Student Category

Evaluating the Risk of Acquiring COVID-19 Illness Among Emergency Medical Services Providers Following Aerosol Generating Procedures

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Emergency Medical Services (EMS) providers may treat patients with SARS-CoV-2 (COVID-19) infection without knowing the patient’s COVID-19 status. Aerosol generating procedures (AGPs) are believed to increase occupational risk. The magnitude of risk from AGPs while wearing personal protective equipment (PPE) is unclear. We investigated the risk of COVID-19 transmission to EMS providers involved in the care of patients with COVID-19 stratified according to AGP use.

This retrospective cohort study identified patients from a statewide COVID-19 registry with a positive COVID-19 nasopharyngeal swab (RT-PCR+) result within 10 days of an EMS encounter, between February 16 and July 31, 2020 in King County, Washington. AGPs were defined as endotracheal intubation, supraglottic airway insertion, bag-valve mask ventilation, continuous positive airway pressure, non-rebreather mask (NRB) oxygen, and nebulizer or metered dose inhaler medication therapy. COVID-19 transmission was attributed to the encounter if the EMS provider’s RT-PCR+ test occurred in the 2-14 day window following the patient encounter.

There were 1383 COVID-19 patient encounters involving 1722 unique EMS providers and 1155 patients with positive COVID-19 test. Among these encounters, 220 involved at least one AGP. In total, 698 (50%) COVID-19 encounters occurred in homes; and 540 (39%) occurred in long-term nursing facilities. The most common AGPs were NRB oxygen (77%), positive pressure ventilation (27%), and advanced airway placement (18%); 25 (11%) required chest compressions. Overall, incidence of EMS COVID-19 infection was 0.57/10,000 person-days (30 infections/525,154 person-days) and did not differ according to person-time attributable to COVID-19 patient encounter (0.24, [1/41,756 person-days]) versus not attributed to COVID-19 patient encounter (0.60, [29/483,398 person-days]) (p>0.05). The one case attributable to a COVID-19 patient encounter occurred during overlapping at-risk period involving AGP and no AGP.

We observed a low risk of COVID-19 infection among EMS first responders attributed to COVID-19 patient encounters. Although PPE was not analyzed as an effect modifier, prior studies in this population suggest fairly comprehensive PPE use. This supports strategies that minimize changes to established pre-pandemic practices for treatment of emergency conditions.
PREHOSPITAL END TIDAL CARBON DIOXIDE PREDICTS HEMORRHAGIC SHOCK UPON EMERGENCY DEPARTMENT ARRIVAL

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ABSTRACT

Introduction: In addition to reflecting gas exchange within the lungs, end tidal carbon dioxide (ETCO₂) also reflects cardiac output based on CO₂ delivery to the pulmonary parenchyma. We hypothesized that low prehospital ETCO₂ values would be predictive of hemorrhagic shock in intubated trauma patients.

Methods: A retrospective observational study of adult trauma patients intubated in the prehospital setting and transported to a single Level 1 trauma center from 2016 - 2019. Continuous prehospital ETCO₂ data was linked with patient care registries. We developed a novel analytic approach that allows for reflection of prehospital ETCO₂ over the entire prehospital course of care. The primary outcome was hemorrhagic shock on ED presentation, defined as either initial Emergency Department (ED) systolic blood pressure (SBP) ≤ 90 mmHg or initial shock index (SI) > 0.9 and transfusion of at least one unit of blood product during their ED stay. Prehospital ETCO₂ < 25 mmHg was evaluated for predictive value of hemorrhagic shock.

Results: 307 patients (82% male, 34% penetrating injury, 42% in hemorrhagic shock on ED arrival, 27% mortality) were included in the study. Patients in hemorrhagic shock had lower median ETCO₂ values (26.5 mmHg vs. 32.5 mmHg; p < 0.001) than those not in hemorrhagic shock. Patients with prehospital ETCO₂ < 25 mmHg were 3.0 times (AOR = 3.0; 95% CI 1.1 - 7.9) more likely to be in hemorrhagic shock upon ED arrival than patients with ETCO₂ ≥ 25 mmHg.

Conclusions: Intubated patients with hemorrhagic shock upon ED arrival had significantly lower prehospital ETCO₂ values. Incorporating ETCO₂ assessment into prehospital care for trauma patients could support decisions regarding prehospital blood transfusion, and triage to higher-level trauma centers, and trauma team activation.
**Title:** Cost-Aware Artificial Intelligence for Acute Traumatic Coagulopathy Prediction

**Authors:** Gabriel Erion, Joseph D. Janizek, Carly Hudelson, Richard B. Utarnachitt, Andrew M. McCoy, Michael R. Sayre, Nathan J. White*, and Su-In Lee*  
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**Abstract:**

**Background:** Artificial intelligence (AI) based models have the potential to help emergency providers diagnose critical illness more quickly and accurately; however, using such predictive models requires additional resources and costs valuable time. Acute traumatic coagulopathy (ATC) is one such time-sensitive diagnosis, for which several prehospital risk scores have been developed but are not widely used. We hypothesized that an AI-based model emphasizing efficiency and incorporating medical expert opinion for feature selection would predict ATC faster without sacrificing accuracy.

**Methods:** We used the Harborview Trauma registry containing data for 14,463 trauma visits. We selected 45 features including dispatch data, time and location, on-scene procedures, and vital signs as predictive features. ATC was defined as an Emergency Department (ED) arrival INR>1.5. We surveyed 3 EMS organizations to obtain the estimated time cost and effort involved in obtaining prehospital features and the total time providers were willing to devote towards risk prediction. A new method called cost-aware AI (CoAI) was used to select the most informative, easiest-to-gather model features, attempting to maximize accuracy while minimizing time and effort. CoAI was compared to the existing PACT using ROC-AUC, sensitivity at fixed positive predictive value (PPV), and feature cost in minutes.

**Results:** The ATC outcome had a base rate of 6 percent, and was predicted by PACT with AUC 0.81, and sensitivity 0.375, while requiring 7.94 minutes per prediction. CoAI used two possible cost budgets: the PACT score cost (7.94 minutes) and the mean time EMS providers reported to be willing to devote to risk scoring during a trauma patient transport in our survey (0.83 minutes). At the same cost as PACT, CoAI achieved AUC 0.84 and sensitivity 0.498. At the EMS-recommended time cost, CoAI achieved AUC 0.82 and sensitivity 0.68. Notably, the CoAI model at the EMS-recommended cost outperformed PACT in predictive power while using roughly tenfold less data-gathering time.

**Conclusion:** A combination of machine learning methods emphasizing efficiency with end-user expert input can reduce time and effort associated with risk prediction while increasing predictive performance for prediction of ATC. The CoAI framework has potential to benefit a wide variety of time-constrained clinical prediction tasks.
Dial-COVID: Remote Mitigation Through Telephone Symptom Surveillance in Refugee Settlements in Uganda

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BACKGROUND: Persons living in refugee settlements in sub-Saharan Africa are at high risk for COVID-19 due to high-density housing, lack of water access, and limited information availability. We aimed to collect COVID-19 symptoms and exposures and disseminate public health information on COVID-19 in refugee settlements in Uganda using a telephone based interactive voice response (IVR) tool, “Dial-COVID”.

METHODS: The toll-free Dial-COVID phone number, accessible in ten languages, was advertised by community health workers in refugee settlements. Additionally, calls were sent out to a random participant sample through random digit dialing (RDD). Consenting call-in and RDD participants were screened for COVID-19 symptoms and exposures through an IVR survey and based on their answers, received tailored public health recommendations in accordance with Ministry of Health guidelines. Callers who were unwilling or ineligible to participate (<18 years of age) could receive COVID-19 public health information. Characteristics of call-in and RDD participants were compared using Chi-squared analysis.

RESULTS: Between January 26 and March 12, 2021, 1,079 participants called in to Dial-COVID and 2,889 participants were reached through RDD using all 10 languages. Of these, 138 participants (3%) were ineligible to participate (<18 years of age) and 595 participants (15%) were unwilling to complete the survey. More call-in participants had not completed primary school compared to RDD participants (44% vs 31%, respectively, p < 0.001). Overall, 62% of participants calling in to Dial-COVID self-identified as refugees, 3% were asylum seekers and 8% were internally displaced Ugandan nationals. Most callers reported living in a refugee settlement (79%). RDD calls reached 4% refugees, 1% asylum seekers and 16% internally displaced Ugandans with 25% RDD participants reporting to live in a refugee settlement. At least one COVID-19 symptom was reported by 51% of call-in participants and 52% of RDD participants (p = 0.20) and COVID-19 exposure was reported by 9% and 7% respectively (p = 0.17). Through Dial-COVID, 1,712 COVID-19 public health messages were shared with 577 call-in and 1,135 RDD participants.

CONCLUSION: Using IVR technology, Dial-COVID is able to reach a high proportion of refugees and hard to reach populations with risk mitigation messaging, including those with COVID risks or exposures.
Title:
Qualitative Study of People who use Methamphetamine during COVID-19 Informing Future ED Risk Mitigation Strategies

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Background and Objectives
Morbidity and mortality related to methamphetamine (meth) are on the rise. The Washington state ‘Stay Home, Stay Healthy’ order issued in March 2020 shuttered non-essential business and encouraged social distancing to decrease transmission of COVID-19. The aim of this study was to explore concerns and COVID-19 risk mitigation strategies with patients who use meth to inform emergency department (ED)-based harm reduction approaches for this vulnerable population.

Methods
This was a mixed-methods study of adults residing in Washington with high-risk meth use, a recent ED visit, and access to a phone from April-September 2020. First, participants completed a survey on substance use, medical history, and perceptions of COVID-19 by phone or internet. Descriptive statistics were used to report survey responses. Next, participants completed a semi-structured interview exploring perceptions of COVID-19 and recent experiences related to meth using a structured interview guide. Interviews were recorded, transcribed, and summarized. Analysis of the transcripts was guided by Grounded Theory using an iterative approach to refine the guide and codebook. Interviews were independently coded by 2 investigators and codes were discussed until consensus. Data collection continued until thematic saturation.

Results
25 participants with meth use completed the survey; 20 participants were interviewed (50% recently used heroin, 40% unstably housed). 35% were somewhat or extremely worried about COVID infection and 35% said they were somewhat to very likely to get infected with COVID in the next year. Three themes emerged from the interviews: 1) increase in meth use including using to cope, using to comply with the new guidelines, loss of routine, and lost opportunities to connect for recovery; 2) interplay of meth obtention and COVID including a description of risk-mitigation strategies or continuing use “as usual” 3) interactions with healthcare which are influenced by historical mistrust in institutions, and the difficulty with internet-based recovery tools.

Conclusion
People who use meth are at risk for COVID-19 and for meth-related harm due to increased use and mistrust in healthcare institutions. Understanding these complex interactions can aid in developing risk-mitigation strategies that are patient-centered and could be deployed from the ED for this vulnerable population.
Association of Small Adult Ventilation Bags with Return of Spontaneous Circulation in Out of Hospital Cardiac Arrest

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Excess minute ventilation adversely affects hemodynamics during cardiac arrest. Little is known about the consistency and efficacy of ventilations delivered by EMS to patients with out-of-hospital cardiac arrest (OHCA). In July 2017, this Seattle Fire Department began using smaller ventilation bags, delivering approximately 450mL per breath, in adults with OHCA. We hypothesized that the rate of return of spontaneous circulation (ROSC) at hospital arrival would increase after this change.

This retrospective analysis of prospectively acquired data evaluated adults treated for OHCA between January 1, 2015 and December 31, 2019 who received advanced airway management. Using waveform capnography obtained from monitor downloads, we calculated ventilation rate and mean end-tidal carbon dioxide (ETCO₂) values for each eligible minute during cardiac arrest. We examined whether ventilation rate, ETCO₂, and ROSC differed before and after the smaller ventilation bag implementation using linear and logistic regression.

Of the 1278 patients evaluated, 668 (52%) were treated with a small adult bag. Utstein characteristics did not differ between the two cohorts. Mean±SD ventilation rates were higher in the large bag cohort compared with small, 12.5±5.1 vs. 11.7±4.7, p < 0.01. Mean±SD ETCO₂ values were lower in the large bag cohort compared with small, 31.5±17.0 mmHg vs. 34.5±18.2 mmHg, p < 0.01. A ventilation rate > 18 was recorded in 10.0% of the 18,709 minutes evaluated. Mean ETCO₂ was less than 15 mmHg in 14.5% of all minutes. The incidence of ROSC on hospital arrival (39% vs. 34%) was not significantly different between the large and small bag cohorts (p=0.07). After adjusting for initial rhythm, age, witnessed arrest, and bystander CPR, ROSC on hospital arrival among the small bag cohort was not different (OR 0.82, CI 0.65–1.04).

Use of a small adult bag during OHCA was not associated with a difference in incidence of ROSC on hospital arrival. Ventilation rate was slightly lower and end tidal carbon dioxide was slightly higher in the small adult bag group. These findings suggest that ventilation with the small adult bag is safe, but the clinical benefits are unclear. Future studies should examine impact on downstream lung injury and acid-base status.
Changes in End-Tidal Carbon Dioxide After Defibrillation During Out-of-Hospital Cardiac Arrest

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A large rise in end-tidal carbon dioxide (ETCO₂) during out-of-hospital cardiac arrest (OHCA) has traditionally been considered a sensitive marker for return of spontaneous circulation (ROSC), despite a relative lack of evidence. National guidelines suggest increases in ETCO₂ of 10 mm Hg or greater likely indicate ROSC, while research has found this value to be specific but non-sensitive for ROSC. While ETCO₂ is considered the gold-standard for monitoring patients during OHCA, the prognostic value of changes post-defibrillation is poorly understood. The purpose of this study is to evaluate the association between ETCO₂ and ROSC during defibrillation in out-of-hospital cardiac arrest.

This retrospective, observational cohort analysis included adult OHCA patients treated by an urban EMS agency from January 1, 2015 to December 31, 2019. Patients who were not intubated, had advance directives, received advanced life support interventions prior to EMS arrival, or were not defibrillated were excluded. Changes in mean peak ETCO₂ were evaluated in the 90 seconds pre- and post-defibrillation. The ETCO₂ was compared to ROSC status on subsequent pulse checks. Patients who re-arrest after ROSC are considered Transient ROSC (T-ROSC), while others are Sustained ROSC (S-ROSC). All ETCO₂ values are reported as (mean ETCO₂ in mm Hg [95% confidence interval]).

441 patients met inclusion criteria and received a total of 1,072 defibrillation shocks. 244 shocks resulted in ROSC, while 828 shocks failed to achieve ROSC at the subsequent pulse check. Changes in post-defibrillation ETCO₂: All ROSC (+8.0 [6.2, 9.9]), T-ROSC (+5.7 [2.6, 8.9]), S-ROSC (+8.7 [6.5, 10.9]). All Non-ROSC (+2.3 [1.4, 3.2]), Never ROSC (+1.1 [0.1, 2.1]), Eventual T-ROSC (+2.3 [0.3, 4.3]), Eventual S-ROSC (+5.4 [3.1, 7.8]).

ETCO₂ increases after defibrillation in OHCA regardless of whether patients achieve ROSC by the subsequent pulse check, and variation among sub-groups is minimal. When present, these nominal differences are unlikely to be clinically beneficial for determination of ROSC in the emergent setting. Despite traditional teaching, change in ETCO₂ after defibrillation is a poor indicator of ROSC during OHCA.
Resident Category

Title: Aero-Tox: Characterizing Cases of Intoxication Aeromedically Retrieved by Airlift Northwest

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Background:

Intoxicated patients are a significant proportion of patients transported by aeromedical care services; however, few case series have been published characterizing this population. In this retrospective observational case series we characterize the population of intoxicated patients transported by Airlift Northwest in the time period of September 2009-September 2020 with the aim of improving understanding of aeromedical transport of intoxicated patients, care processes in transport, and outcomes.

Methods:

Airlift Northwest’s EHR was queried for cases of intoxication over the past 10 years. Demographic data and data related to pre-transport and intra-transport course, and destination hospital were abstracted. These cases were identified in the UWMC/HMC EHR and outcome variables were abstracted.

Results:

166 cases of intoxication were transported by Airlift Northwest over the study time period. Of these 31.3% were transported to UWMC/HMC, 31.3% were transported to regional children’s hospitals, and the remainder (37.3%) were transported to other local hospitals. Average age was 41.8 years (+/- 5.70 years). 51.7% were polydrug overdoses with ethanol being the most common coingestant (36.5%), while the most common single substances overdoses were toxic alcohols (7.7%) and carbon monoxide (7.7%). 34 were intubated prior to transport with three intubated during transport. 76.9% were admitted to the ICU, while 3.8% were discharged from the emergency department, one patient was transferred to the local hyperbaric oxygen center, and one patient died in the emergency department. One patient was placed on ECLS (ECLS duration 3 days). Average hospital length of stay was 7.87 days (+/-3.47 days), and four patients (7.7%) expired in hospital.

Conclusion:

This is the largest study of intoxicated patients aeromedically retrieved for a higher level of medical care. The majority of cases were polydrug intoxications, and the majority of these patients required ICU level care with airway support being a primary indication.
Systematic Review and Meta-Analysis of Remote Ischemic Conditioning in Patients With ST-Elevation Myocardial Infarction

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Disclosures:

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Remote ischemic conditioning (RIC) induces non-lethal ischemia in an extremity by intermittent application of a cuff in order to reduce cell injury, morbidity and mortality associated with reperfusion injury. Multiple small randomized controlled trials suggest that RIC reduces infarct size in patients with ST-elevation myocardial infarction (STEMI). We sought to systematically review the effectiveness and safety of RIC versus standard care in patients with STEMI.

Systematic review and meta-analysis were performed on randomized trials identified by search of English-language PubMed, Embase and the Cochrane Database of Systematic Reviews on Mar 15, 2021. Randomized studies comparing mortality, infarct size, major adverse cardiac events (MACE) and/or other adverse events in adults aged 18 years or greater with STEMI were eligible for inclusion. The quality of included studies was evaluated using the Cochrane Collaboration's risk of bias tool. Random effects modeling
was used to calculate risk differences for each outcome. Statistical heterogeneity and publication bias were assessed using standard methods. All analyses used standard statistical software (Major meta-analysis module for Jamovi, R).

In total, 13 trials met our a priori inclusion criteria. These enrolled 4,132 patients who received RIC; and 4,122 who received standard care. Arithmetic mean mortality was 3.2% in the RIC group and 2.9% in the standard care group [pooled risk difference -0.01 (95% CI -0.02, 0.01)]. Arithmetic mean MACE including death, reinfarction or repeat target vessel revascularization was 12% in the RIC group and 12.2% in the standard care group [pooled risk difference -0.04 (95% CI -0.07, 0)]. There was no significant difference in reported adverse events between groups. Analysis of the pooled effect of RIC on infarct size is ongoing.

Mortality was low among all enrolled patients with STEMI. RIC was not associated with significantly lower mortality but was associated with significantly fewer major adverse cardiac events. Further research is needed to assess the practical relevance of RIC’s significant reduction of morbidity in STEMI as well as how it may affect outcomes in other conditions associated with reperfusion injury.
Prevalence and Risk Factors for Hypertension and Diabetes Among Those Screened in a Refugee Settlement in Uganda

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Background: Diabetes and hypertension are increasingly prevalent in low- and middle-income countries, but they are not well-documented in refugee settlements in these settings. We sought to estimate the prevalence and associated characteristics of diabetes and hypertension among adults presenting for clinic-based HIV testing in Nakivale Refugee Settlement in Uganda.

Methods: Eligible participants presenting to outpatient clinics for HIV testing at three health centers in Nakivale Refugee Settlement were enrolled from January 2019 through January 2020. Multi-lingual research assistants administered questionnaires aloud to ascertain medical history and sociodemographic information. The research assistants then used standardized procedures to measure participants’ blood pressure and to conduct a point-of-care blood glucose test. We used χ²-square or Fisher’s exact test to test for differences in disease prevalence by refugee status and log-binomial or Poisson regression models to estimate associations of immigration status and country of origin, respectively, with hypertension and diabetes while controlling for age, sex, education level, and body mass index.

Results: Among 2127 participants, 1379 (65%) were refugees or asylum seekers and 748 (35%) were Ugandan nationals. Overall, 32 participants met criteria for diabetes (1.5%, 95% CI 1.1-2.1%). There were 1,067 (50%, 95% CI 48.0-52.2%) who met the criteria for pre-hypertension and 189 (9%, 95% CI 7.7-10.1%) for hypertension. These proportions did not vary by immigration status or country of origin in univariate tests or multivariable regression models.

Conclusions: Hypertension was common and diabetes was uncommon among those screened in a Ugandan refugee settlement. Routine blood pressure screening should be considered in this setting. Additional research could develop diabetes screening criteria to help identify at risk individuals in this limited resource setting.
**Title: Simulation Based Mastery Learning for Ultrasound Guided Peripheral IV Insertion Leads to Improved Contrast Extravasation Rates with Computerized Tomography in the Emergency Department**

Jeremy Shin, Bennett King, Ashely Amick, Ross Kessler

Computerized tomography (CT) with intravenous (IV) contrast have become indispensable for the evaluation of patients in the emergency department (ED). Contrast extravasation (CE) occurs when contrast errantly infuses into the extravascular space. CEs may result in patient morbidity, delays, and increased costs. For patients with difficult IV access (DIVA), Ultrasound Guided Peripheral IVs (USGPIV) are increasingly used to facilitate enhanced CTs. However, studies have shown USGPIVs have high rates of CE compared traditional PIVs. While many factors may influence CE rates in USGPIV, the role of provider training has been unexplored. Our objective was to determine if training emergency nurses (ENs) using a novel simulation-based mastery learning (SBML) curriculum would improve CE rates at our institution.

This is a quasi-experimental pre-post study from Sept 2018 – Sept 2020. 21 ENs were USGPIV trained from Sept 2019-Sept 2020. All EN-USGPIV insertions were recorded in a secure database and prospectively reviewed to determine if they were used for an enhanced CT, and if a CE event occurred. To obtain the baseline institutional CE event rate we queried a database maintained by the radiology department. We then reviewed all USGPIVs inserted from Sept 2018 - Sept 2019, which were placed by MD/APPs. We compared CE events for EN-USGPIV to the established institutional baseline, as well as to MD/APP-USGPIVs placed during the pre-intervention period.

During the pre-intervention period, there were 9249 contrast-enhanced CT studies with 67 CE events across the institution, with a baseline event rate of 0.72%. During the pre-intervention period, 236 ED MD/APPs-USGPIVs were used in CT with 18 CE events, for a CE event rate of 7.6%. During the intervention period, 271 EN-USGPIVs were used in CT with 2 CE events, for an event rate of 0.7%. There was no significant difference in CE rate for EN-USGPIV compared with the baseline, p=.97. ED MD/APP-USGPIVs were significantly more likely to extravasate in CT, p<.0001.

Despite previous reports of high CE rates with USGPIV, intensive SBML USGPIV training demonstrated improved CE rates. Additionally, USGPIVs placed by SBML-trained ENs were significantly less likely to undergo CE compared to USGPIVs placed by MDs or APPs at our institution. Increasing attention should be paid to the quality and rigor of USGPIV training efforts.
Obtaining IV access is a critical to emergency care. Ultrasound guided peripheral IV insertion (USGPIV) is frequently used in difficult IV access (DIVA), however traditionally required the time and skill of a physician to perform. Emergency Nurses (ENs) are increasingly performing USGPIV insertion; however, there is heterogeneity in the design, rigor, and outcomes from training programs, with overall success rates of 70-90%, and first pass success rate of 60-70%. Simulation-based mastery learning (SBML) is one strategy to standardize learning outcomes by training all participants to a rigorous, predetermined minimal passing standard (MPS). SBML is highly effective for procedural training in physicians but has been underutilized in nursing. Our objective was to establish a SBML USGPIV curriculum for ENs with a structured bedside deliberate practice (DP) paradigm to determine if this can improve EN USGPIV procedural success rates.

This is a prospective observational study from Sept 2019-Sept 2020 at a large, urban academic ED. We implemented the curriculum in 2 phases. In phase 1 ENs underwent a simulated assessment using a 30-item dichotomous checklist, followed by a recorded video, and then DP of the entire procedure on a simulator with expert feedback. ENs then returned at a later date to complete a post-test using the same checklist and were required to meet the MPS. Those who did not meet the MPS underwent further DP until able to do so. In phase 2, ENs performed supervised insertions on actual patients with expert coaching that was grounded in DP principles. ENs were deemed “independent” after completing 5 successful USGPIVs, but all received 8-12 hours of dedicated bedside coaching. ENs recorded all insertion attempts in an online database.

All 21 ENs enrolled in the training program completed the SBML curriculum and achieved independent status. From Sept 2019-Sept 2020, ENs successfully inserted 1067 USGPIV (70% of all USGPIV inserted in the ED). The overall success rate was 97.8%, first-pass success rate of 86.1%, and a mean of 1.15 insertions per encounter.

Compared with previously reported USGPIV curricula, SBML with DP demonstrates marked improvement in overall and first-pass success. Improving EN USGPIV skills through SBML training may reduce the number of insertion attempts, decrease the demand on physicians, and improve ED efficiency.
Faculty/Fellows Category

Emergency department characteristics and associations with intensive care admission among patients with coronavirus disease 2019

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Abstract

Objective: There have been few descriptions in the literature to date specifically examining initial coronavirus disease 2019 (COVID-19) patient presentation to the emergency department (ED) and the trajectory of patients who develop critical illness. Here we describe the ED presentation and outcomes of patients with COVID-19 presenting during our initial local surge.

Methods: This is a multicenter, retrospective cohort study using data extracted from the electronic health records at 3 hospitals within a single health system from March 1, 2020 to June 1, 2020. Patients were included in the study if they presented to an ED and had laboratory-confirmed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection during the study period. Data elements were extracted from the electronic health record electronically and by trained data abstractors and entered into a secure database. We used multivariable regression analysis to examine ED factors associated with the development of critical illness and mortality, with a primary outcome of ICU admission.

Results: A total of 330 patients with laboratory-confirmed SARS-CoV-2 infection were admitted during the study period. Of these, 112 (34%) were admitted to the ICU. Among these patients, 20% were female, 50% were White, the median age was 61 (interquartile range [IQR], 52–72), and the median body mass index (BMI) was 28.1 (IQR, 24.3–35.1). On univariable analysis, a doubling of lactate dehydrogenase (LDH) (odds ratio [OR], 3.87; 95% confidence interval [CI], 2.40–6.27) or high-sensitive C-reactive protein (hsCRP; OR, 1.32; 95% CI, 1.11–1.57) above the reference range or elevated troponin (OR, 12.1; 95% CI, 1.20–121.8) were associated with ICU admission. After adjusting for age, sex, and BMI, LDH was the best predictor of ICU admission (OR, 3.54; 95% CI, 2.12–5.90). Of the patients, 15% required invasive mechanical ventilation during their hospital course, and in-hospital mortality was 19%.

Conclusions: Nearly one-third of ED patients who required hospitalization for COVID-19 were admitted to the ICU, 15% received invasive mechanical ventilation, and 19% died. Most patients who were admitted from the ED were tachypneic with elevated inflammatory markers, and the following factors were associated with ICU admission: elevated hsCRP, LDH, and troponin as well as lower oxygen saturation and increased respiratory rate.
“That Line Just Kept Moving”: Motivations of People Who Use Methamphetamine and Their Experiences in the Emergency Department

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Background: Methamphetamine (meth) use is on the rise nationwide with increasing emergency department (ED) visits and deaths related to overdose. Previous research notes that emergency providers describe meth use as a significant problem with high resource utilization, recidivism, and violence against staff, but little is known about the perspectives of patients. The objective of this study is to identify the motivations of people who use meth and their experiences in the ED in order to guide future ED-based approaches.

Methods: This is a qualitative study of adults residing in Washington state, who used meth in the last 30 days, met criteria for high-risk use, recently visited the ED, and had access to a phone. Twenty individuals were recruited to undergo semi-structured interviews, which were recorded and transcribed prior to being coded. Grounded Theory guided the analysis, and the interview guide and codebook were refined iteratively. Two investigators coded the interviews until consensus was reached. Data were collected until thematic saturation was achieved.

Results: Participants described a shifting line that separates the positive attributes from the negative consequences of using meth. Many initially used meth to enhance social interactions by consuming with their network, combat boredom by chasing the high, and escape difficult circumstances by numbing the senses. However, continued use regularly led to isolation, ED visits for the sequelae of “overamping,” and engagement in increasingly risky behaviors. Because of their overwhelmingly frustrating experiences in the past, interviewees anticipated difficult interactions with healthcare providers, leading to avoidance of the ED at all costs and downstream healthcare complications. Participants desired linkage to outpatient resources and treatment without stigma.

Conclusion: Meth use drives patients to EDs, where they often feel stigmatized and like they are provided little assistance. ED providers should acknowledge addiction as a chronic disease, address symptoms adequately, and provide positive connections to outpatient resources. Future work should incorporate the perspectives of people who use meth into ED-based programs and interventions.
Title: The role of speciality identity on physician-to-physician interactions during hospital admission conversations.

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Abstract:

Background: Communication and teamwork are core competencies for physicians. However, despite the use of structured hand-off tools, interpersonal interactions at the time of admitting a patient continue to be an underexplored source of workplace conflict. The goal of this study was to gain a more nuanced description of conflictual interpersonal interactions between physician colleagues in order to provide foundational guidance for how training communities can support best practices and curricular innovation regarding communication.

Methods: Using constructivist grounded theory we explored the lived experience of physician-to-physician conflict among emergency medicine (EM) and internal medicine (IM) clinicians. Using purposive recruiting sampling, data were collected via hour-long, semi-structured interviews. A constant comparative and integrative analysis was used to refine our interview guide. All transcripts were double coded by the two primary investigators. Interviews were concluded after reaching thematic sufficiency.

Results: We interviewed 18 participants:, which included: 9 IM faculty, 8 EM physicians (3 faculty, 5 residents), and one faculty member dual trained in EM and IM. In reflecting upon admissions conversations with their colleagues, many participants described aspects of group identification that lead to interpersonal conflict. The themes identified highlighted the role of specialty identity in priming creating conflict, promoting parallel discourses regarding expectations for clinical care, and generating mutual disempowerment between groups. However, participants also spoke to how these boundaries dissolved when they unified around the shared care of a patient and emphasized cross-specialty team formation and collaboration.

Conclusions: Speciality identity formation plays a key role in interpersonal conflict between physicians. Understanding the consequences of this phenomena has the potential to provide a foundation for curricular innovation and cultural change as we strive to improve communication among providers.
Delivery of a resuscitation fluid cocktail containing fibrinogen and vasopressin as an infusion rather than boluses decreases hemorrhage in swine polytrauma model

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**Background.** Hemorrhage is a major contributor to the massive burden caused by trauma, and treatment of trauma victims in austere settings can be challenging. We have previously shown that a low-volume resuscitation fluid cocktail containing vasopressin and fibrinogen improves vital organ perfusion while minimizing hemorrhage when delivered in two boluses 30 minutes apart in a swine model of polytrauma. However, each bolus caused a spike in mean arterial pressure, possibly leading to thrombus failure and contributing to hemorrhage. If the vasoactive cocktail were administered in a slower fashion, it could blunt these blood pressure spikes and further mitigate blood loss. Our objective was to determine whether administration of this multifunctional resuscitation fluid cocktail as a continuous infusion rather than as two boluses can improve outcomes in a swine model of polytrauma.

**Methods.** Eighteen immature, anesthetized, splenectomized Yorkshire swine were subjected to fluid percussion brain injury, femur fracture, catheter hemorrhage, and aortic tear. After a shock period, animals received 14 mL/kg of the previously described fluid resuscitation cocktail (hydroxyethyl starch solution with 0.8 U/kg vasopressin and 100 mg/kg fibrinogen). They were randomized to receive this either divided into two boluses delivered at 0 and 40 minutes after resuscitation began (n=9) or as a continuous infusion over 60 minutes (n=9). Animals were monitored for six hours or until time of death, after which intraperitoneal blood loss was measured. Hemorrhage volume was compared by t-test, and survival was compared by Kaplan-Meier log rank test.

**Results.** Baseline characteristics were similar between groups. Hemorrhage volume was lower with slow infusion compared to boluses (15.0 ± 11.2 vs. 26.1 ± 13.4 mL/kg, p=0.04). Survival was not significantly changed with infusion compared to boluses (78 vs 44% at six hours, p=0.16).

**Conclusion.** Delivery of a previously identified multifunctional resuscitation fluid cocktail as a continuous infusion rather than as two separate boluses improved blood loss though not survival after injury.
RATIONALE AND DESIGN OF HYPOTHERMIA IN PATIENTS WITH ST-ELEVATION MYOCARDIAL INFARCTION RESEARCH PROGRAM

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RATIONALE Induced hypothermia (IH, also known as targeted temperature management) is used to reduced inflammation and cell injury in the heart and brain in patients resuscitated from cardiac arrest. Similar inflammation and cell injury occurs in the heart after ST-elevation myocardial infarction (STEMI). In prior trials of IH in patients with STEMI (n=6 trials, n=629 patients), the IH group did not achieve target temperature before primary percutaneous coronary intervention (PCI), nor reduce infarct size (IS) or improve clinical outcomes versus the control group. Post hoc analysis suggested reduced IS in patients with anterior STEMI cooled before reperfusion by primary PCI. A novel intravascular temperature management (IVTM) catheter and cooling system (Thermogard 3 Temperature Management System, ZOLL Circulation, San Jose, CA) rapidly achieves target temperature in animal models. This medical device has not been evaluated in patients with STEMI in the United States.

OBJECTIVE The overall objective is to assess whether IH to of 33°C before primary PCI significantly reduces IS and clinical outcomes versus standard care in patients with acute anterior STEMI.

METHODS Included will be adults who present to a participating hospital with symptoms and electrocardiographic signs of acute anterior STEMI, eligible for primary PCI, provide informed consent, and capable of achieving core temperature 33°C with minimal delay in reperfusion. The IH group will have an IVTM applied prior to PCI and hypothermia will be maintained for 3 hours. All study patients will receive standardized evidence-based concurrent care. The primary outcome measure is IS measured by cardiac magnetic resonance imaging 5 days after PCI. IS is known to be associated with the subsequent risk of major adverse cardiac events (MACE) i.e., death, reinfarction, target vessel revascularization, stent thrombosis, heart failure, or bleeding.

RESULTS The pilot phase will enroll 60 roll-in and 20 randomized participants in 10 sites to assess device and protocol feasibility and safety. If the pilot phase is successful, a subsequent pivotal phase would require 490 patients (245 per group) in 40 sites to detect a 5% absolute reduction in IS in the IH group vs. the control group.

CONCLUSION If IH is effective and safe in patients with STEMI, the results may change contemporary care for patients with STEMI, and generalize to care of other conditions associated with inflammation and cell injury after restoration of blood flow.
Time to antibiotics and in-hospital mortality are triage temperature dependent among ED patients with suspected sepsis

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Background

Emergency department (ED) triage temperature likely influences clinical decision making and relates to patient outcomes in sepsis. This study investigates the association between ED triage temperature, antibiotic order timing, and in-hospital mortality among ED patients with sepsis.

Methods

We performed a retrospective cohort study of suspected sepsis patients presenting to an urban, academic, ED from January 2016 to December 2018. We included adult ED patients who met suspected sepsis criteria, as defined by one of the following: 1) two or more systemic inflammatory response syndrome criteria 2) organ dysfunction, 3) systolic blood pressure <90 mmHg, or lactate ≥4.0 mmol/L, who also received broad spectrum antibiotics and required hospital admission. Our primary outcome was time to antibiotic order. Secondary outcomes included in-hospital mortality. Patients were grouped by triage temperature: afebrile (temperature <38 ºC) and febrile (temperature ≥38 ºC). First, we described the univariate relationship between triage temperature and antibiotic timing. Second, a multivariable Cox Proportional Hazards model assessed the independent effect of triage temperature on antibiotic order timing. Last, we assessed the independent association between triage temperature and in-hospital mortality using multivariable logistic regression, controlling for ED data associated with mortality and antibiotic timing.

Results

During the study period, 1623 ED patients met suspected sepsis criteria: 273 (16.8%) febrile, 1350 (83.2%) afebrile, and 171 (10.5%) who died during hospitalization. The median unadjusted time to antibiotic order was 77 (IQR 43-130) minutes in febrile versus 104 (58-172) minutes in afebrile patients. In the Cox Proportional Hazards model, afebrile patients had HR 0.71 (0.62 - 0.81) risk of antibiotic order compared with febrile patients. Afebrile patients also demonstrated significantly increased in-hospital mortality, aOR 2.51 (1.34 - 4.70), even after controlling for time to antibiotic order.

Conclusion

Septic ED patients without fever at triage have significant antibiotic order delays and increased mortality. Improving early infection identification may improve timing of sepsis care. Furthermore, triage temperature deserves special consideration as a confounder in studies relating time to sepsis therapies and mortality.
Dial-COVID: Remote mitigation through telephone symptom surveillance in refugee settlements in Uganda

Kelli O’Laughlin

PLACEHOLDER.......
Evaluating the Impact of Washington State’s Emergency Department Information Exchange

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Background: Health information exchange (HIE) has been promoted as a strategy to facilitate care coordination and reduce costs for high-needs Medicaid patients. In 2012, Washington state implemented an HIE referred to as the Emergency Department Information Exchange (EDIE) as part of its “ER is for Emergencies” program. To date, the impact of EDIE has not been systematically evaluated. The purpose of this study is to examine how EDIE influenced ED utilization, inpatient admissions, and expenditures for Medicaid beneficiaries.

Methods: We identified monthly cohorts of index visits from Washington Medicaid patients. Frequent users, defined by ≥5 ED visits in the preceding 12-month period, were compared to infrequent users with <5 ED visits. Users were followed for 1 year to assess outcomes. We employed a difference-in-difference approach to estimate the effects of EDIE. We defined four time periods of interest for the analysis: Baseline period (Jan 2010-Jun 2011), Anticipatory period (Jul 2011-Jun 2012), and the first and second year after the implementation of the ER is for Emergencies Program (Jul 2012- Jun 2013 and Jul 2013- Jun 2014, respectively). The marginal, population-averaged policy effects were estimated from our models using recycled predictions.

Results: Our analysis included 505,667 index visits from January 2010 to October 2014 (prior to Medicaid expansion in Washington State). Approximately 40% of the users were classified as frequent users. ED visits among frequent users declined from 8.63 visits per beneficiary-per year in the baseline period to 6.90 visits in the first year after implementation (20.4% relative decrease). This compared to a decline from 2.21 visits per beneficiary-per year to 1.92 visits among infrequent users (13.2% relative decrease). This reflected a mean DID of (-1.42; 95%CI: -1.53, -1.31) in ED use for frequent users vs. infrequent users. During the same period, inpatient admissions and annual expenditures increased. However, the observed trends in outcomes appeared to begin in the baseline period, continue through the anticipatory period and level off during the policy implementation, and were not statistically significantly different over the study period.

Conclusion: The ER is for Emergencies Program mandating statewide use of EDIE was not associated with a reduction in health care utilization or costs for frequent ED users. Lower rates of ED use coupled with higher rates of inpatient admissions and annual expenditures among Medicaid beneficiaries is likely attributable other simultaneous state policies and programs impacting frequent ED users.
Title: Simulation Based Mastery Learning for Ultrasound-Guided Peripheral IV Insertion Skills Among Emergency Nurses Improves IV Failure Rates

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Obtaining prompt intravenous (IV) access is a cornerstone of emergency care. Ultrasound guided peripheral IV insertion (USGPIV) is effective at obtaining access in patients with difficult IV access (DIVA). However, recent studies have reported poor USGPIV performance, with only 50% surviving beyond 24hrs. To date, the role provider training may play in premature USGPIV failure has been unexplored. Our objective was to implement a Simulation-Based Mastery Learning (SBML) USGPIV curriculum for Emergency Nurses (EN), and to compare the performance of SBML-trained EN USGPIVs to those placed by physicians or advanced practice providers (MD/APP).

This was a quasi-experimental pre-post study taking place from Sept 2018 – Sept 2020. Beginning in Sept 2019 we trained 21 ENs using a SBML USGPIV curriculum. ENs recorded all USGPIV insertions in a secure database. The time of insertion, time of removal, reason for removal, and complications were prospectively collected by chart review. For comparison, we retrospectively reviewed all USGPIVs inserted the year prior to our intervention, which were exclusively performed by MD/APPs. USGPIV failure was defined as removal of IV for any reason other than ‘routine exchange,’ ‘no longer required,’ or discharge. We used a Chi-squared test to compare percent failure for EN vs MD/APP placed USGPIVs at 24, 48, 72, 96, and 120 hours.

From Sept 2019 through August 2020, we reviewed 1067 charts of patients who received USGPIVs inserted by ENs, and 788 charts of patient who received a USGPIV by MD/APPs from Sept 2018 through August 2019. Overall percent failure was 18.4% for EN-USGPIVs vs 37.4% for MD/APP-USGPIVs (p<.0001). Similarly, comparative failure rates were 15.7% (EN) vs 37.2% (MD/APP) at 24hrs; 22.8% (EN) vs 50.6% (MD/APP) at 48hrs; 30.3% (EN) vs 59.9% (MD/APP) at 72hrs; 36.1% (EN) vs 67.7% (MD/APP) at 96hr; and 40.6% (EN) vs 72.0% (MD/APP) at 120hr (all p<.0001). Additionally, 14.7% of USGPIVs placed by MD/APPs failed while the patient was still in the ED.

Despite reports of high premature failure rates of USGPIVs, SBML USGPIV training for ENs results in marked improvements in failure rates compared with existing literature. Additionally, USGPIVs placed by SBML-trained ENs significantly outperformed USGPIVs placed by MDs or APPs at our institution. Increasing attention should be paid to the quality and rigor of USGPIV training efforts.