, and the need for further review. Results: There were 172 calls made over a 39-day period (average 4.4 per day). At least one call was made every day, and a maximum of 11 calls were received in a 24-hour period. For the final 4 weeks, three consultations were for pediatrics, and 129 were for adults. One hundred and twelve calls (65%) were for assistance with patient referral of transport, 133 (78%) were for additional medical decisions, 19 (11%) were for code termination, and 18 (10%) were for discharge. Conclusions: Despite the high prevalence of ePCRs in our sample, the ability to electronically integrate ePCRs into the patient’s hospital EHR is rare across systems of all sizes. There is an opportunity to improve EMS electronic health information exchange given the current high degree toward increase.

**114. PEDIATRIC PREHOSPITAL MEDICATION DOSING ERRORS: A QUALITATIVE STUDY**

John Hoyle, Rebecca Henry, Brian Mavis, Todd Chassee, Debby Sleight, William Fales, Michigan State University

**Background:** To identify barriers and enablers to correct pediatric prehospital drug dosing and possible solutions through a qualitative study. Pediatric prehospital drug dosing errors affect approximately 56,000 US children yearly. To decrease these errors, barriers, enablers and potential solutions from the EMT-P standpoint need to be understood. Methods: A qualitative focus group (FG) study of EMT-Ps in Michigan. FGs were held at EMS agencies and a state EMS conference. Participants were identified by random number only. To protect anonymity, no identifying information was collected. FGs were led by a trained moderator. Questions focused on the drug dose delivery process, barriers and enablers to correct drug dosing, and possible solutions to decrease errors. Responses were recorded, transcribed, and coded by 2 members of the research team for themes and number of response mentions. Participants completed a pre-discussion survey on pediatric experience and agency characteristics. Results: FG responses reached thematic saturation after 4 groups were completed. There were a total of 35 participants. Participants’ EMS agency characteristics were 26 public, 9 private non-profit, 23% fire, 77% third service. All were transporting agencies. 43% of participants had been EMT-Ps > 10 years, 11% had been EMT-Ps 1 year. 25% reported administered a drug dose to a child in the last 12 months. EMT-Ps who were “very comfortable” with their ability to administer a correct drug dose to infants, toddlers, school-aged, and adolescents were 4%, 12%, 10%, and 54%, respectively. FGs identified themes of difficulty in obtaining an accurate weight, infrequent pediatric encounters, infrequent pediatric training with inadequate content and practice, difficulties with drug packaging/shortages, drug bags that weren’t “EMS friendly,” difficulty remembering drug doses/calculations, and lack of dosing aids. Few enable factors to correct dosing were mentioned. Simplification of drug delivery, an improved length-based tape for EMS, pediatric checklists, and dose cards in milliliters were given as solutions. Conclusions: This qualitative study identified barriers and potential solutions to reducing prehospital pediatric drug dosing errors, including improved training frequency/content as well as simplification of drug calculations and the addition of pediatric checklists.

**115. THE ASSOCIATION BETWEEN PEDIATRIC FALL INJURY AND PROPERTY TYPE IN A FIRE DISTRICT OF CLACKAMAS COUNTY**

Sarah Siegel, Craig Warden, Dongseok Choi, Jane Boone-Heinonen, Oregon Health Science University
Background: Falls account for a disproportionate number of nonfatal injuries in the pediatric population. In 2010, 2.6 million pediatric injuries in children 0-19 years old were reported to emergency departments. Research of fall injuries has traditionally focused on individual factors. Our study evaluated the relationship between environmental factors, such as higher rates of poverty and smaller household size, and fall injuries. Objective: To identify characteristics of the environment surrounding emergency medical services (EMS) systems in urban/suburban communities and rural areas in Clackamas County, Oregon. Methods: This case-control study included children 7 years old transported to a children's hospital who presented within 24 hours of the incident. Logistic regression was used to determine the relationship to poverty and the likelihood of fall injury. Results: Compared to those without severe fall injuries, those with severe (≥2) injuries were more likely to have poverty (OR 2.34, 95% CI: 1.16, 4.69; p = 0.016) and small household size (OR 5.47, 95% CI: 1.90, 15.60; p = 0.002). Conclusions: Poverty and small household size are associated with increased likelihood of fall injury in children. This information may be useful in making dispatch decisions.
familiar with the PAT (OR 2.7, 95% CI 1.3, 5.9). PALS training was associated with reports of knowledge of VS norms (OR 2.7, 95% CI 1.2, 5.2). Independent of training, the majority agreed that interventions may often be needed based on VS (75.7%), and the PAT should not replace VS (75.8%). Independent of training, the majority disagreed that interventions may often be needed based on B-P (77.2%), respiratory rate (72.4% vs. 70.2%), and capillary refill (72.4% vs. 69.1%), and did not believe all were necessary in all patients. Overall, only 65.6% reported that a BP was necessary. Independent of training, responders strongly agreed that B-P was necessary for B-P patients in most clinical situations excluding psychiatric emergencies. Conclusions: PHSs recognize the importance of pediatric VS measurement. PHSs with PEPP/PALS training are more likely to report assessment of VS in all patients. Only PALS training increased reported knowledge of VS norms.

120. BYSTANDER CPR AND HOSPITAL OUTCOMES AFTER PEDIATRIC OUT-OF-HOSPITAL CARDIAC ARREST (OHCA): A NATIONALWIDE OBSERVATIONAL STUDY


Background: Pediatric out-of-hospital cardiac arrest (OHCA) is known to have different etiology, outcomes, and bystander cardiopulmonary resuscitation (B-CPR) protocol compared with that of adults. However, it is unclear whether B-CPR has an interaction effect with VS (68.5%). When stratifying by individual VS, those with either training were more likely to report that assessment of heart rate (92.9% vs. 77.2%), respiratory rate (92.4% vs. 70.2%), and capillary refill (71.5% vs. 49.1%) was necessary in all patients. Overall, only 65.6% reported that a BP was necessary. Independent of training, responders strongly agreed that B-P was necessary for B-P patients in most clinical situations excluding psychiatric emergencies. Conclusions: PHSs recognize the importance of pediatric VS measurement. PHSs with PEPP/PALS training are more likely to report assessment of VS in all patients. Only PALS training increased reported knowledge of VS norms.

121. FIELD TRAIGHT PROTOCOL FOR BEHAVIORAL HEALTH PATIENTS

Jay Blankenship, Scott Youngquist, Mike Reynolds, Ty Sheppard, University of Utah, Utah; Gold Cross Ambulance, Salt Lake City Fire

Background: Mental illness represents the second largest disease burden in the United States. While the gross number of annual emergency department (ED) visits has remained relatively stable, the proportion of patients presenting with psychiatric complaints continues to increase. Furthermore, psychiatric patients are more likely to be frequent EMS and ED users than non-psychiatric patients. In this review of prospective data, we evaluate the efficacy of a field triage protocol implemented by EMS providers to divert behavioral health patients from the EDs directly to a psychiatric facility.

Methods: A triage protocol was designed for use by EMS personnel to identify behavioral health patients who can safely be transported directly to a psychiatric facility without medical evaluation in an emergency department. Exclusion criteria included age <18, temperature ≥38.0°C, HR >130, SBP <100, RR >10, aggressive/dangerous behavior, significant comorbidities, known drug overdose, and acute drug or alcohol intoxication. Patients without any exclusion criteria were transported by EMS directly to a psychiatric evaluation center. Data were collected prospectively during 12-month periods before and after initiation of the protocol. Primary outcome was number of patients taken by EMS to the ED for behavioral health complaints. Results: In total, 125 patients were triaged directly to a psychiatric facility using the protocol. Prior to initiation of the protocol, the average of 92 patients/month were taken to area EDs for evaluation. In the period following implementation, on average 16 patients per month (18%) with EMS behavioral health transfers were directly triaged to a psychiatric facility, bypassing area EDs. Eight patients (6.4%) were subsequently transferred to an ED for medical clearance. All of these patients were returned to the psychiatric facility for admission following ED evaluation. Of the 125 patients directly transported to the psychiatric facility, there were no adverse outcomes. Conclusions: Use of a behavioral health triage protocol can be safely implemented in the prehospital setting. Use of such protocol appears to decrease ED behavioral health patient volume and may allow for more appropriate utilization of the health-care system. One limitation of the study was that we were unable to calculate the number of patients who were transported to the ED despite qualifying for the protocol.

122. IS A SUCCESSFUL ADVANCED LIFE SUPPORT PARAMEDIC CERTIFICATION EXAMINATION USING OSCE METHODOLOGY A PREDICTOR OF AUTONOMOUS PRACTICE CONSISTENT WITH CLINICAL MEDICAL DIRECTIVES AND GUIDELINES?

Maud Huiskamp, Leah Watson, Linda Turner, Sunnybrook Centre for Prehospital Care

Background: Widely used in other health professions but often unevaluated, objectively structured clinical examination (OSCE) methodology using simulated patient encounters is uncommon in paramedicine. In our system, a basic life support course (BLS) and advanced care life support (ALS-EMS) certification. Objective: To determine whether the number of attempts required to successfully complete an OSCE was associated with subsequent autonomous practice consistent with medical directives and whether consistency increased with time. Methods: The setting was a 14-person paramedic school (population, approximately 8 million). Examination comprised 15 components assessing competence in communication, patient assessment, judgment, and procedure. Hemisphere of subsequent clinical practice was based on review of ambulance call reports (ACRs) electronically triaged through an algorithm to identify areas of potential variance from medical directives. Identified cases were peer reviewed. Variance judged to have occurred were graded as minor, major, or critical. The number of major or critical variances per 100 high-acuity calls (Canadian Triage and Acuity Scale level 1 or 2) that each successful candidate had attended within 2 years following certification was recorded. Results: There was a strong correlation between the number of AORs attempted and the number of variances required to successfully complete the OSCE. AORs of B-CPR and interaction effect with cardiac, trauma, drowning, asphyxia, and other groups were all significantly higher than 1.0. Conclusions: There was significant association between number of AORs required to successfully complete the OSCE with presumed etiologies groups in pediatric OHCA.
expressed satisfaction with the education program. This appraisal was maintained in the monthly follow-up survey. Conclusions: These results suggest that EMS providers can learn information regarding the out-of-hospital delivery and neonatal care after a didactic and hands-on workshop. Further study is needed to develop the reliability and validity of the test and to determine how this information is clinically applicable.

124. PERCEPTION AND COST OF A PREHOSPITAL PROVIDER WORKSHOP UTILIZING CADAVERS

Thomas Hartka, Mark Sochor, Sara Helzel, University of Virginia

Background: EMSIs and paramedics may be called on to execute a number of procedures in the field that are infrequently performed. Cadavers serve as realistic models on which to teach and practice these medical procedures. Methods: A half-day workshop was developed in order to train local EMS personnel in medical procedures utilizing cadavers and trainer manikins. Medical procedures included intubation, needle decompensation, chest tube placement, thoracotomy, and thoracotomy. The course was taught by an attending physician, two emergency medicine residents, and a Certified Surgical Technologist (CST). Two sessions of 45-minute lectures were presented, followed by two-hour blocks in which participants performed procedures on either simulated trainer manikins or cadavers. Participants were asked to complete an anonymous questionnaire evaluating the course on a clinical scale (1 = poor, 5 = superior). Each section of the course was evaluated and an overall of assessment of the course was obtained. The cadaver course was approved by an oversight committee and all specimens were screened for communicable diseases. Results: Since 2012, 35 participants have attended three course offerings of this workshop. The mean overall evaluation of the course was 4.8 out of 5. The mean score for the trainer manikin section was 4.6, while all participants gave a superior response (Likert = 5) to the cadaver portion of the workshop. The costs of two cadavers, $4,500 each, and included fees for acquisition, serology, storage, and disposal. The physician instructors and CST volunteered time to the workshop, while the hospital obtained cost of charge from the local teaching hospital. The approximate cost per participant was $300; however, participants paid $200 per workshop to help defray expenses. Conclusions: This procedure workshop provided a unique opportunity for EMS personnel to train on infrequent, but highly technical skills. The cadaveric portion of the workshop unanimously received the highest possible evaluation scores, yet all aspects of the workshop were well received, suggesting a potential for continuation and expansion of the workshop in the future. The cost of the workshop and the time commitment of instructors is substantial; therefore, additional research is needed.

125. EQUIVALENT CERTIFICATION RATES AND TEST PERFORMANCE OF STUDENTS IN AN ONLINE VS. TRADITIONAL CLASSROOM PARAMEDIC TRAINING PROGRAM

Brad Newbury, Colby Redfield, Timothy Peck, Kim Newbury, David Schoenfeld, James Rifino, Jonathan Fisher, National Medical Education and Training Center, Beth Israel Deaconess Medical Center

Background: There is some evidence to suggest that distance learning or Web-based education may be an effective alternative to more traditional training. Few studies have compared the education outcomes of the traditional classroom learning (n = 85, 31.7%; n = 68, 25.4%), and median age was 23 years (IQR 21-26). Mean score for rational thinking was 3.97 (95% CI 3.92-4.02) compared to 3.55/5 (95% CI 3.50-3.61) for experiential thinking (p < 0.001). Participants scored their ability to use rational thinking higher than experiential thinking (p = 0.001). Higher rational scores were given by younger paramedic students (p = 0.04) and students with more prior education (p = 0.01) compared to their colleagues. Conclusions: Paramedic students perceived themselves able to use rational over experiential thinking, similar to findings from working paramedic, emergency physician, and cardiologist samples, but contrasting with college students who scored experiential thinking higher. This study adds to what is known about paramedic decision-making. It is important for paramedic educators and mentors to understand how paramedic students tend to process decisions. Future research includes identifying how to assess decision-making in training and determining which thinking style is best for particular clinical conditions.

127. A NOVEL SIMULATION-BASED EDUCATIONAL PROGRAM FOR ADVANCED EMERGENCY MEDICAL SERVICES PROVIDERS

Michael Hilton, Mark Pinchalk, Patrick Lambert, Christian Martin-Gill, City of Pittsburgh Bureau of Emergency Medical Services, University of Pittsburgh

Background: Simulation-based training is commonly used and shown to be effective for medical and nursing providers of various levels of training, with fewer data available on simulation-based training programs designed by and for paramedics. We aimed to determine whether a simulation-based educational program designed and implemented by paramedics can lead to changes in performance of key interventions by paramedics by standardizing respiratory emergencies. Methods: We retrospectively reviewed a quality improvement database containing data from 517 respiratory emergency cases from one EMS service. We reviewed the medical care provided in cases that had any one of the following: Glasgow Coma Scale less than 15, pulse oximetry less than 90%, respiratory rate greater than 24 bpm, or heart rate greater than 100 bpm (n = 481). The primary outcomes included the proportion of cases receiving key airway interventions or specific protocol-appropriate medications before and after the delivery of the training program. We also report the results of a post-instruction satisfaction survey. Primary outcomes were compared with Pearson's chi-squared test for airway interventions and two-tailed Student's t-test for mean number of medication interventions. Results: Of the 481 cases, 46 (10%) had an airway intervention and 103 (21%) had a medication administration. There was a significant increase in the mean number of protocol-based medication administrations before and after the training program (6.5 ± 2.3 vs. 4.2 ± 2.0, p = 0.001). Conclusions: Our findings indicate that simulation-based training programs designed and implemented by paramedics can lead to changes in performance of key interventions by paramedics by standardizing respiratory emergencies. We also report the results of a post-instruction satisfaction survey. Primary outcomes were compared with Pearson's chi-squared test for airway interventions and two-tailed Student's t-test for mean number of medication interventions.
that such programs can lead to changes in paramedic practice and paramedics were satisfied with the intervention.

128. **Did Paramedics Learn in CME?**

Seam Teed, Jeanny Verdon, Richard Dionne, Lanark County Paramedic Service, Regional Paramedic Program for Eastern Ontario

**Background:** The Kolb experimental learning design identifies four distinct learning styles, which may influence a four-staged learning cycle. The Kolb method includes learners feeling, watching, thinking, and doing. The Regional Paramedic Program for Eastern Ontario is mandated to provide multidisciplinary overnight inclusion of Continuing Medical Education (CME) to nine paramedic service operators in Southeastern Ontario. Our goal was to evaluate the Kolb experimental learning model after implementation at our CME. **Methods:** The CME session was planned, designed, and implemented utilizing the Kolb model. Facilitators were introduced to the learning objective and anticipated outcomes prior to the CME sessions and delivered the objectives to the learners (paramedics) during the CME day. Anonymous pre-learning questionnaires included 157 paramedics (58%) responders, which were compared with the same preceptor (PRC). When PRC was 90-100%, students reached Eureka in an average of 35.2 runs. Controlling for total run count (included as a demographic variable) for every 1% increase in runs with the same preceptor, the Eureka run number decreases by 0.4 (p < 0.001). **Conclusions:** Exposing PS to fewer preceptors during CME results in a more rapid attainment of team leadership competency.

130. **Learning Style Preferences and Continuing Medical Education Activities of Nova Scotia Paramedics: A Pilot Study**

Louis Staple, Alix Carter, Mark Walker, Jan Jensen, Dalhousie University, EHS Nova Scotia

**Background:** Paramedics participate in continuing medical education (CME) to maintain their skills and knowledge. It is important for participants to understand their learning style for education to be most effective. This study identifies the preferred learning styles of ground ambulance paramedics to determine elective CME opportunities paramedics attend, and examined associations between learning style and types of CME attended. **Methods:** Paramedics were invited to participate in a voluntary online questionnaire containing the Kolb Learning Style Inventory and a CME activity survey. CME activities were categorized into the four learning styles, Results: A total of 712 paramedics participated in Spring CME. 492 paramedics completed pre and post questionnaires. 157 (32%) responders were ACP, 335 (68%) responders were PCP, Mean knowledge increase range for 157 ACPs: 12.1% to 32.1% (confidence interval [CI] 95%). Median range for 157 ACPs: 3.9% to 20.10%. Mean knowledge increase range for 335 PCPs: 18.0% to 27.3% (confidence interval [CI] 95%). Median range for 335 PCPs: 13.4% to 26.7%. The results demonstrate a marked increase in paramedic learning after leaving the CME session, two-tailed p value is < 0.0001 and one-tailed p value is 0.0002. There was evidence that suggested that participant satisfaction scores did not correlate with learning style. **Conclusions:** Utilizing Kolb’s experimental learning design model for adult learners, paramedics did increase their learning in their classroom continuing medical education session.

129. **Fewer Preceptors Leads to Faster Attainment of Team Leadership Competency During Paramedic Student Internships**

Todd Cage, James Dinsch, Mike Mayne, Steve Asche, David Page, Mayo Clinic Medical Transport, Indian River State College

**Background:** Previous research has shown that limiting the number of preceptors a paramedic student intern may have during field internships results in greater opportunity to serve as a team leader and greater overall number of successful leads. This project sought to investigate if limiting PS preceptors led to attainment of complex patient care sooner. Exposing paramedic students to fewer preceptors during field internship results in a more rapid attainment of level two (TL) performance outcomes. **Methods:** During field internships PSs and their preceptors involved in the National Registry of EMTs Paramedic Psychomotor Competency Portfolio Package Program. Data was recorded post lead. Exposed paramedic students to fewer preceptors during field internship resulted in a more rapid attainment of teamwork leadership competency. **Results:** 260 paramedics participated. The medium age was 36 (range 20-63). 38% were female (n = 92). Most had college (n = 146, 68%) or university education (n = 68, 32%). Half had 10 or fewer years (n = 129, 53%). Preferred learning styles were assimilator (n = 72, 28%), diverger (n = 66, 25%), converger (n = 62, 24%), and accommodator (n = 80, 23%). More advanced life support providers (n = 131, 54%) were assimilators (n = 45, 36%), and more basic life support providers (n = 111, 46%) were divergers (n = 33, 43%) (chi-squared p = 0.16). No significant associations were not found between learning style and previous education or years of experience. The type of CME activities attended were assimilating (e.g., lectures) 25%, diverging (e.g., scenarios) 26%, converging (e.g., formal testing) 25%, and accommodating (e.g., job shadowing) 24%. No significant association was found between learning style and type of CME attended. **Conclusions:** This even distribution of learning styles suggests paramedics are a diverse group of learners. Paramedics attend a wide variety of types of CME activities. Paramedics may be able to select CME activities that better match their style to improve learning efficiency. Organizations providing education opportunities to paramedics should consider paramedics a diverse learning group when designing their programs.

131. **A Quantitative Analysis of the Content of Critical Patient Handovers Between Emergency Medical Service and Emergency Department Providers**

Scott Goldberg, Avital Portail, N Q Lim, Christopher Strother, Kevin Munjal, University of Texas Southwestern

**Background:** Patient handovers are an integral component of quality patient care, yet are increasing recognized as the source of medical error. Studies have demonstrated the benefits of standardized handovers in decreasing morbidity, particularly in critical patients. While much is known in the literature on improving handovers in the hospital setting, data on handovers from emergency medical services (EMS) providers are limited. Further, to our knowledge there has not been a quantitative analysis of the content of EMS provider handovers. We here present a quantitative analysis of the content of handovers from EMS providers to emergency department (ED) physicians. **Methods:** Handovers from EMS to ED providers in the resuscitation bay of our academic level II trauma center were recorded from April to July 2013. Handovers occurring during daytime weekday hours were audio recorded by a trained research assistant. Pediatric and non-critical patients were excluded, as were handovers to non-physician providers. Recordings were coded on a standardized form by physicians trained in EMS and entered into a spreadsheet for analysis. **Results:** A total of 186 handovers were recorded during the study period, 82.6% 9-1-1 transports and 8.1% interfacility transfers. 38% were performed by EMTs while 62% were performed by paramedics. EMTs reported a chief concern, 57.7% contained a scene description, 56.7% contained patient vital signs, 47.4% contained a physical examination, 31.9% included a patient medical history, and 6.2% included an allergy history. 30.9% of providers included an overall assessment. Significantly more paramedics included vital signs (71% vs. 57%, χ² = 4.9, p = 0.03) although this did not reach statistical significance. **Conclusions:** To our knowledge, this is the first quantitative analysis of the content of patient handovers between EMS and ED providers. While previous studies have demonstrated that EMS providers feel they generally provide adequate handovers, we identified substantial deficiencies in the quantity of information transferred. Our analysis demonstrates the need for further training in the provision of patient handovers, particularly at the EMS level. Such handovers are currently under development in our EMS system.
at a large urban academic medical center. Participants were unaware of the study and involved. Paramedic science students were randomly assigned to two groups. Students in the experimental group received a 1-hour formal lecture on patient handover. Both student groups were presented with the same adult trauma case for handover. Student communication skills were tested by one of two methods: inter-facility simulation or classroom-based tabletop exercises. Students were randomized equally into testing methods and interactions were video-recorded and data collected by independent reviewers using standardized collection forms. Results: We studied 24 paramedic students on the 9-item scale. Control group students appropriately communicated an average of 6.33 items correctly (SD 1.4). Experimental group students appropriately communicated an average of 7.5 items correctly (SD 1.4). Comparing testing methods for all groups, high-fidelity simulation and traditional exercises were presented with the same high-fidelity simulated high-fidelity simulated working environment when compared to classical classroom tabletop methods. We observed more difficulty communicating these items in the high-fidelity simulation. Comparison of student performance when compared to classical classroom tabletop methods. This model may provide further direction in prehospital communication curriculum development.

133. AN EDUCATIONAL MEASURE TO SIGNIFICANTLY INCREASE THE CRITICAL KNOWLEDGE REGARDING INTER-FACILITY PATIENT TRANSFERS (EMS-SICK-PT)

Torben Becker, James Skiba, Cemal Sozener, University of Michigan

Background: Emergency medicine residents and critical care fellows have limited educational exposure to the challenges of inter-facility patient transfers. Methods: A one-hour educational intervention had affected their practice. Students rated their knowledge as poor to average on the pre-test. On follow-up, learners were noted to have significantly increased knowledge in both the experimental and control group. They felt more comfortable in accepting and facilitating patient transfers and felt that the educational intervention had affected their practice in a positive way. Conclusions: A one-hour paramedic science education intervention served as an effective tool to objectively increase the knowledge of emergency medicine residents and critical care fellows regarding patient handoff, legal aspects of inter-facility patient transfers. Participants also felt much more comfortable with patient transfers in their daily practice.

134. DEATH NOTIFICATION TRAINING: A SURVEY OF EMERGENCY MEDICAL SERVICES (EMS) PROVIDERS’ NEEDS

Lee Anne Douglas, Sheldon Cheskes, Michael Feldman, Savithri Rathnakaran, Sunnybrook Center for Prehospital Medicine

Background: Emergency medical services (EMS) providers are frequently called on to communicate death notifications in the field. Many EMS providers do not have formal training for this task. The purpose of this study is to explore EMS providers’ attitudes toward death notification training. Methods: A convenience sample of Canadian EMS providers completed an online survey that ascertained their attitudes to death notification training. Descriptive and inferential statistics were calculated and subgroup analyses were performed. Results: 493 EMS providers were presented with the same adult trauma case for death notification training. They also had a low response rate. There were no significant differences in the age, gender, initial vital signs, or transportation and emergency medical services (EMS) experience.

135. DEFINING COMPONENTS OF TEAMWORK IN PREHOSPITAL EMS: A QUALITATIVE STUDY

Remle Crowe, Jennifer Eggerichs, Severo Rodriguez, Melissa Bentley, National Registry of EMIs

Background: Complex work environments require the use of teams, and prehospital care is no exception. Emergency medical services (EMS) professionals respond to high-stakes, time-sensitive situations as a part of a multi-provider crew. Crew resource management (CRM) focuses on minimizing errors and improving safety and performance through teamwork skills. Many studies have examined the relationship and benefits of CRM in the prehospital context; however, teamwork and its components have not been explored in the prehospital context. The objective of this study was to identify specific components of both team leadership and followership in the context of prehospital EMS. Methods: Ten national EMS experts were interviewed and asked to participate in a focus group. Utilizing the nominal group technique (NGT), participants were asked to answer the following question: “What are the specific components of both team leadership and team followership on a single patient call where multiple EMS providers are present?” Results: All ten EMS experts participated in limited knowledge regarding the clinical and legal scope of practice of EMS providers involved in patient handoff. Participants rated their knowledge as poor to average on the pre-test. On follow-up, participants were noted to have significantly increased knowledge in both the experimental and control group. They felt more comfortable in accepting and facilitating patient transfers and felt that the educational intervention had affected their practice in a positive way. Conclusions: A one-hour paramedic science education intervention served as an effective tool to objectively increase the knowledge of emergency medicine residents and critical care fellows regarding patient handoff, legal aspects of inter-facility patient transfers. Participants also felt much more comfortable with patient transfers in their daily practice.
CONCLUSIONS: These findings support the hypothesis that a new index, the product of an EEG BIS signal and ETCO2 values during and after compressions, correlates with cerebral perfusion pressure (CPR). Further studies to determine if this non-invasive neurological index is predictive of awakening in pigs are underway. These findings support the hypothesis that a new index, the product of an EEG BIS signal and ETCO2 values during and after compressions, correlates with cerebral perfusion pressure (CPR). FURTHER STUDIES TO DETERMINE IF THIS NON-INVASIVE NEUROLOGICAL INDEX IS PREDICTIVE OF AWAKENING IN PIGS ARE UNDERWAY. 

A retrospective chart review was conducted for June 1, 2009 to May 31, 2010, establishing baseline CPR data, and June 1, 2010 to May 31, 2011, for CCR data. CCR’s focus and therefore protocol compliance criteria were based on Bobrow’s 2008 MIRC study. Criteria were developed to include cardiac resuscitation, standard of care, and CPR quality. CPR quality and flow were not part of the MIRC study, therefore these were added for CCR. CPR quality was assessed using the CPR Quality Improvement Tool for Out-of-Hospital Cardiac Arrest (CPI QIT). The tool is designed to assess chest compression quality performed on scene versus in an ambulance using data collected on cardiac arrest patients. Measurements: CCR was to assess chest compression data extracted from cardiac monitors from a large urban emergency medical service (EMS) from January 1, 2013 to July 30, 2013. Patients were included if resuscitation was attempted, a transport occurred, and no return of spontaneous circulation was documented. CPR data were extracted in 30-second epochs occurring on scene or during transport. Each segment provided data on flow (percentage of time compressions occurred), average depth of compressions (mm), count of shallow compressions, count of compressions with leaning, and percentage of adequate compressions. The data was analyzed using several statistical methods. The results of this analysis demonstrated that CPR performed on cardiac arrest patients is of higher quality when performed on scene compared to after departure. The decreased effectiveness of chest compressions may be detrimental to patients who are transported prematurely. EMS administrators and medical directors should consider delaying patient transport until high-quality chest compressions have been performed on scene for an appropriate length of time.
Compliance was judged on percentage of applicable criteria met. CODE STAT computed compression rate and ratio (time spent performing compressions in relation to total time); reports for the first 6 minutes were averaged. Chi-squared tests and logistic regression were used in analysis. Results: 740 patients were included in the OHCA study (CPR: n = 179, CCR: n = 561), and 66 CCR patients in the CODE STAT analyses. Overall, OHCA survival-to-discharge rates increased significantly (13.4% survival CPR, 14.6% CCR; p = 0.046; odds ratio [OR] = 1.10; 95% confidence interval [95% CI]: 0.88, 1.80), as did overall chest compression rates, incompressible fibrillation initial rhythm (30.8% survival CPR, 42.7% CCR; p = 0.035; OR = 1.68; 95% CI: 0.65, 4.29). 13 of 66 CODE STAT cases (20%) were 100% protocol compliant. Percent compliance was significantly correlated to outcome (p = 0.025; OR = 1.05; 95% CI: 1.01, 1.09). Neither any particular criterion nor compressions frequency correlated to outcome. Compression rate was significantly related to outcome (p = 0.026; OR = 0.94; 95% CI: 0.89, 0.99).

Conclusions: CCR yielded increased OHCA survival-to-discharge rates. Protocol compliance to protocol was a significant factor in patient outcome, but no individual criterion was significant. The compressions ratio’s negative correlation should be investigated further. The limited number of cases of CODE STAT analysis warrants further investigation, yet overall results support CCR protocol.

141. CHEST COMPRESSION QUALITY DECLINES IN THE MINUTES PRECEIVING SCENE DEPARTURE IN OUT-OF-HOSPITAL CARDIAC ARREST
Ben Bobrow, Annemarie Silver, Tyler Vadeboncoeur, Gary Smith, Margaret Mullins, Daniel Spaite, Maricopa Medical Center

Background: Previous studies have shown that chest compression (CC) quality declines during ambulance transport. However, the quality of CCs while preparing a patient for transport and transferring to the ambulance has not been described in the clinical setting. We tested the hypothesis that CC quality diminishes during transfer from the scene to the ambulance.

Methods: CC quality was monitored at two EMS agencies using an E Series defibrillator with CC sensing capability (ZOLL Medical Corporation). CCs of out-of-hospital cardiac arrest patients who received CC on scene and were transported to the ED with ongoing CC. Minute-by-minute CC process data were averaged for all minutes without ROSC during late scene treatment (i.e., 3 minutes prior to transport) and early scene treatment (i.e., all minutes prior to scene). Faced t-tests were used to compare CC quality during late scene vs. early scene treatment. Results: A total of 211 cardiac arrest events requiring CPR at the time of scene departure were studied (mean age 64 years, 76% male, 8% survival to discharge). CC fraction, rate, and percent of compressions >2 inches were significantly reduced during late vs. early scene treatment and variability in depth and rate (standard deviation) were increased during late scene treatment. Mean CC fraction (%): early scene (ES) 74 ± 16 vs. late scene (LS) 63 ± 23, p < 0.001; mean depth (in.): ES 1.92 ± 0.47 vs. LS 1.79 ± 0.24, p = 0.011; mean rate (cpm): ES 108 ± 21 vs. LS 103 ± 20, p < 0.001; rate of elapsed time (rOT): ES 12.02 ± 2.81 vs. LS 10.01 ± 0.8, p = 0.001; SD of depth (in.): ES 0.18 ± 0.06 vs. LS 0.30 ± 0.14, p < 0.001; SD of rate: ES 13 ± 5 vs. LS 23 ± 9, p < 0.001; CC > 2 in (%): ES 53 ± 33 vs. LS 45 ± 32, p < 0.001. Conclusions: Declines in the minutes preceding transport, presumably because of the difficulty of performing high-quality CCs while preparing the patient for transport and moving the patient to the ambulance. The impact of this finding on outcome requires further study.

142. REDEFINING ROLES FOR CARDIAC ARREST: TESTING THE UTILITY OF A CPR FEEDBACK COACH
Allison Infinger, Steve Vandeventer, Jonathan Studnek, Mecklenburg EMS Agency

Background: Real-time CPR feedback devices (CPR-FD) have been shown to improve CPR quality provided to in-hospital cardiac arrest patients. Despite use of CPR-FD, variability in CPR performance exists. The objective of this study was to determine if CPR performance would be improved through an intervention that assigned a responder to interpret visual feedback and provide real-time coaching. It was hypothesized that this intervention would significantly improve compression depth compliance and reduce time to defibrillation.

Methods: This pre/post-study collected data from a single advanced life support EMS agency with basic life support first responder and second-responded by the fire department. The intervention modified a current focused cardiac arrest protocol by training fire department captains to interpret the CPR waveform displayed on the cardiac monitor and provide immediate feedback concerning compression depth. Prior to systemwide implementation, the intervention was pilot tested in April 2007 using a single out-of-hospital cardiac arrest in five of the areas busiest fire crews. This was followed by a period of data collection where the same crews utilized the intervention during clinical practice, concluding in a systemwide training in June 2007. The pre-intervention phase was defined as March 2007 and post-intervention as July 2007. CPR data captured from the cardiac monitor included rate, compliance with compression depth, time to defibrillation (the interval between the end of a compression cycle and shock delivery), and flow time. Patients were excluded if all four metrics were unrecorded.

Results: There were 109 cardiac arrest patients during the 2-month study period, with 51 patients eligible for analysis. Median compliance with compression depth was 82.2% (IQR: 51%-95.4%) in the pre-intervention phase compared to 93.8% (IQR: 76.2%-98.9%; p < 0.05) in the post-intervention phase. Time to defibrillation, and flow time saw no improvement in the post-intervention phase. Conclusions: The use of CPR-FD alone may not adequately ensure adequate CPR and the responder to interpret CPR feedback and provide coaching improved compliance with compression depth in this analysis. EMS administrators and medical directors should consider dedicating a responder to interpret visual feedback from the CPR-FD and act as a CPR coach in their resuscitation strategy.

143. IMPORTANCE OF RELEASE VELOCITY FOR IMPROVED HEMODYNAMIC POWER AT VARYING CHEST COMPRESSION DEPTHS
Joshua Lampe, Tai Yin, Josiah Garcia, George Bratnov, Theodore Weiland, Christopher Kaufman, Lance Becker, University of Pennsylvania

Background: During cardiac arrest, chest compression (CC) release velocity or waveform has been suggested to be important for coronary perfusion and maintaining blood flow to the heart. A detailed investigation of the impact of changes in CC waveform on blood flows and pressures during prolonged CPR has yet to be thoroughly performed. In this study, we examined CPR hemodynamics in 12 domestic swine (~30 kg) were studied using standard physiological monitoring, flow probes were placed on the abdominal aorta, the inferior vena cava (IVC), the right reartery and vein, the right common carotid and external jugular. Ventricular fibrillation (VF) was electrically induced and CC were started after at least 10 minutes of untreated VF. CC release was changed so that sternal recoil lasted 100 ms, 200 ms, or 300 ms. CC were delivered at a rate of 100 per minute and at a depth of 1.25 inch (n = 9) and at a depth of 1.9 inch (n = 3). Transitions between waveforms occurred every 2 min and were randomized. Results: An increase in sternal recoil (power = flow × pressure) indicated that there was a significant difference in the amount of energy each CC waveform transferred to the blood. In the IVC during ventricular fibrillation initial rhythm (30.8% survival CPR, 42.7% CCR; p = 0.035; OR = 1.68; 95% CI: 0.65, 4.29). 13 of 66 CODE STAT cases (20%) were 100% protocol compliant. Percent compliance was significantly correlated to outcome (p = 0.025; OR = 1.05; 95% CI: 1.01, 1.09). Neither any particular criterion nor compressions frequency correlated to outcome. Compression rate was significantly related to outcome (p = 0.026; OR = 0.94; 95% CI: 0.89, 0.99).

Conclusions: CCR yielded increased OHCA survival-to-discharge rates. Protocol compliance to protocol was a significant factor in patient outcome, but no individual criterion was significant. The compressions ratio’s negative correlation should be investigated further. The limited number of cases of CODE STAT analysis warrants further investigation, yet overall results support CCR protocol.

144. A CASE SERIES: HEMODYNAMICS OF LUCAS DEVICE PLUS AN ITD IN CARDIAC ARREST
Mark Escott, Kevin Traynor, Shane Jenks, Levon Vartanian, Carol Miller, Dick Kuo, Baylor College of Medicine

Background: Cardiac arrest with a rhythm of PEA or asystole remains an almost uniformly fatal process in the community. A recent study involving an impedance threshold device (ITD) in combination with active compression-decompression cardiopulmonary resuscitation (ACD-CPR) has shown a survival benefit over standard CPR. However, in the absence of literature describing the hemodynamic parameters associated with a combination of LUCAS 2 device CPR (LUCAS-CPR) and an ITD in cardiac arrest. Little is known regarding the hemodynamics of these two devices in combination in cardiac arrest. The goal was to determine if there is adequate perfusion, oxygenation, and ventilation in patients with an initial rhythm of PEA or asystole in cardiac arrest. Methods: A retrospective chart review was performed in a single suburban Houston, Texas EMS service which routinely uses both an LUCAS-CPR and an ITD in cardiac arrest. Inclusion criteria: PEA or asystole cardiac arrest with no ROSC recorded, ITD + LUCAS-CPR, hemodynamic parameters of BP, SpO2, EtCO2, and ECG were recorded in real time. Thirteen cases were analyzed using Minitab 142 and simple statistics and boxplots were created displaying the characteristics of the hemodynamic measures. Results: For the 13 patients in cardiac arrest without ROSC, the parameters were MAP: median 83 mmHg, mean of 86 mmHg (SD 31 mmHg); EtCO2: median 28, mean of 31 (SD 17); SpO2: median 85%, mean 82% (SD 16). Conclusions: This data set demonstrates near-normal parameters of perfusion, oxygenation, and ventilation in cardiac arrest patients with an initial rhythm of PEA or asystole. This represents optimization of cardiac arrest perfusion management. The concern, however, is that despite excellent hemodynamic parameters, these patients obtained ROSC. Further studies need to be performed to determine why resuscitation is not successful given optimized hemodynamics.

145. THE AVAILABILITY OF PRIOR ECGS IMPROVES PARAMEDIC ACCURACY IN IDENTIFYING STEMI
Daniel O’Donnell, Eric Savory, Mike Mancera, Shawn Christopher, Steve Roumpf, Daniel Escott, Kevin Traynor, Shane Jenks, Levon Vartanian, Carol Miller, Dick Kuo, Baylor College of Medicine
Jason Schaffer, Indianapolis Emergency Medical Services, Indiana University

Background: Early and accurate identification of ST-elevation myocardial infarction (STEMI) by prehospital providers has been shown to significantly improve door to balloon times and improve patient outcomes. Previous studies have shown that paramedic accuracy in reading 12-lead ECGs can range from 86 to 94%. However, recent studies have demonstrated that accuracy diminishes for the more uncommon STEMI presentations (i.e., anterior and lateral). Unlike hospital physicians, paramedics rarely have the ability to review previous ECGs for comparison. Whether or not a prior ECG can improve paramedic accuracy is not known. Prior ECGs improve paramedic accuracy in identifying STEMIs. Methods: 130 paramedics were given a single clinical scenario. Then they were randomly assigned 12 computerized prehospital ECGs, 6 with and 6 without an accompanying prior ECG. All ECGs were obtained from a local STEMI registry. For each ECG paramedics were asked to determine whether or not the ECG was STEMI and to rate their confidence in their interpretation. To determine if the old ECGs improved accuracy we used a mixed effects logistic regression model to calculate the true value of the control and interaction. Results: The addition of a previous ECG improved the accuracy of identifying STEMIs from 75.5% to 80.5% (p = 0.015). A previous ECG also decreased time to STEMI identification (p = 0.011). Conclusions: The availability of previous ECGs improves paramedic accuracy and enhances their confidence in interpreting STEMIs. Further studies are needed to evaluate this impact in a clinical setting.

146. IMPACT OF EMS PREHOSPITAL ACTIVATION OF CARDIAC CATHETERIZATION LAB ON DOOR TO BALLOON AND EMS TO BALLOON TIMES

Ryan Hartman, Mary Colleen Bhalla, Scott Wilber, Jennifer Frey, Francis Mencel, Summa Akron City Hospital

Background: Rapid identification and treatment of ST-elevation myocardial infarction (STEMI) reduces mortality and morbidity. The times to treatment, measured as emergency department (ED) door-to-balloon (DTB) or emergency medical services (EMS) to balloon (E2B) time are important quality measures. For years, area EMS have been transmitting electrocardiograms (ECGs) electronically allowing ED physicians to assess the cardiac catheterization lab ahead of the patient’s arrival when an STEMI is detected. At our institution 80% of STEMIs arise due to EMS, 60% of them when the catheterization lab is closed and the team must be called in from home. In 2012, select EMS agencies began activating the catheterization lab directly from the field before transmitting the ECG to the ED, speeding up the process. The purpose of this study was to determine the impact of EMS catheterization lab activation on DTB and E2B times. Methods: This was a quality assurance study in which 2 years of nonhuman subjects data were analyzed from our STEMI database. All EMS patients for whom the EMS or first ED ECG showed a STEMI were included. The DTB and E2B times were analyzed by year and by mode of activation. We report mean times, with 95% confidence intervals (CI). Two sample t-tests were performed to determine if the difference was statistically significant. Results: Data from 225 STEMI patients were analyzed. 107 patients in 2011 and 118 in 2012 with mean DTB times of 45.7 minutes (CI 44.2-47.2) and 39.7 minutes (CI 38.0-41.3), respectively. Mean E2B times were 75.3 minutes (CI 71.0-79.6) and 71.0 minutes (CI 68.1-73.9), respectively. In 2012, EMS field activation occurred in 22 patients with a DTB time of 33.4 minutes (CI 28.5-38.2) compared to a non-EMS field activation time of 51 minutes (CI 44.1-57.9), a difference of 11.5 minutes (p = 0.011). The E2B time for EMS field activations was 63.4 minutes (CI 57.8-69.0) compared to 74.1 minutes (CI 71.4-76.8), a difference of 10.7 minutes (p = 0.013). Conclusions: In our study population, EMS activation of the cardiac catheterization lab decreased door-to-balloon and EMS-to-balloon times.

147. EFFECTS OF PREHOSPITAL ECG USE AND PATIENT RESIDENCE DISTANCE FROM PCI CENTER ON TIME TO DEVICE ACTIVATION IN STEMI PATIENTS: A COHORT ANALYSIS FROM THREE PCI CENTERS

Bryn Mumma, Michael Kontos, S A Peng, Deborah Diercks, Virginia Commonwealth University

Background: American Heart Association guidelines recommend <90 minutes from first medical contact (FMC) to reperfusion for ST-segment elevation myocardial infarction (STEMI) patients. Prehospital electrocardiograms (ECGs) reduce time to reperfusion, but the relative influence of patient distance from a percutaneous coronary intervention (PCI) center on this effect is unclear. We evaluated the relationship between patient distance from a PCI center, prehospital ECG use, and interval from FMC to device activation among patients with STEMI. Methods: We performed a retrospective cohort study including all STEMI patients in the ACTION Registry-Get With the Guidelines from 7/1/2008 to 9/30/2012 who were transported by ground emergency medical services (EMS) to a PCI center. Patient distance was defined as the driving distance from the patient’s home zip code to the PCI center address as calculated by Google Maps. Home zip code was used as a surrogate for EMS call location. Patient distance was classified into tertiles (~71 mi, 71-163 mi, >163 mi), and simple linear regression was used to characterize the interaction between prehospital ECG use and patient distance with respect to time to device activation. Results: Of the 29,506 STEMI patients, 19,690 (67%) received a prehospital ECG. The median patient distance was 11.0 mi among patients with a prehospital ECG and 9.9 mi among those without. Overall, a prehospital ECG reduced the FMC to device activation time by 10.9 minutes (95% CI 9.2-12.5 minutes). The reduction in time from FMC to device was consistent across tertiles of distance (1st, median 11 minutes; 2nd, median 11 minutes; 3rd, median 10 minutes). The effect of prehospital ECG is attenuated by 0.8 minutes for every 10-mile increase in distance (interaction p = 0.0002). During off hours, median time from FMC to device activation was longer in each distance tertile when compared to work hours (86 vs. 68, 86 vs. 70, and 92 vs. 77 minutes, respectively; p < 0.001 for all). Conclusions: Prehospital ECGs are common among STEMI patients and can reduce the time from FMC to device activation by approximately 10 minutes. Patient distance from a PCI center was not associated with this time interval, but presentation during off hours was associated with longer times.

148. NOVEL APPLICATION OF 9-1-1 DISPATCH IN STEMI ALERT PROCESS DECREASES DOOR TO BALLOON TIMES (DTB)

Justin Stevens, Robert Rosenbaum, Seema Sonnad, Angela Hoban, Christiana Care Health Services

Background: Some hospital systems have incorporated EMS-directed activation of the cardiac catheterization lab (CCL) for STEMI patients. The focus on streamlining this process has remained largely centered on in-hospital variability. We sought to determine if potential reduction in DTB by allowing paramedics to perform prehospital STEMI notification by brief communications (one sentence with age, gender, STEMI, and EMS 9-1-1 dispatchers who directed the request to hospitals. Theoretically, this allowed immediate CCL activation even when on-scene variables delayed conversation. Methods: The study setting was a single suburban academic hospital with ED seeing >120,000 patients/year and a regional PCI referral center. STEMI notifications from 7/2010 to 7/2012 occurred by either standard direct EMS to physician notification or by immediate 9-1-1 dispatch notification. A retrospective chart review with statistical analysis was performed to assess a difference in DTB between the groups. Results: 1,405 total STEMI notifications occurred. 866 notifications arrived by EMS. 730 notifications were excluded due to confounding events, such as cardiac arrest, arrhythmia, death, resolution of EKG changes and/or symptoms, cardiologist decision not to perform PCI, or prior stabilization at a referring facility. Of the remaining 539, a descriptive analysis of 64 patients in each group was performed. This powered the study to show significance for a 10-minute difference. The average DTB for the standard group was 57.6 minutes (SD 4.5). 9-1-1 dispatcher-aided communication average DTB was 46.1 minutes (SD 3.2). The difference between the two groups was an average of 11.5 minutes (p = 0.001). In the 9-1-1 dispatcher-aided group 92% (59/64) met national standards of <90-minute DTB. Only 64% (41/64) met this goal in the standard communication group (p = 0.001). Conclusions: Brief, early notification of STEMI by 9-1-1 dispatchers achieves earlier CCL activation in a hospital system that already utilizes EMS directed CCL activation. This practice substantially decreased DTB and allowed a far higher percentage of patients to meet the DTB <90-minute metric.

149. A CHARACTERIZATION OF STEMI ACTIVATIONS BY PATIENT’S PREHOSPITAL PRESENTING LOCATION

Jonathan Studnek, Chrystan Skefos, Allison Infinger, Lee Garvey, Mecklenburg EMS Agency, Carolinas Medical Center

Background: Early identification of patients presenting to emergency medical services (EMS) with an ST elevation myocardial infarction (STEMI) has been shown to decrease time to definitive treatment. A further understanding of the characteristics of patient’s presenting to EMS with STEMI may assist in the development of care processes that improve early recognition or expedite delivery of patients to appropriate facilities. The objective of this study was to identify characteristics of STEMI patients that vary by a patient’s presenting location. Methods: This was a retrospective study of all STEMI patients presenting to a single hospital system’s three PCI centers transported by a single EMS agency between May 2007 and March 2011. Data were extracted from prehospital records and an in-hospital STEMI database. Patients were classified by EMS as presenting at either home or some other public location. Other patient characteristics assessed included the day of the week, time of day of presentation, gender, race, age, and number of comorbidities. False-positive STEMI activations were excluded from this analysis. Descriptive statistics were calculated with chi-squared tests to assess for significant associations. Results: There were 238 patients included in this analysis, of which 71.8% were found by EMS at a location classified as home. The average age of patients was
60.6 years (SD = 14.3) and they were predominately male (70.2%) and white (60.1%), with 59.9% of EMS between 06:00 and 18:00. Time of day and race were the two characteristics of patients that varied by the patients presenting location. 77.7% of patients presenting to EMS at home rather than home did so between the hours of 06:00 and 18:00 with only 53.0% of patients presenting at home during the same hours (p = 0.01). Further, 80.0% of patients with STEMI were classified as a race other than white presented to EMS at home compared to 66.4% of white patients (p = 0.023).

Conclusions: This study indicated that a clear majority of patients presenting to EMS at home rather than hospital did so between the hours of 06:00 and 18:00. Our findings further suggest that our EMS providers may be more likely to see STEMI mimics than they were to see STEMIs. For our EMS providers to be well trained in STEMI identification they must be taught how to distinguish between these rhythms is dependent on accurate patient characterization and should not be used as a benchmark for first ECG-to-CCL activation times. Further research should investigate these time delays and focus on methods to reduce transmission delays.

150. PREVALENCE OF PREHOSPITAL ELECTROCARDIOGRAPHIC TRANSMISSION AND IMPACT ON EMERGENCY DEPARTMENT EFFECTIVENESS

Yee, Christopher Myers, William Hardy, Francis Meng, Summa Akron City Hospital

Background: Emergency medical services (EMS) are a vital component of rapid identification and transportation of patients with ST-elevation myocardial infarctions (STEMI) for definitive treatment. Such a task may be impeded, however, by ECG rhythms that mimic STEMIs, such as left bundle branch block (LBBB), right bundle branch block (RBBB), ventricular paced rhythms (VP), and supraventricular tachycardia (SVT). Distiguishing between these rhythms is dependent on provider training. Our objective was to evaluate the prevalence of prehospital ECG STEMI mimics and to identify further steps that can help improve EMS and prehospital STEMI team activation protocols.

Methods: Our setting is a community-based university-affiliated STEMI receiving center hospital with an ED seeing 77,000 adult patients a year and providing medical direction for more than 21,000 EMS transports a year. ECGs received electronically from prehospital centers are entered into our electronic database. Eight hundred ECGs were randomly selected from the 4,979 ECGs in the 2012 database. We included for analysis the first 600 that were not rejected by our algorithm (10%). Other notable contributors were administrative processes (billing, financial and professional services, or 231 tons CO2e per $1 million of expenditures), and should not be used as a benchmark for first ECG-to-CCL activation times. Further research should investigate these time delays and focus on methods to reduce transmission delays.

152. IMPLICATIONS OF PREHOSPITAL ELECTROCARDIOGRAPHIC TRANSMISSION AND EMERGENCY DEPARTMENT RECEIPT TIMES ON PREHOSPITAL CARDIAC CATHETERIZATION LAB ACTIVATION

Timothy Lenz, Jeffrey Luk, Mattew Woller- man, Edward Michelson, Medical College of Wisconsin

Background: Chest pain warrants a rapid assessment, including an early 12-lead ECG. Rapid identification of ST-segment elevation myocardial infarctions (STEMIs) or new left bundle branch blocks is of critical importance. Established guidelines emphasize the importance of early STEMI identification and minimization of door-to-balloon (DTB) times. Prehospital identification of STEMI mimics may result in earlier cardiac catheterization lab (CCL) activation. However, no guidelines currently exist to guide the prehospital identification of STEMI mimics other than cardiac monitoring. We sought to determine the association between prehospital ECG misidentification and the time to CCL activation. Prehospital misidentification of STEMI mimics may result in earlier cardiac catheterization lab (CCL) activation. However, prehospital misidentification of STEMI mimics may result in earlier cardiac catheterization lab (CCL) activation.

Methods: Our setting is a community-based university-affiliated STEMI receiving center hospital with an ED seeing 77,000 adult patients a year and providing medical direction for more than 21,000 EMS transports a year. ECGs received electronically from prehospital centers are entered into our electronic database. Eight hundred ECGs were randomly selected from the 4,979 ECGs in the 2012 database. We included for analysis the first 600 that were not rejected by our algorithm (10%). Other notable contributors were administrative processes (billing, financial and professional services, or 231 tons CO2e per $1 million of expenditures), and should not be used as a benchmark for first ECG-to-CCL activation times. Further research should investigate these time delays and focus on methods to reduce transmission delays.

153. THE ENVIRONMENTAL IMPACT OF THE EMS SUPPLY CHAIN

Lawrence Brown, Ian Blanchard, James Cook University, Alberta Health Services Emergency Medical Services

Objective: To estimate the life cycle emissions of U.S. EMS systems, including emissions from supply chain process, and identify the components of the supply chain that contribute most to these emissions. Methods: The websites for 200 randomly selected U.S. cities and counties were searched to obtain publicly available EMS budget information for the two most recent budget years. Where line-item budgets were available, the consumer price index was used to convert expenditures to standard year (2002) amounts. Published input-output-based emissions multipliers, accounting for emissions from the upstream and downstream supplying industries associated with any product or service, were then used to calculate “indirect” emissions related to those expenditures. We estimated the volume of diesel, gasoline, and natural gas consumed by each system (amount spent average price), and used volume-based multipliers to calculate emissions from “direct” energy consumption. “Indirect” and “direct” emissions were summed to calculate life cycle emissions. Results: Detailed line-item budgets were available for nine EMS systems located in seven states (population: 7,500 to 400,000; annual response volume: 1,200 to 900,000; average expenditures: $50 ± 20 per capita, $290 ± 128 per response). Over recent budget years, these EMS systems spent a combined $94.7 million (in 2002 dollars) and generated 21,877 tons of carbon dioxide equivalent (CO2e) emissions. "Indirect" and "direct" emissions were summed to calculate life cycle emissions. Results: Detailed line-item budgets were available for nine EMS systems located in seven states (population: 7,500 to 400,000; annual response volume: 1,200 to 900,000; average expenditures: $50 ± 20 per capita, $290 ± 128 per response). Over recent budget years, these EMS systems spent a combined $94.7 million (in 2002 dollars) and generated 21,877 tons of carbon dioxide equivalent (CO2e) emissions.
primarily from vehicle fuel consumption, are the clear priority for EMS sustainability initiatives. This chain accounts for over 25% of EMS-related emissions. Reducing waste in the EMS supply chain could have dual benefits of reducing system operational costs and reducing greenhouse gas emissions.

154. EMERGENCY MEDICAL SERVICE SUPER-USER RESOURCE UTILIZATION: THE LOS ANGELES EXPERIENCE

Stephen Sanko, Marc Eckstein, Keck School of Medicine of USC, Los Angeles Fire Department

Background: Overutilization of emergency medical services (EMS) by a select group of “super-users” strains prehospital resources, though few systems have formally reported this. The objective of our study was to quantify the frequency of EMS responses, the resources mobilized, clinical interventions provided, and financial burden that this group represents for a large, urban EMS provider agency. Methods: A retrospective review of electronic medical records from the Los Angeles Fire Department (LAFD), the EMS provider for a city of 3.8 million people, was used to identify the 40 most frequently transported patients between July 1, 2011 to June 30, 2012. Outcomes reported included the number of fire department resources deployed for each patient encounter, total resource turnaround time (time from alarm to being back in service), and the financial debt of each frequent user. Results: During the 12 months under study, LAFD providers responded to approximately 336,000 incidents, resulting in 204,900 patient transports. The top 40 EMS “super-users” accounted for 2,359 separate EMS incidents, resulting in 204,900 patient transports (1% of all transports). These patients received more than 23,000 EMS services, including 2,209 transports, or 1% of all system transports, which included 1,836 single-vehicle and 602 multivehicle dispatches. 37 (92.5%) of the 40 super-users had days in which they required transport by LAFD EMS multiple times. On average, these 37 patients had over 6 days per year (range: 1-32 days) in which they required multiple transports, including one individual with 32 multitransport days. Overall, 2,980 vehicles were involved in care of these patients, including 2,080 BLS and 900 ALS deployments. EMS turnaround time dedicated to those patients increased by over 1,540 person-hours, including 540 hours of ALS service. The total charges for these 40 patients over the study period were $24 million, of which $2 million (82%) were paid in median balance collected by each of these patients were $20,232. Conclusions: An identified small group of EMS “super-users” places an inordinate demand on our local EMS system. Emergency health-care stakeholders should make efforts to coordinate preventative care and seek alternative uses of the 9-1-1 system to provide these patients with the help they need while also relieving the EMS system of this burden.

155. THE IMPACT OF LEAN SIX SIGMA METHODOLOGY ON OFFLOAD DELAY IN A CANADIAN EMS SYSTEM

Sheldon Cheskes, Peter Dundas, Mary Ellen Duff, Claudia Mititelu, Oscar Karbi, Kiki Ferrari, Naveed Mohammad, Cindy Hawkswell, Karen Idriz, Sunnybrook Centre for Prehospital Medicine, Peel Region Paramedic Service

Background: Emergency department (ED) arrival to transfer of patient care continues to significantly impact paramedic operational costs, ED staff availability for paramedics to provide emergency coverage in their communities. Lean Six Sigma is a methodology commonly used in industry to simplify systems and improve efficiency. The objective of this study was to examine the impact of Lean Six Sigma strategies on offload delay times in a Canadian EMS system. Methods: We conducted a before and after study in a large community hospital ED with historically high offload delay times. Front-line stakeholders, including paramedics, nurses, physicians, and managers, submitted the Lean Six Sigma formal approach to process improvement. Key performance metrics and mean off-load delay times were collected before (January 1–December 31, 2011) and after (January 1–June 30, 2012) implementation of Lean Six Sigma strategies. Results: Mean (SD) offload delay time decreased from 33.5 (36.0) minutes before the Lean Six Sigma intervention to 40.3 (32.1) minutes (95% CI: 12.1, 14.2; 25% decrease) in the post-implementation phase. Similarly, 90th percentile offload time decreased from 109.3 min to 74.9 min in the after phase (delta 34.4 min; 95% CI: 29.3, 38.6; 31% decrease). Individual components of off-load delay that showed the most improvement post implementation of Lean Six Sigma findings were time to transfer of care (51.4 vs. 19.0 min; delta 32.4 min; 63% decrease), time to registration (9.0 vs. 7.0 min; delta 2.0 min; 22% decrease), and transport to ED departure (40.5 vs. 33.5 min; delta 5.2 min; 13% decrease). Based on a mean monthly EMS transport rate of 1,569 patients, process improvements resulted in 344 hours of reduced system operational costs and reducing the community monthly EMS cost savings as a result of process improvements were $75,336 per month, and $904,032 per year. Conclusions: With time on scene, response, transport, and receiving EDs, Lean Six Sigma methodology may result in significant reductions in ambulance offload delay times. Further study is required to determine whether these findings can be sustained over time and replicated in other EMS systems.

156. CHARACTERISTICS OF THE MOST FREQUENT “SUPER-USERS” OF EMERGENCY MEDICAL SERVICES

Stephen Sanko, Marc Eckstein, Keck School of Medicine, Los Angeles Fire Department

Background: A small group of “super-users” account for a disproportionate number of emergency medical service (EMS) encounters and transports. These patients receive more transports and hospital destinations than those accounted for by the remaining 95% of the patient population. “Super-users” are defined as patients who account for a disproportionate number of emergency resources, including paramedics, nurses, physicians, and receiving EDs. Lean Six Sigma methodology may result in significant reductions in ambulance offload delay times. Further study is required to determine whether these findings can be sustained over time and replicated in other EMS systems. Results: The top 40 EMS “super-users” accounted for an inordinate number of ambulance transports. These individuals were predominately male, homeless, and multiple ED and hospital users, some of whom have some form of health insurance. Efforts should focus on the creation of sobering centers with immediate referral to detoxification programs and the assignment of these patients to “home” hospitals.

157. INTERFACILITY TRANSPORTS BETWEEN EMERGENCY DEPARTMENTS UTILIZING THE 9-1-1 EMS SYSTEM

Shira Schlesinger, Stephen Sanko, Marc Eckstein, Keck School of Medicine, UCI Medical Center

Background: With increasing development of specialty centers and regionalization of care, emergency physicians (EPs) are often confronted with patients needing definitive care that is unavailable at their hospital. In these cases, the traditional interfacility transport (IFT) is a useful tool; but may also delay care by hours. Since 2007 the City of Los Angeles has implemented a policy permitting IFTs between emergency departments (EDs) via the 9-1-1 EMS system. Any EP may initiate ED-to-ED IFTs via 9-1-1 EMS system. To determine the frequency and nature of IFTs provided by the local 9-1-1 EMS system and to evaluate the impact of this use of EMS resources, Methods: Retrospective review of all paramedic records for ED-to-ED IFTs between April 2007 and February 2013 in Los Angeles. All IFTs initiated by call to 9-1-1 from an ED and performed by Los Angeles Fire Department paramedics were included. Transferring and receiving hospital, reason for transfer, patient descriptors, and time metrics were captured, including time on scene, response, transport, and turn-around times. Results: There were 729 IFTs via 9-1-1 EMS system during the study period, comprising 0.06% of all EMS calls. The most frequent reason for IFT was for transport of patients with ST segment elevation MI (STEMI) to a STEMI center (59.0%, N = 430), followed by major trauma (12.5%, N = 91), and intracranial hemorrhage (8.1%, N = 59) to trauma and neurosurgical centers. Less common reasons included aortic dissection transferred for vascular surgery (3.7%, N = 27), patients transported to a stroke center (3.7%, N = 27), obstetric emergencies (3.7%, N = 27), and transfers to pediatric critical care facilities (2.7%). Median transport time was 1 hour (range 33-61 minutes) and median turn-around time was 50 minutes (IQR 39-67 minutes). All IFTs involved a potentially life-threatening condition, requiring a higher level of care than was available at the referring hospital. Conclusions: Emergency IFTs via 9-1-1 contact are an infrequent but appropriate use of local EMS resources that increase speed of transfer to definitive care. With an increase in the designation of specialty centers, EMS providers should have procedures in place to handle these requests.

158. THE OFFLOAD ZONE AS A SOLUTION TO EMERGENCY MEDICAL SERVICES (EMS) OFFLOAD DELAY IN THE EMERGENCY DEPARTMENT: A PROCESS MAP AND HAZARD ANALYSIS

Alix Carter, James Gould, Peter Vanberkel, Jan Jensen, Jolene Cook, Steven Carrigan, Mark Whealey, Andrew Travers, EHS Nova Scotia, Dalhousie University

Background: Offload delay is a prolongation of the interval between ambulance arrival in emergency department (ED) to ED arrival for ambulatory patient care. This reduces the availability of ambulances for emergency response in the community. The offload zone (OZ), which can receive multiple ambulances, has been implemented as a
state of the community level and to develop the well-defined regional overcrowding index.

160. THE DEMAND FOR EMERGENCY CARE: SUPPLY OF EMS PROVIDERS AND THE GENERAL POPULACE

Melissa Bentley, Jennifer Eggerichs, Severo Rodriguez, Remle Crowe, National Registry of EMTs

Background: As the population ages the demand for emergency care increases. Public expectations dictate that emergency care should be available to all at a moment’s notice. A well-supplied emergency care system is necessary to meet the demand. Further, little is known about the supply of emergency medical services (EMS) providers in the United States. Objective: To describe the number of EMS professionals per 10,000 members of the general populace.

Methods: To estimate the number of individuals in the United States, the most current population estimates were obtained from the Census Bureau. To obtain these estimates, the Census utilizes the enumerated population for each state from the most recent census (2010) and accounts for estimated rates of international and intercensal migration. At the time of this study, state population estimates were available for 2011. To obtain the number of EMS providers, data were utilized from June 13, 2012 publication from the National Registry of EMTs (NREMT). As the NREMT is a registry of only nationally certified EMS professionals, only those states that require both initial and national recertification were included in this study. Results: The number of EMS providers assessed incorporated all the elements of the BTF guidelines. Conclusions: Despite more than four years since publication of BTF guidelines, incorporation of BTF treatment protocols is not universal.

161. PENETRATION OF BRAIN TRAUMA FOUNDATION GUIDELINES IN THE PREHOSPITAL SETTING: A SYSTEMATIC PROTOCOL REVIEW

Dustin LeBlanc, Jason McMullan, Michael Steuerwald, Michael Bohansky, Kelly Thomas, Joshua Lyons, Stewart Wright, University of Cincinnati

Background: In 2007 the Brain Trauma Foundation released the second edition of Guidelines for Prehospital Trauma Care. This study sought to determine the degree of adoption of the Brain Trauma Foundation guidelines (BTF) by prehospital care providers. To accomplish this, the BTF guidelines were scored in terms of the presence or absence of individual guidance elements and compared to state and regional guidelines.

Methods: BTF guidelines were scored using the BTF guideline scoring tool (Connect). The BTF guideline scoring tool was based on the principles of assessment and treatment of the TBI patient from the BTF tool was based on the principles of assessment and treatment of the TBI patient from the BTF guidelines. The tool was based on the principles of assessment and treatment of the TBI patient from the BTF guidelines. Each item of the tool was based on the principles of assessment and treatment of the TBI patient from the BTF guidelines and determined to be present or absent after review of the entire protocol set. Protocols were scored by one of five reviewers after training and practice in administration of the tool. Microsoft Excel/Apperson DataLink Connect was used for descriptive data analysis.

Results: The data reveal a significant deficit in the penetration of the BTF guidelines into protocols. Of the 61 protocols, initial GCS measurement was specified in 40 (66%), ETCO2 monitoring recommended in 45 (74%), and hypotension defined in 50 (82%). Additionally, 34 (55%) state to avoid hyperventilation except if signs of herniation are present, 14 (23%) define an ETCO2 goal of 30-35 mmHg when hyperventilating, and 5 (8%) recommend cessation when clinical signs have improved. Fifteen (25%) protocols incorporated the BTF treatment protocols assessed incorporated all the elements of the BTF guidelines.

Conclusions: Despite more than four years since publication of BTF guidelines, incorporation of BTF treatment protocols is not universal.
aid significantly improved EMS accuracy of scenario-based GCS scoring. Even with an aid, hyperventilation remained poorly, especially among lower GCS scores and within the motor component.

163. THE ACCURACY OF PREHOSPITAL PROVIDER OXYGEN SATURATION AND END-TIDAL CO₂ DOCUMENTATION IN SEVERE TRAUMATIC BRAIN INJURY

Ben Bobrow, Madalyn Karamozou, Annemarie Silver, Nathan Heagerty, Aaron Dunham, Matthew McDonald, Daniel Besel, Daniel Spait, University of Pennsylvania, ZOLL Medical Corporation

Background: The prevention of secondary brain injury by EMS providers is critically important to traumatic brain injury (TBI) outcome. Mortality increases 2- to 6-fold with hyperventilation and doubles with a single episode of hypoxia (SpO₂ < 90%). The Brain Trauma Foundation TBI guidelines recommend frequent (≥5 min) assessment and documentation of patient vital signs, including SpO₂ and ETCO₂ (in intubated patients); however, continuous monitoring may be more reflective of the patient’s condition. The aim of this study was to compare the accuracy of EMT documentation compared with continuous SpO₂ and ETCO₂ monitoring by the provider. Methods: Patient care reports (PCR) and monitor (ZOLL E Series) data were collected during the treatment of TBI patients by 2 EMS agencies participating in the EPIC-TBI (Excellence in Prehospital Care-Traumatic Brain Injury) study in Arizona between 10/12 and 5/13. Inclusion criteria: head trauma with potential to have caused brain injury and GCS = 12, GCS < 15 with decreasing GCS or increasing confusion, multisystem trauma requiring intubation, and/or post-traumatic seizures. ETCO₂ and SpO₂ documented by providers were compared to actual monitor recordings. Results: 217 TBI cases were included (mean age = 40 ± 20 years, 62% male, mean initial GCS = 9 ± 4). In 6/34 cases (24%), vital signs were documented every 5 min per guidelines. SpO₂ was documented below 90% by providers in 8/33 cases (24%) although, according to the monitor, SpO₂ dropped below 90% in 23/33 cases (70%). Hyperventilation (ETCO₂ < 35 mmHg) was documented by providers in 4/9 cases (57%) vs. 7/9 (78%) according to the monitor. Notably, hypoxia and hypocarbia are very common during the management of severe TBI. Furthermore, the presence of these conditions often results in unnecessary immobilization, which has been implicated in tissue ischemia. Studies have validated the use of clearance criteria for EMS providers to limit unnecessary immobilization, which have been implemented in many EMS systems. Despite clinical criteria for c-spine clearance, EMTs continue to over-immobilize trauma patients. Our goal was to determine the characteristics of patients with potential cervical spine injury (CSI) to our EMS system. Methods: Our study was a retrospective chart review of a single EMS system from September 1, 2012 to February 28, 2013. We reviewed all calls with a dispatch complaint of “motor vehicle crash” or “fall.” We used the Pennsylvania Commonwealth EMS protocol for selective spine immobilization (SSI), which mirror the NEXUS criteria, to determine appropriateness of immobilization. We reviewed the factors leading to over-immobilization of patients. Results: Our EMS system responded to 1,151 motor vehicle crashes and falls over the 18-month study period. Of these patients, 76 (6.6%) were immobilized. Of the patients immobilized, 12/76 (15.8%) did not meet immobilization criteria. The reasons for immobilization included “mechanism of injury” (50%), “head injury” (33%), and “vehicular damage” (17%). Of these patients who were immobilized by EMT-Ps and 50% by EMT-Bs. Of the 2 patients who were over immobilized by EMS, 9 (75%) were clinically cleared by the emergency physician, 2 (16%) had a negative CT scan of the neck, and the remaining patient was unavailable for review. Conclusions: A significant number of patients continue to be over-immobilized despite current guidelines. 75% of patients who were over-immobilized had no imaging done in the ED. This was a limited chart review involving only two dispatch categories. We may have missed patients who were under-immobilized from other dispatch categories. In addition, in some cases, we abstracted the criteria for spinal immobilization based on the documentation provided rather than speaking to the treating EMT. Continued education among EMS providers that use of SSI is safe regardless of mechanism of injury, associated head injury, or vehicle damage.

166. GAGG COMA SCALE SCORES (GCS) ARE OFTEN INACCURATE

Bryan Bledsoe, University of Nevada

Background: The Glasgow Coma Scale (GCS) is an assessment tool for measuring the level of consciousness and coma in patients with possible neurologic impairment. The GCS is important in determining whether a patient is improving or worsening as care is provided. Despite standardization, there appears to be significant variation in GCS scoring by various emergency health-care professionals. Such discrepancies can complicate emergency care. The objective of this study was to determine the accuracy of GCS scoring by various levels of health-care professionals treating GCS standardization video scenarios. Methods: We prepared a video of 10 patient scenarios where GCS scores could be readily determined. The correct GCS score for each scenario was determined by independent scoring by two board-certified neurologists. Inter-rater agreement was perfect (k = 1.0). The video was loaded onto iPad tablets and shown to a convenience sample of health-care professionals. Subjects were asked to watch the video non-stop and score the 10 vignettes on paper score sheets. Electronic and visual aids were not permitted. The score sheets requested basic demographic information and the 10 GCS scores (eye opening response [E], verbal response [V], motor response [M], and total GCS score [T]). The score sheets were collected and entered into an Excel spreadsheet for data summation and statistical analysis. Results: A total of 217 score sheets were collected from 3 EMS systems. Even non-expert EMS providers were able to accurately rate GCS scores within 1 point. Conclusions: Only one-third of GCS scores were accurate in this mixed emergency health-care provider cohort. Strategies should be developed to promote improved accuracy of GCS scoring or development of a simpler tool should be considered.

167. TOURNIQUET UTILIZATION PATTERNS AND IMPACTS ON HEMOSTASIS IN A LARGE URBAN EMS SYSTEM

Mathew Martinez, Annette Arthur, Sean Parker, Stephen Thomas, Jeffrey Goodloe, University of Oklahoma

Background: Combat casualty care education and peer-reviewed mandated training in EMS is an essential component of care as performed in the military conflict theatre. There are significant survival benefits from the timely application of tourniquets in the setting of extremity trauma to control significant bleeding. There is an increasing proportion of older vehicles in an increasing number of trauma patients. The Brain Trauma Foundation guidelines recommend documenting every 5 min per guidelines. SpO₂ was documented below 90% by providers in 8/33 cases (24%) although, according to the monitor, SpO₂ dropped below 90% in 23/33 cases (70%). Hyperventilation (ETCO₂ < 35 mmHg) was documented by providers in 4/9 cases (57%) vs. 7/9 (78%) according to the monitor. Notably, hypoxia and hypocarbia are very common during the management of severe TBI. Furthermore, the presence of these conditions often results in unnecessary immobilization, which has been implicated in tissue ischemia. Studies have validated the use of clearance criteria for EMS providers to limit unnecessary immobilization, which have been implemented in many EMS systems. Despite clinical criteria for c-spine clearance, EMTs continue to over-immobilize trauma patients. Our goal was to determine the characteristics of patients with potential cervical spine injury (SSI) to our EMS system. Methods: Our study was a retrospective chart review of a single EMS system from September 1, 2012 to February 28, 2013. We reviewed all calls with a dispatch complaint of “motor vehicle crash” or “fall.” We used the Pennsylvania Commonwealth EMS protocol for selective spine immobilization (SSI), which mirror the NEXUS criteria, to determine appropriateness of immobilization. We reviewed the factors leading to over-immobilization of patients. Results: Our EMS system responded to 1,151 motor vehicle crashes and falls over the 18-month study period. Of these patients, 76 (6.6%) were immobilized. Of the patients immobilized, 12/76 (15.8%) did not meet immobilization criteria. The reasons for immobilization included “mechanism of injury” (50%), “head injury” (33%), and “vehicular damage” (17%). Of these patients who were immobilized by EMT-Ps and 50% by EMT-Bs. Of the 2 patients who were over immobilized by EMS, 9 (75%) were clinically cleared by the emergency physician, 2 (16%) had a negative CT scan of the neck, and the remaining patient was unavailable for review. Conclusions: A significant number of patients continue to be over-immobilized despite current guidelines. 75% of patients who were over-immobilized had no imaging done in the ED. This was a limited chart review involving only two dispatch categories. We may have missed patients who were under-immobilized from other dispatch categories. In addition, in some cases, we abstracted the criteria for spinal immobilization based on the documentation provided rather than speaking to the treating EMT. Continued education among EMS providers that use of SSI is safe regardless of mechanism of injury, associated head injury, or vehicle damage.

168. GLASSON COMA SCALE SCORES (GCS) ARE OFTEN INACCURATE

Bryan Bledsoe, University of Nevada

Background: The Glasgow Coma Scale (GCS) is an assessment tool for measuring the level of consciousness and coma in patients with possible neurologic impairment. The GCS is important in determining whether a patient is improving or worsening as care is provided. Despite standardization, there appears to be significant variation in GCS scoring by various emergency health-care professionals. Such discrepancies can complicate emergency care. The objective of this study was to determine the accuracy of GCS scoring by various levels of health-care professionals treating GCS standardization video scenarios. Methods: We prepared a video of 10 patient scenarios where GCS scores could be readily determined. The correct GCS score for each scenario was determined by independent scoring by two board-certified neurologists. Inter-rater agreement was perfect (k = 1.0). The video was loaded onto iPad tablets and shown to a convenience sample of health-care professionals. Subjects were asked to watch the video non-stop and score the 10 vignettes on paper score sheets. Electronic and visual aids were not permitted. The score sheets requested basic demographic information and the 10 GCS scores (eye opening response [E], verbal response [V], motor response [M], and total GCS score [T]). The score sheets were collected and entered into an Excel spreadsheet for data summation and statistical analysis. Results: A total of 217 score sheets were collected from 3 EMS systems. Even non-expert EMS providers were able to accurately rate GCS scores within 1 point. Conclusions: Only one-third of GCS scores were accurate in this mixed emergency health-care provider cohort. Strategies should be developed to promote improved accuracy of GCS scoring or development of a simpler tool should be considered.
involved application of at least one tourniquet. 83/106 (78.3%) of patients were male. Mean patient age was 40.4 years old, with 10% of patients being 65 years of age or older. The most common injury type was laceration, sustained in 62/106 (58.5%) patients. The second most common indication for tourniquet application was bleeding from a dialysis fistula in 14/106 (13.2%) patients. 80/106 (75.5%) injuries treated were located on an upper extremity, and 74/106 (69.8%) injuries were located in the proximal half of the involved limb(s). In the 80 patients in which pre-tourniquet hemostatic treatment was attempted, the most common option failing to achieve desired hemostasis was direct pressure, utilized in 58/80 (72.5%) of this subgroup. Overall, hemostasis was documented post-tourniquet application as successful in 90/106 (84.9%) patients. Using Fisher’s exact test, there was not a statistically significant difference in achieving hemostasis comparing upper to lower extremity location (p = 0.36) or comparing distal to proximal injury location (p = 0.50). **Conclusions:** In a civilian cohort of patients with extremity injuries treated with tourniquets applied by EMS professionals in a large, urban EMS system, hemostasis was achieved in the large majority. Location of injury and limb(s) involved did not affect likelihood of resulting hemostasis.

168. **TOURNIQUET USE IN A CIVILIAN EMERGENCY MEDICAL SERVICES SETTING: A DESCRIPTIVE ANALYSIS OF THE BOSTON EMS EXPERIENCE**

Ricky Kue, Sophia Dyer, Boston Emergency Medical Services

**Background:** Early use of tourniquets for severe extremity hemorrhage has become standard of care in the military and tactical medical settings. As a result, tourniquet use in the civilian emergency medical services (EMS) setting has become more common. **Objective:** To describe the experience of tourniquet use in a civilian, urban EMS setting. **Methods:** A retrospective chart review of prehospital tourniquet application was performed from January 1, 2005 to December 1, 2012. Data such as the total time duration of tourniquet placement, EMS scene time, mechanism of injury, and patient demographics underwent descriptive analysis. Hospital data available for patients presenting specifically to Boston Medical Center were also reviewed. Statistical significance level was set at p < 0.05. **Results:** Ninety-eight cases of prehospital tourniquet use were identified. The most common causes of injury requiring a tourniquet were penetrating gunshot or stab wounds (67.4%, 66/98). 7.1% (7/98) of cases were due to blunt trauma. 22.5% (22/98) of cases were from non-traumatic injuries related to uncontrolled hemodialysis shunt or wound bleeding. 73.5% (72/98) of cases were placed on a lower extremity. 25.5% (25/98) were placed on an upper extremity. The mean total time of tourniquet placement was 14.9 minutes. The mean EMS scene time was 10.7 minutes. 50% of tourniquets were placed by a BLS provider. Four patients were in cardiac arrest prior to EMS arrival, 1 from blunt trauma and 3 from bleeding hemodialysis fistulas, of which 1 had prehospital return of spontaneous circulation. Hospital follow-up was available for 61.2% (60/98) of all cases reviewed. Of these cases, the tourniquet was removed by EMS in 5% (3/60), the emergency department in 50% (30/60), and in the operating room (OR) in 30% (18/60) of the time. 61.7% of cases going to the OR documented a major vessel injury. Overall, there were 7 deaths, none of which were due to tourniquet use. There were no documented cases of nerve injuries or long-term complication after tourniquet use. **Conclusions:** In an urban EMS setting, the early use of tourniquets for extremity hemorrhage appears to be safe, with complications occurring infrequently.