Table 1. WPRS by volume and proximity to HAPH

	Overall (N=3933)	<30 minutes to HAPH (N=1009)	>30 minutes to HAPH (N=2924)	P-value
Low (N)	1625	261	1364	
Mean WPRS (SD)	61.9 (16.18)	66.7 (18.06)	61 (15.63)	<0.001[1]
Medium (N)	1241	312	929	
Mean WPRS (SD)	69.7 (15.81)	73.8 (16.04)	68.3 (15.5)	<0.001[1]
Medium-High (N)	697	257	440	
Mean WPRS (SD)	73.6 (16.45)	77.1 (16.17)	71.6 (16.28)	<0.001[1]
High (N)	370	179	191	
Mean WPRS (SD)	79.0 (16.42)	81.1 (15.80)	77.1 (16.79)	0.029[1]

1 Wilcoxon rank-sum test

14 Nontargeted Hepatitis C Virus Screening in an Appalachian Emergency Department Identifies a High Prevalence of Infection Among Adult Emergency Department Visitors

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Study Objectives: We describe the initial results of an adult academic emergency department (ED) non-targeted hepatitis C virus (HCV) screening program serving Appalachia, which is disproportionately affected by the opioid epidemic.

Methods: The study was a retrospective cohort analysis of ED systematic, non-targeted, opt-out HCV testing outcomes from July 2018 through January 2019. Those eligible for "non-targeted" HCV testing included: adults (greater than 17 years), verbally able to communicate, receiving blood work already as part of routine clinical care, and not opting-out of testing. For eligible individuals who did not opt-out of testing, an HCV antibody (Ab) test was performed. Reactive Ab tests were confirmed with reflexive RNA testing. The primary study outcome was the characterization of HCV Ab and RNA prevalence.

Results: There were 21,359 unique adult visitors during the time period studied. Of these, 16,700 individuals were verbally engaged about testing and did not opt out. A total of 11,635 individuals received HCV Ab testing with 1,459 patients (12.5%) having reactive results. RNA confirmatory testing was reflexively performed in all Ab positive patients with 830 (56.9%) being positive. Of those Ab positive: 43% (627/1453) had a documented history of injection drug use, 27 (1.9%) were born before 1945, 410 (28.1%) were born between 1945 and 1965, and 1022 (70.0%) were born after 1965. The birth decade with the greatest burden of disease included those born between 1976 and 1985, of whom 20.1% (398/1981) were Ab positive. The seroprevalence for baby boomers was 11.2% (410/3646), and was higher in blacks than whites (17%, 75/441 vs. 10%, 334/3145; $p<0.0001$), males than females (14.3%, 270/1886 vs. 8%; $p<0.0001$) and those uninsured or with government vs. commercial insurance (medicare: 10.2%, 178/1746; medicaid: 20.0% 158/789; commercial: 5%, 10/201; uninsured: 19.2%, 15/78; $p<0.0001$). The seroprevalence for those born after 1965 was 14.8% (1,022/6901), and was higher in whites than blacks (16.8%, 961/5737 vs. 4.6%, 44/956; $p<0.0001$), males than females (18.5%, 556/3013 vs. 12.0%, 466/3888; $p<0.0001$) and those uninsured or with government vs. commercial insurance (medicare: 13.8%, 69/500; medicaid: 23.3%, 755/3242; uninsured: 14.5%, 84/580; commercial: 2.7%, 15/548; $p<0.0001$).

Conclusion: ED non-targeted, opt-out testing identified a high prevalence of HCV infection among adult visitors - approximately six times the estimated regional adult prevalence. HCV infection was disproportionately high among younger, white individuals likely reflecting the escalating syndemic of opioid injection and HCV transmission in Appalachia.

15 Standardizing Measurement of Missed Emergency Department Acute Myocardial Infarction Diagnoses Using the SPADE Method

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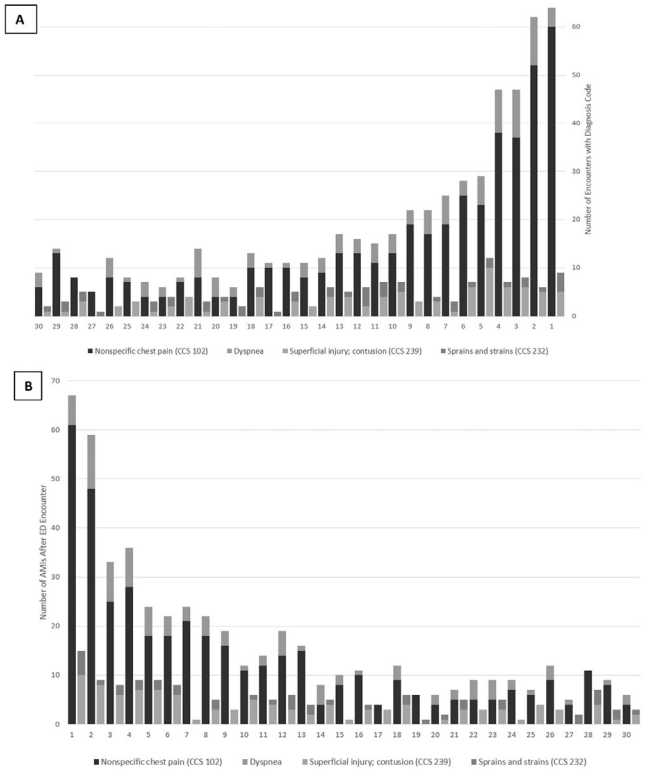
Study Objectives: Diagnostic error is a serious public health problem, but standardizing ways to measure and report hospital and health system performance has remained elusive. Our study aims to identify missed acute myocardial infarctions (AMI) using a previously described symptom-disease pair analysis of diagnostic error (SPADE) methodological approach.

Methods: We analyzed data from electronic health records and administrative claims for adult members of Kaiser Permanente Southern California between 1/1/2009-12/1/2017. First, we identified all AMI hospital admissions and "looked back" 30-days for any preceding treat-and-release emergency department (ED) visits. The top diagnoses for ED visits prior to AMI were identified. Symptoms with the highest prevalence and observed to expected (O/E) ratio were identified as a symptom-disease pair and compared to a control group. Second, we identified all ED visits with the symptom-disease pair and "looked forward" 30-days to identify potentially missed AMIs, also comparing a control group.

Results: 44,473 initial AMI hospital admissions were used to identify the most common treat and release ED visits in the preceding 30-days. Nonspecific chest pain and dyspnea were identified as the most likely missed diagnoses with O/E ratios of 2.54 (95% CI 2.34-2.76) and 3.70 (95% CI 3.13-4.36) respectively. This represented 574 (1.3%, 95% CI 1.2%-1.4%) probable missed AMIs. Looking forward, 325,088 chest pain and dyspnea ED encounters lead to 508 (0.2%, 95% CI 0.1%-0.2%) delayed AMI diagnoses. Misses were most likely to occur in the first 5-7 days after the encounter and returned to near baseline by 30 days (Figure 1).

Conclusion: SPADE methods provide a standardized method to identify missed AMIs, providing an opportunity for hospitals and health systems to measure and track. Although ~1.3% of ED AMIs may correspond to >10,000 US ED missed coronary events each year, identifying higher-risk sub-cohorts (demographic/clinical) will be crucial given the low overall rate of AMI "misses."

Figure 1: Daily counts of likely missed acute myocardial infarctions (AMI) using a "look back" (A) and "look forward" (B) approach. Strains, sprains and superficial injuries are reported as a control group for comparison in both figures. Figure A) represents ED diagnoses 1 to 30 days before an inpatient AMI encounter and figure B) represents inpatient AMI encounters 1 to 30 days after an ED visit.



16 Procainamide vs Ibutilide in the Cardioversion of Recent-Onset Atrial Fibrillation and Flutter in the Emergency Department: A Retrospective Cohort Study

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Study Objectives: Intravenous (IV) procainamide and ibutilide are two commonly used medications for the cardioversion of emergency department (ED) patients with recent-

onset (<48h) atrial fibrillation (AF) and atrial flutter (AFL; either = AF/AFL) across North America. It is unclear which medication is preferable. No trials have compared these agents for this indication and North American society guidelines offer contradictory recommendations: procainamide is the drug of choice in the Canadian guideline, where ibutilide is not recommended; the converse is true in U.S. guidelines. Issues of effectiveness, safety, and ease of use may contribute to drug selection. Ibutilide carries a black-box warning for the risk for torsade de pointes (polymorphic ventricular tachycardia [VT]) and requires at least 4h of monitoring, making it riskier and more cumbersome to administer than procainamide. We compare patient selection, effectiveness, and side-effect profiles of IV procainamide and ibutilide in the treatment of ED patients with recent-onset AF/FL.

Methods: This retrospective cohort study included all adults who received IV procainamide or ibutilide for recent-onset AF/FL from 01/2009 to 06/2015 in 21 community EDs within a large U.S. integrated health care delivery system. We gathered demographic and clinical variables from the electronic health record and structured manual chart review. Our effectiveness outcome was cardioversion at 90m, sustained to ED discharge. Safety outcomes were the 60m incidence of hypotension (defined as more than one systolic blood pressure <100 mmHg) and VT, at least three beats in duration. We describe patient characteristics and compare outcomes using Fisher's exact test (two-tailed) with significance noted when $p<0.05$.

Results: Among 730 unique ED adults, 376 received procainamide (51.5%) and 354 (48.5%) ibutilide. The two cohorts were comparable in demographics, symptom duration, and cardiac history, but ibutilide was preferred for patients with AFL (Table). The two agents had similar 90m rates of cardioversion for AF. For AFL, however, ibutilide was more effective. Hypotension occurred in 34 procainamide recipients (9.0%), only 17 of whom (4.5%) required any treatment (IV fluids or procainamide discontinuation or both) and resolved without sequelae in all 34 cases. Non-sustained monomorphic VT was uncommon. One ibutilide patient developed torsade, which resolved with treatment. More ibutilide-recipients received observation or hospitalization (Table).

Conclusion: ED patients selected for treatment with procainamide or ibutilide for the cardioversion of recent-onset AF/FL appear similar in demographics, cardiac history, and symptom duration. The two agents demonstrate comparable 90m effectiveness for AF, but ibutilide is more effective for AFL. Until randomized trials are conducted on patients with recent-onset AF/FL, our findings suggest that IV ibutilide may be preferable for AFL based on effectiveness, whereas procainamide may be preferable for AF based on ease of use and safety.

Table. Characteristics and outcomes of emergency department patients receiving IV procainamide or ibutilide for the cardioversion of recent-onset atrial fibrillation (AF) or atrial flutter (AFL)

	Procainamide N=376	**Ibutilide N=354**
Characteristics		
Age, years; median (interquartile range)	63 (53-71)	61 (52-71)
Sex, female	166 (44.1)	140 (39.6)
AFL*	31 (8.2)	61 (17.2)
Duration ≤12h	322 (85.6)	290 (81.9)
No history of AF/AFL	168 (44.7)	147 (41.5)
Reduced cardiac ejection fraction (<40%)	1 (0.3)	5 (1.4)
Outcomes		
Cardioversion <90m	168 (44.7)	156 (44.1)
AF	160/345 (46.4)	116/293 (39.6)
AFL*	8/31 (25.8)	40/61 (65.6)
Hypotension*	34 (9.0)	0
Monomorphic ventricular tachycardia (non-sustained)	3 (0.8)	1 (0.3)
Torsade de pointes	0	1 (0.3)
Admitted to short-term observation or to hospital*	45 (12.0)	84 (23.7)

Cell contents are reported as n (%), except where noted.
Bold font denotes statistically significant between-group difference.
* P<0.001

17 Efficacy of Four Hemostatic Dressings for Prolonged Field Care in a Swine Model of Junctional Hemorrhagic Injury

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Study Objectives: The goal of this preclinical study is to evaluate the incidence of significant re-bleed and survival for a prolonged period after extremity mobilization for four hemostatic strategies applied to a swine model of non-compressible groin injury. More than 90% of all preventable battlefield deaths are caused by exsanguinating hemorrhage, prompting the call for expanded research in the areas of non-compressible hemorrhage, hemostatic dressings and junctional hemorrhage control [1-4]. Research over the past few years has spurred the development of new hemostatic products, but few are tested for use in prolonged field care and its situational challenges [5, 6, 7, 8]. Although out-of-hospital providers try to transport patients with care, situations may require that a patient be moved out of harm's way without consideration to their wounds [8-10]. A casualty may be required to walk with assistance, to be carried, or even dragged [11]. While a particular hemostatic agent may be effective under static conditions, it may fail during movement.

Methods: We compared Chito Gauze to Combat Gauze and NuStat tactical. Kerlix rolled gauze, which contains no clotting agent, served as our control treatment. To test these hemostatic strategies, we used a well-established swine model of severe hemorrhage. The animals were placed under general anesthesia. We induced injury by cutting a 6mm femoral arteriotomy, after which uncontrolled bleeding was allowed for 60-seconds [15, 9, 16]. After the hemorrhage period, the randomly selected hemostatic agent was applied to the wound. Following the assigned treatment, intravenous fluid (Hextend) and tranexamic acid (TXA) were administered per TCCC battlefield resuscitation protocol, and the experimental extremity was mobilized systematically (flexion, extension, abduction and adduction) 10 times to determine whether the hemostatic strategy maintains clot integrity during movement. Our objective was to determine which hemostatic strategy is most efficacious in maintaining a blood clot for a prolonged period after extremity mobilization.

Results: Survival was 100% across groups. Initial rebleed was significantly lower for Combat Gauze® (27%) than for NuStat TacticalTM (63%, $p<0.02$), while ChitoGauze® and KerlixTM were similar (each 50%). Rebleed at the end of the observation period occurred with NuStat TacticalTM (25%) and KerlixTM (13%) but not with Combat Gauze® or ChitoGauze®. Vitals and blood chemistry remained within physiologic parameters throughout. None of the rebleed rates resulted in a significantly significant blood loss nor significantly significant clot formation as measured by TEG, with the exception of decreased clot strength of NuStat at 270 minutes.

Conclusion: Combat Gauze® performed best overall, with the lowest rates of initial rebleed and no rebleeds after prolonged monitoring and may therefore be suitable for prolonged field care. NuStat TacticalTM performed worst overall, with the highest rates of initial rebleed and rebleed after prolonged monitoring and may therefore be inappropriate for prolonged field care settings that require limb movement. It is important to note that rebleed rates decreased significantly across all products after prolonged monitoring illustrating the importance of delayed movement or immobilization of a bleeding wound exposed to hemostatic gauzes.

18 Improving the Safety of Insulin Treatment for Hyperkalemia

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Study Objectives: This study's objective was to determine key clinical predictors of hypoglycemia following insulin therapy for the emergent management of hyperkalemia and derive a safe insulin treatment strategy.

Methods: We performed a retrospective observational study across 4 hospitals that was inclusive of consecutive ED and hospitalized adults that received insulin for the management of hyperkalemia over a 12-month period. We excluded patients treated in the setting of cardiac arrest. The primary outcome was hypoglycemia (glucose < 70 mg/dL) following treatment. We performed multivariate logistic regression to determine clinical predictors of hypoglycemia. We then tested the pre-treatment glucose-insulin ratio (glucose divided by planned weight-based insulin dose) and tested its ability to alert clinicians to the risk of treatment related hypoglycemia.