Research and Academics in KP California Emergency Medicine

Quarterly Report: 2022 Q3

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Hot Off the Press[a]

TPMG (Northern CA)

Ballard D, **Vinson D**. Medically Clear: Don't fall prey to implicit left-digit bias. *Emerg Med News*. 2022;44(8):24.

Link: https://journals.lww.com/em-news/Fulltext/2022/08000/Medically_Clear__Don_t_Fall_Prey_to_Implicit.21.aspx

Ballard D. The surprising benefits of yawning: 3 potential reasons why yawning may be good for you. *Psych Today*. 2022 Aug 1.

Link: The Surprising Benefits of Yawning | Psychology Today

Dayan PS, **Ballard DW**, Shelton RC, Kuppermann N. Implementation trials that change practice: evidence alone is never enough. *Ann Emerg Med*. 2022;80(4):344-346.

Link: https://doi.org/10.1016/j.annemergmed.2022.06.003

[a] Publications, including abstracts and educational works, are organized by the region of the leading TPMG/SCPMG emergency physician author, whose name is the first one in bold font. We also highlight all KP EM co-authors. Included are activities undertaken *during* PMG employment. Updates for coming quarterlies can be sent to David R. Vinson, KP CREST Network: david.r.vinson@kp.org

Tavender EJ, Wilson CL, Dalziel S, Oakley E, Borland M, **Ballard DW**, Cotterell E, Phillips N, Babl FE. Qualitative study of emergency clinicians to inform a national guideline on the management of children with mild-to-moderate head injuries. *Emerg Med J*. 2022 Aug 24. Online ahead of print.

Link: https://emj.bmj.com/content/early/2022/08/24/emermed-2021-212198

Li K, Offerman S. Massive lacosamide overdose with severe neurologic and cardiac poisoning. *Clin Toxicol*. 2022;60(52):151 [abstract 308].

Vinson DR, Rouleau SG, **Casey SD**. Pulmonary embolism [letter]. *N Engl J Med*. 2022;387(13):1242.

Link: https://www.nejm.org/doi/pdf/10.1056/NEJMc2210390

Zhang JY, Rauchwerger AS, **Vinson DR**. Ten additional cases of atrial fibrillation triggered by the sequence of strenuous exercise and cold drink [letter]. *J Emerg Med*. 2022;63(1):131-132.

Link: https://pubmed.ncbi.nlm.nih.gov/35940986/

SCPMG (Southern CA)

Avila CO, Sayson SC, Bennett B. Whole blood storage temperature investigation in austere environments. *J Spec Oper Med*. 2022;22(3):19-21.

Link: https://pubmed.ncbi.nlm.nih.gov/35862848/

Mati B, Silver MA. Diagnosing and Treating an Acute Anterior Shoulder Dislocation Using Point-of-Care Ultrasound in an Urgent Care Setting. *Perm J*. 2022;26(3):135-138.

Full-text: https://www.thepermanentejournal.org/doi/10.7812/TPP/21.208

Negriff S, Sidell M, Nau C, **Sharp AL**, Koebnick C, Contreras R, Grant DSL, Kim JK, Hechter RC. Factors associated with firearm injury among pediatric members of a large integrated healthcare system. *Acad Pediatr*. 2022 Sep 16. Online ahead of print.

Link: https://doi.org/10.1016/j.acap.2022.09.005

Negriff S, Huang BZ, **Sharp AL**, DiGangi M. The impact of stay-at-home orders on the rate of emergency department child maltreatment diagnoses. *Child Abuse Negl.* 2022;132:105821.

Full text: https://doi.org/10.1016/j.chiabu.2022.105821

Abstracts Presented at National Meetings

North American Congress of Clinical Toxicology 2022

- **Li K, Offerman S**. Massive lacosamide overdose with severe neurologic and cardiac poisoning. Clin Toxicol. 2022;60(52):151 [abstract 308].

Research Forum, 2022 American College of Emergency Physicians Scientific Assembly (links to KP Northern CA abstracts can be found on our CREST webpage: Publications | kpcrest)

- **Diaz O**, **Esener D**, Sacci P, **Abrams E**, **Rose G**. Evaluation of performance of transesophageal echocardiography by emergency medicine residents after a single simulation-based training session. *Ann Emerg Med*. 2022;80(4s):S77 [abstract 170].

- Mells A, **Lapoint J, Lorenzen B**. Outpatient management of spontaneous pneumothorax with thoracic vent: A retrospective analysis of a device-specific treatment modality. *Ann Emerg Med*. 2022;80(4s):S71 [abstract 157].

- **Sax DR, Mark DG, Kene MV, Vinson DR, Ballard DW**, Reed ME. Rates and predictors of emergency department mis-triage: a multiyear, multicenter study. *Ann Emerg Med*. 2022;80(4s):S62 [abstract 133].

- Khan Z, Tucker LY, **Sax DR**. Assessment of sociodemographic disparities in emergency department pain management. *Ann Emerg Med*. 2022;80(4s):S170 [abstract 397].

- Sturmer L, **Sax DR, Mark DG**, Reed ME. Opportunities to optimize implementation of an emergency department acute heart failure risk tool: a mixed-method study of physician openness to clinical decision support. *Ann Emerg Med*. 2022;80(4s):S134 [abstract 314].

- Zhang JY, **Sax DR**, Warton EM, Somers MJ, Rauchwerger AS, Reed ME, **Kene MV**. Short-term emergency department encounters following primary care telemedicine visits in the era of COVID-19. *Ann Emerg Med*. 2022;80(4s):S145 [abstract 341].

- Rouleau S, Campbell AR, Huang J, Reed ME, **Vinson DR**. Emergency department arrival by ambulance for patients receiving a pulmonary embolism diagnosis is associated with hospitalization: Is coming from off-site radiology an exception? *Ann Emerg Med*. 2022;80(4s):S110 [abstract 251].

In Preparation[b]

1. A Qualitative Study Exploring the Experiences of Undomiciled Adults Seeking Care in a Large Urban Emergency Department

Principal Investigators: **David R. Vinson** (Roseville/Sacramento) and Nichole Zinn (social worker, Roseville/Sacramento, and doctoral student)

Summary: California Legislature passed SB 1152 in 2018 and implemented the bill on July 1, 2019. SB 1152 requires hospitals to have a written policy and process for patients experiencing homelessness. This qualitative study seeks to explore what social work interventions might benefit patients experiencing homelessness, gain a better understanding of this populations'

[b] Funding in place, if applicable, but approval is pending by our respective Institutional Review Boards.

needs, and examine the impact, if any, SB 1152 has had on patients' well-being. Semi-structured interviews will be conducted with patients experiencing homelessness until saturation is reached. Data will be analyzed with qualitative content analysis methods. This sample of patients experiencing homelessness will provide first-person knowledge about their experiences in the emergency department and provide insight into the effects, if any, SB 1152 has had on patients' lives.

Just Launched or Added

1. California Febrile Infant Risk Stratification Tool (CA FIRST) Study: EXPANSION

Principal Investigators: **Dustin W. Ballard** (San Rafael) and Tara Greenhow (Pediatric Infectious Disease, San Francisco)

Co-Investigators: KP CREST Network, Bev Young and Tran Nguyen (Pediatric Hospitalists, Roseville), Patrick Van Winkle (Pediatric Hospitalist, Anaheim), Margaret Stone (Pediatric Infectious Disease, Woodland Hills), Sonya Negriff (Research Scientist, Dept of Research and Evaluation, Pasadena)

Funding: Garfield Memorial Fund

KP Study Sites: KPNC and KPSC

Summary: Our CA FIRST protocol for the management of febrile infants was structured on the validated Roseville protocol and modified in light of the recent American Academy of Pediatrics (AAP) guidelines. With broad multispecialty endorsement, the protocol has been accepted by physician leadership in both KP Northern and Southern CA and posted on the Clinical Library. In an earlier GMF-supported study, we designed, built, and implemented a structured electronic clinical decision support module to bring the CA FIRST protocol to emergency physicians across KPNC. This new study had three aims to further the scope of our work: We will (1) retrospectively validate the CA FIRST protocol in a large cohort febrile infants in KPSC and compare its performance with the AAP guidelines; (2) prospectively evaluate the performance of the CA FIRST protocol in KPNC for key safety and diagnostic outcomes; and (3) expand decision support in KPNC to promote best practices regarding optimal ordering of chest x-rays, urinalysis and culture, and lumbar punctures in febrile infants <90 days of age.

2. Trends in the use of CT cerebral angiography for ED patients with headache

Principal Investigators: **Dustin G. Mark** (Oakland/Richmond) and Mary E. Reed (KPNC Division of Research)

Sites: KP Northern California

Funding: The Rapid Analytic Unit of The Permanente Medical Group's Delivery Science Program

Summary: Some ED headache presentations are suspicious for aneurysmal subarachnoid hemorrhage. In many cases, a negative non-contrast CT scan is insufficient to exclude the diagnosis. Further testing may be indicated, but the next best test is debated: lumbar puncture or CT cerebral angiography? This retrospective cohort study will include ED patients with a chief complaint of headache and a negative non-contrast cranial CT. We will examine rates of subsequent secondary investigations (lumbar puncture or CT cerebral angiography). Results will characterize objective trends in clinical practice and suggest whether decision support may be useful.

3. Does risk of post-hospital venous thromboembolism in COVID-19 patients vary by SARS-CoV-2 period and vaccination status?

Principal investigator: Nareg H. Roubinian, MD (Pulmonology/critical care, Oakland)

Co-investigators: Ashok P. Pai (Hematology/oncology, Oakland), Tess Knudson-Fitzpatrick (Internal medicine, Oakland), Jacek Skarbinski (Infectious disease, Oakland), Vinnie X. Liu (Pulmonology/critical care, Oakland), **David R. Vinson** (Roseville/Sacramento), and **Dustin G. Mark** (Oakland/Richmond)

Sites: KP Northern California

Funding: National Heart, Lung, and Blood Institute (R01HL126130)

Summary: The benefit of extended thromboprophylaxis in post-hospital COVID-19 patients remains unclear. In this retrospective cohort analysis of 63,920 hospitalized adults, we evaluated the incidence of 90-day post-hospital venous thromboembolism, stratified by SARS-CoV-2 positivity, variant period (pre-Delta, Delta, Omicron) and COVID-19 vaccination status.

Status: The manuscript was recently accepted for publication by the journal *Blood Advances*.

Ongoing Research Projects[c]

1. Creation of a high-fidelity 3D simulation model for performance of POCUS guided lumbar puncture and erector spinae block

Principal investigator: **Kate Anderson** (San Diego)

Co-investigators: Gabe Rose, Dasia Esener, Drew Silver, and Eric Abrams (San Diego)

Site: KP San Diego

Summary: We plan to create a semi 3D printed back (lumbar) and create a ballistics gelatin in-molding to simulate the vertebrae and erector spinae muscles. We will have residents perform an

[c] Active studies are organized alphabetically by the leading TPMG or SCPMG emergency physician investigator, whose name is in bold font.

LP as well as the erector spinae block under ultrasound guidance and measure pre- and post-procedural confidence.

2. Post-acute sequelae of SARS-CoV-2 infection (PASC) in adult KPNC members

Principal Investigators: **Dustin W. Ballard** (San Rafael) and Mary E. Reed (DOR).

Co-investigators: Jacek Skarbinski (Infectious Disease, Oakland), Edward J. Durant (Modesto/Manteca), David R. Vinson (Roseville/Sacramento), Dustin G. Mark (Oakland/Richmond), Marc Siqueiros (Internal Medicine, Santa Clara), Madhavi Cholletti (Internal Medicine, Campbell) and the KP CREST Network

Sites: KP Northern California

Funding: The Permanente Medical Group's Delivery Science Program

Summary: This retrospective cohort study will evaluate the incidence, temporal trends, characteristics, and predictors of PASC encounters among adult KPNC members between 11/1/2020 and 7/1/2022. The cohort will include patients with prior SARS-CoV-2 infection and identify those with a confirmed PASC diagnosis. We will use predictive analytic techniques to examine predictors of PASC diagnoses and associated encounters among all KPNC members with known prior SARS-CoV-2 infection, testing the hypothesis that COVID-19 vaccination is protective. We will also evaluate PASC patient clinical characteristics, including recidivism, temporal trends, and utilization metrics such as specialty and diagnostic (imaging and laboratory) referrals. This study will add to our understanding of the natural history, utilization, and short-term and longitudinal outcomes of PASC patients in KPNC and will inform clinical practice recommendation revisions and referral criteria.

Status: We are defining our variables in preparation for data collection.

3. Infant Fever STEWARD Project (STandardizing Emergency Work-up Around Risk Data): ORIGINAL

Principal Investigators: **Dustin W. Ballard** (San Rafael) and Tara Greenhow (Pediatric infectious disease; San Francisco)

Co-Investigators: KP CREST Network, Adam L. Sharp (DRE[d] and Los Angeles), and Pediatric Hospitalists Bev Young and Tran Nguyen

Funding: Garfield Memorial Fund

KP Study Sites: KP Northern California and KP Southern California

Summary: We first defined retrospective incidence rates of clinical and utilization outcomes in two cohorts (age 7-90 days, and 91-365 days) presenting to the emergency department (ED) in Kaiser

[d] DRE = KPSC Department of Research & Evaluation (Pasadena); DOR = KPNC Division of Research (Oakland)

Permanente Northern California (KPNC) and Kaiser Permanente Southern California (KPSC) with fever. We have deployed these incidence data in a structured electronic clinical decision support (CDS) module that promotes American Academy of Pediatrics guidelines and prospectively collects data. We are collecting real-time patient-specific clinical data in a structured fashion based on age strata and offer CDS links to Peds HBS/Peds ID-approved guideline documents/flowcharts. CDS content and evaluation emphasize utilization outcomes.

Status: The CDS module has been rolled out across most KPNC facilities. We presented two abstracts at the Society of Academic Emergency Medicine meeting in New Orleans in May. Our first manuscript was recently published in *JACEP Open*: Clinical management and outcomes for febrile infants 29-60 days evaluated in community emergency departments. We have two further manuscripts undergoing peer-review: (1) Using AAP Guidelines for Managing Febrile Infants without C-reactive Protein and Procalcitonin; (2) An all-inclusive model for predicting invasive bacterial infection in febrile infants aged 7-60 days.

4. Risk stratification of ED patients with lower gastrointestinal bleeding: identifying patients who may be safe for outpatient management

Principal Investigator: **Sean C. Bouvet** (San Francisco)

Co-Investigators: T.R. Levin (Gastroenterology, Walnut Creek), **Dana R. Sax** (Oakland/Richmond), Mary E. Reed and Adina S. Rauchwerger (DOR) and the CREST Network

Sites: KP Northern California

Funding: KP Northern California Community Health Program

Summary: Emergency physicians evaluate approximately 10,000 adults annually in our 21 EDs with a diagnosis of lower gastrointestinal bleed. There is a recently validated tool, the Oakland score, to risk-stratify *hospitalized* patients to identify those at low risk who may be eligible for expedited discharge with close outpatient follow-up. This tool, however, has not been assessed on an ED population. This retrospective cohort study will evaluate a cohort of 20,000 ED adults with a diagnosis of lower gastrointestinal bleed in 2019-2020 and identity the frequency of adverse events. Performance metrics of the Oakland Score will be calculated at different point thresholds. If the score performs well in this population with sufficient sensitivity, it will set the stage for a prospective validation study.

Status: We are collecting data.

5. Traditional ACLS Training vs TeamSTEPPS plus ACLS Training - A Comparison of Outcomes

Principal Investigator: **Charles Chiang** (San Diego)

Co-Investigators: Marlene M Alfaro, Adam Schwartz, Peter Sacci, Sari Lahham, Ian Chong, Daniel Lee (all San Diego)

Site: San Diego

Summary: This is a prospective observational study to evaluate the effectiveness of ACLS simulation + TeamSTEPPS training compared with standard AHA didactic ACLS training received by emergency and family medicine residents. Residents that have undergone prior didactic ACLS training and are "ACLS certified" undergo a simulated cardiac arrest case in the simulation lab. Residents are then trained via simulation and TeamSTEPPS methodology on running cardiac arrest cases and are later run through another cardiac arrest simulation. Observational variables collected and compared include time to recognition of arrest, time to initiation of CPR, time to defibrillation, time to epinephrine, among others. Subjective data surveys are also collected pre- and post-simulation training.

Status: Data has been collected and is now undergoing analysis.

6. Association of volume of early fluid resuscitation with adverse outcomes in patients with COVID-19

Principal Investigator: **Kristel Choy** (San Diego)

Co-Investigators: Christopher Scott and Brent Lorenzen (San Diego)

Site: San Diego

Summary: This retrospective study is evaluating the association of volume of early fluid resuscitation with subsequent adverse outcomes in patients hospitalized with COVID-19.

Status: Data collection is near completion.

7. The effect of electronic assignment of patients to physicians in the ED on operational metrics

Principal Investigator: **Andrew Ciennik** (San Diego)

Co-Investigators: Brent Lorenzen, Adam Schwartz, Tom Hauck, Charles Chiang (San Diego)

Summary: Retrospective, before and after, observational study of the association of an implementation of an electronic chart assignment system on multiple commonly used metrics of ED throughput. The implementation was associated with multiple significant improvements. Some metrics were slightly worse and overall patient volumes were greater in the post-intervention period, perhaps suggestive of pressures that limited potential gains.

Status: Abstract presented in October at the 2021 Research Forum of the American College of Emergency Physicians. Full manuscript is in preparation.

8. How do physicians consider cost in comparison with other factors when prescribing medications to patients discharged home from the ED?

Principal Investigator: **Chad Correa** (San Diego)

Co-Investigators: Brent Lorenzen (San Diego)

Summary: This is a cross-sectional survey study assessing how physicians considered cost compared to other factors when prescribing common classes of medications from the ED. Physicians at a variety of practice sites and with varying levels of experience were included. Two-way ANOVA showed that class of medication was associated with the level of importance ascribed to various factors influencing choice of medication prescriptions. The considered factors were also associated with differences in the importance of these factors. There was significant interaction between class of medication and category of factor considered. In general, physicians were less likely to consider cost compared to other factors.

Status: Abstract presented last year at the 2021 Research Forum of the American College of Emergency Physicians. Full manuscript is in preparation.

9. Cannabinoid Hyperemesis Syndrome in the ED: characteristics and determinants of length of stay

Principal Investigator: **Dale M. Cotton** (South Sacramento)

Co-Investigators: Caleb D. Sunde, Erik Hofmann, Steven R. Offerman and Carissa Shenko (South Sacramento), David R. Vinson (Roseville/Sacramento), E. Margaret Warton, Mary E. Reed, and Cynthia I. Campbell (DOR), and the KP CREST Network

Funding: KP Northern California Community Health Program

KP Study Sites: KPNC

Summary: This is a retrospective observational study of patients explicitly identified by diagnosis as having Cannabinoid Hyperemesis Syndrome (CHS) during an Emergency Department (ED) encounter in KPNC. We will describe patient demographics, cannabis use, treatments received, resource utilization, and length of stay (LOS) for ED visits given a diagnosis of CHS in 2016-2019. We will examine which factors, including treatment medications, influence ED LOS. Since a minority of CHS patients are explicitly coded as CHS during their encounter, we will also develop case-ascertainment strategies to find CHS patients who do not carry an explicit diagnosis.

Status: We are collecting data.

10. Evaluation of proficiency in performing transesophageal echocardiography in an EM Residency Program

Principal Investigator: **Olga Diaz** (San Diego)

Co-Investigators: Dasia Esener, Gabriel Rose, and Eric Abrams (San Diego)

Study Site: San Diego

Summary: Limited transesophageal echocardiography (TEE) performed by ED trained physicians is rapidly becoming the standard of care in the evaluation of critically ill patients who present to the ED. To date, abilities (and retention) to perform this exam has not been evaluated in emergency

resident physicians. This study evaluates the retention of TEE knowledge and aptitude in emergency medicine residents after a didactic and hands-on experience on a high- fidelity TEE trainer.

Status: Abstract was just presented at the American College of Emergency Physicians Research Forum in San Francisco in October.

11. CT Use Reduction in Ostensive Ureteral Stone (CURIOUS): retrospective validation of clinical decision rules to predict complicated ureteral stone

Principal Investigator: **Edward J. Durant** (Modesto/Manteca)

Co-Investigators: Annie Ma (UC Davis), Vignesh Arasu (Radiology, Vallejo), Raymond Bernal (Urology, Manteca), Mary E. Reed and E. Margaret Warton (DOR), and David R. Vinson (Roseville/Sacramento) of the KP CREST Network

Funding: KP Northern California Community Health Program

KP Study Sites: KPNC

Summary: Computed tomography (CT) is considered the gold standard for diagnostic imaging in suspected renal colic. Several researchers have attempted to develop clinical decision rules to predict ureteral stones without the use of CT. The main drawback of these clinical decision tools is that they were not designed to predict complications from stones, such as the need for admission or urologic intervention. In this retrospective study, we sought to derive clinical decision rules to guide imaging decisions based on the patient's risk of complicated stones. To our knowledge, ours is the first study specifically designed to derive clinical decision rules to predict clinically important stones in patients with suspected renal colic. If validated, these rules could be used to guide imaging decisions, expedite ED throughput, save resources, reduce radiation exposure, and provide a model for other EDs to follow.

Status: We have published our methods paper in *Am J Emerg Med*. We presented abstracts at the American College of Radiology annual meeting in Washington, DC in April and the Society of Academic Emergency Medicine annual meeting in New Orleans in May. Our manuscript is currently undergoing peer-review.

12. Right ventricular dilatation on computed tomography pulmonary angiography in adults with acute pulmonary embolism

Principal Investigator: **Edward J. Durant** (Modesto/Manteca)

Co-Investigators: Joshua Chang (KP IM resident, Oakland), Bahman Sayyar Roudsari (Radiology, Modesto), **David R. Vinson** (Roseville/Sacramento), Darcy Engelhart and Sarah Fetterolf (CA Northstate Univ Coll of Medicine), and Judy Shan (CREST and UCSF)

Funding: Kaiser Permanente Northern California Graduate Medical Education, Kaiser Foundation Hospitals

KP Study Sites: KPNC

Summary: The retrospective cohort study is evaluating the accuracy of pre-med and medical students in identifying right ventricular strain on CT imaging compared with a radiology gold standard.

Status: We presented an abstract at the American College of Radiology annual meeting in Washington, DC in April and the Society of Academic Emergency Medicine annual meeting in New Orleans in May. The ms is undergoing peer-review.

13. Evaluation of normal reference ranges for ultrasound measurements of hip joint in elderly patients

Principal Investigator: Felipe Aguayo Romero (Baylor)

Co-Investigators: **Dasia Esener, Gabriel Rose, William Swanson, and Eric Abrams** (all San Diego)

Site: San Diego

Summary: Ultrasound can be used to evaluate for effusion of the hip joint which may be useful in screening for septic arthritis or occult injury. The current reference range for this measurement is based on decades old ultrasound machine technology when hip joint capsule size was used as a surrogate for presumed presence of hip effusion. The primary objective of this study is to determine whether the current reference range for this measurement is accurate and is sufficiently specific for abnormal hip joint capsule size in the elderly population.

Status: The abstract was just presented at the Research Forum of the American College of Emergency Physicians meeting in San Francisco in October.

14. The frequency of point-of-care ultrasound (POCUS) use in the treatment of ED patients with sepsis

Principal Investigator: **Dasia Esener** (San Diego)

Co-Investigators: Bryan Dalla Betta and William Swanson (San Diego)

Study Site: San Diego

Summary: Retrospective analysis of point of care ultrasound use within the emergency department amongst patients with sepsis. Analysis included types of studies utilized, use patterns and change in use over time. Analysis of this cohort of septic patients found a significant increase in the use of POCUS during the four-year study period. This increase is attributable to more diagnostic and resuscitative exams being performed.

Status: Abstract presented last year at the 2021 Research Forum of the American College of Emergency Physicians. The manuscript has been submitted for peer-review.

15. Risk of Short-Term Vital Sign Deterioration in Low-Risk Pulmonary Embolism Patients Presenting to the Emergency Department with Normal Initial Vital Signs.

Principal Investigator: **Erik R. Hofmann** (South Sacramento)

Co-Investigators: David R. Vinson (Roseville/Sacramento), Edward Durant and Liga Yusvirazi (Modesto/Manteca)

Funding: Kaiser Permanente Northern California Graduate Medical Education, Kaiser Foundation Hospitals

Study Site: KPNC

Summary: This retrospective cohort study is evaluating the prevalence of ambulatory ED patients with acute pulmonary embolism (PE) and normal initial vital signs who develop abnormal vital signs within 6 hours of ED arrival and cross the threshold from low to high-risk PE based on the PE Severity Index with associated ICU admission and 30-day adverse events.

Status: Data collection is underway.

16. Optimizing quality and safety in the era of COVID-19: Virtual care first utilization and outcomes for potentially emergent conditions among KPNC members

Principal Investigators: **Mamata V. Kene** (San Leandro/Fremont) and **Dana R. Sax** (Oakland/Richmond)

Co-Investigators: Adina S. Rauchwerger, Judy Shan, Jennifer Zhang, Mary E. Reed (DOR), Dustin G. Mark (Oakland/Richmond), Dale M. Cotton (South Sacramento), Dustin W. Ballard (San Rafael), and David R. Vinson (Roseville/Sacramento) of the KP CREST Network

Funding: Garfield Memorial Fund

KP Study Sites: KPNC

Summary: KPNC rapidly increased virtual care services (video and telephone visits) and decreased in-person visits in March 2020 during the recognized arrival of the COVID-19 pandemic. How this shift in site of care affected downstream ED and hospital utilization and subsequent clinical outcomes has not been well described. In this retrospective cohort study, we will evaluate the safety and efficiency of virtual care first by examining three high-risk conditions that often require ED evaluation and hospitalization: chest pain, abdominal pain, and respiratory illness. Analysis of care-seeking behavior, utilization (telephone, video, in-person and ED visits) and outcomes for these complaints (that include likely COVID-19 illness as well as those occurring independent of SARS-CoV-2) will allow us to assess the safety and efficiency of current virtual care workflows while identifying potential opportunities to optimize outcomes and resource utilization. Ultimately, our current understanding of how safely these urgent conditions can be managed virtually is limited, and the insights gathered herein will help shape care delivery during the

continued pandemic and beyond, into the transformed landscape of healthcare delivery following the comprehensive disruptions of 2020.

Status: Collecting data. Jennifer Zhang just presented an abstract at the American College of Emergency Physicians Research Forum in San Francisco in October: Short-term ED encounters following primary care telemedicine visits in the era of COVID-19.

17. Spinal epidural abscess: an evaluation of frequency of and risk factors for delay in diagnosis

Principal Investigator: **Mamata V. Kene** (San Leandro/Fremont)

Co-Investigators: Sarabeth M. Maciey (EM resident, Stanford); Erik R. Hofmann (South Sacramento), Meena Ghiya (South San Francisco), Edward J. Durant (Manteca/Modesto), Sean C. Bouvet (San Francisco)

Funding: The KPNC Graduate Medical Education Program, Kaiser Foundation Hospitals

KP Study Sites: KPNC

Summary: Spinal epidural abscess (SEA) is a rare condition with increasing incidence that if not promptly diagnosed and treated can lead to permanent and devastating neurologic disability. Accurate diagnosis requires mobilization of magnetic resonance imaging (MRI), a relatively scarce resource in emergent situations, and transfer for surgical intervention. The clinical presentation of SEA can vary, however, and many patients have multiple visits before a diagnosis is established. Delays in diagnosis, the most common complaint in SEA malpractice claims, are costly, with awards ranging from several hundred thousand dollars to multiple millions, due to the high morbidity. This retrospective cohort study will identify incidence of and factors associated with potential delay in diagnosis of SEA.

Status: Analysis is underway. An abstract was presented last year at the 2021 Research Forum of the American College of Emergency Physicians.

18. Utilization of CT pulmonary angiograms for pulmonary embolism evaluation: predictors of higher yield and comparison to national rates

Principal Investigator: **Mamata V. Kene** (San Leandro/Fremont)

Co-Investigators: Dana R. Sax (Oakland/Richmond), David R. Vinson (Roseville/Sacramento), Mary E. Reed (DOR), and the KP CREST Network, along with Vignesh Arasu (Radiology, Vallejo)

Funding: KP Northern California Community Health Program

KP Study Sites: KP Northern California

Summary: This retrospective cohort study will evaluate the yield of CT pulmonary angiography (CTPA) in KPNC ED patients from 2012-2018 compared to national averages. We hypothesize that the CTPA yield will be higher in KPNC compared with non-integrated delivery systems, and will

identify provider-, facility- and patient-level factors associated with CTPA use and yield rates. We will also apply natural language processing (NLP) techniques to identify whether risk stratification tools were documented in the record. The results of this study will inform future design of prospective clinical decision support for PE diagnostics that will facilitate risk stratification tool use prior to imaging ordering in hopes of optimizing CTPA use, with improvements in patient care, resource use, and department throughput.

Status: We presented an abstract of our NLP work at the 2020 Society for Academic Emergency Medicine. Analysis continues. We hope to submit the manuscript soon.

19. Patterns and impact of chemical restraint use for ED patients with acute psychiatric distress

Principal Investigator: **Suzanne C. Lippert** (Oakland/Richmond)

Co-Investigators: **Mamata V. Kene** (San Leandro/Fremont), Juleon W. Rabbani and Adina S. Rauchwerger (DOR)

Sites: KPNC EDs

Funding: KP Northern California Community Health Program

Summary: Neither use patterns, nor outcomes associated with nonconsensual chemical restraints (receiving IM sedating medications) in the ED have been investigated through a disparity lens. This retrospective cohort study will include adults (and subgroup analysis limited to patients with insurance) aged 18-64 years presenting to the ED for acute psychiatric crisis from 2017-2021. We will describe patient characteristics associated with receiving chemical restraint. We also will describe the frequency of adverse outcomes occurring after chemical restraint administration during the index ED visit and delineate patient characteristics associated with adverse outcomes. We hope to better understand chemical restraint use patterns to inform the development of standardized practices for patients presenting in acute psychiatric crisis. Without standardized criteria for using chemical restraints, implicit bias may lead to different use patterns and different risks of adverse events in particular subgroups of our patients.

Status: We are working on cohort derivation and validating our definitions.

20. In-hospital mortality among patients with non-traumatic intracranial hemorrhage: In a hub-and-spoke model of neuroscience care, are outcomes non-inferior following presentation to a spoke versus a hub medical center?

Principal Investigator: **Dustin G. Mark** (Oakland/Richmond)

Co-Investigators: Chris Sonne (Radiology, Oakland), Mary E. Reed and E. Margaret Warton (DOR), and David R. Vinson (Roseville/Sacramento), of the KP CREST Network

Funding: KP Northern California Community Health Research Program

KP Study Sites: KPNC

Summary: KPNC provides neuroscience care using a hub-and-spoke model, where several hub hospitals serve as referral centers of neuroscience excellence, inclusive of dedicated neuroscience intensive care units staffed by board-certified neurointensivists. Within KPNC most patients with non-traumatic ICH are cared for in hospitals lacking neuroscience units, relying on remote neuroscience consultation and reserving transfer for patients likely to require neurosurgical interventions, in part given the limited census capacities of the neuroscience centers. The comparative efficacy of this care model (against default care of non-traumatic ICH within neuroscience centers) is unknown. To help address the knowledge gap, we propose to compare mortality rates between patients with non-traumatic ICH presenting KPNC medical centers without neuroscience units (spokes) versus those with neuroscience units (hubs). To adjust for case mix we will use several strategies including adjustment for predicted mortality using hierarchical multivariable regression analyses and propensity score adjustment for hub presentation. We hypothesize that observed mortality will be similar between patients with non-traumatic ICH who present to neuroscience hub medical centers compared with non-neuroscience spoke medical centers within an integrated care delivery system.

Status: Data collection is underway.

21. Chest pain STEWARD (STandardizing Emergency Work-up Around Risk Data) investigation

Principal Investigator: **Dustin G. Mark** (Oakland/Richmond) and Mary E. Reed (DOR)

Co-Investigators: KP CREST Network

Funding sources: TPMG DARE's Delivery Science Grant Program and the Lokahi Foundation

Study Sites: KP Northern California

Summary: The prospective component is leveraging findings from the published retrospective study to provide point-of-care clinical decision support via the RISTRA platform to ED physicians, while dually serving as a prospective data collection tool to validate findings from the retrospective study.

Status: Six studies have been published: (1) Performance of coronary risk scores in patients with CP in the ED (*JACC*); 60-day major adverse cardiac event rates in ED CP patients with non-low modified HEART risk scores (*Am J Emerg Med*); (3) The performance of a retrospective method to determine risk score classification for ED patients with possible ACS (*Acad Emerg Med*); (4) Prospective validation and comparative analysis of coronary risk stratification strategies among emergency department chest pain patients (*J Am Heart Assoc*). (5) Graded coronary risk stratification for emergency department patients with chest pain: a controlled cohort (*J Am Heart Assoc*). (6) Higher intensity of 72-hour non-invasive cardiac test referral does not improve short-term outcomes among emergency department patients with chest pain (*Acad Emerg Med*). As a follow-up to this work, we hope to modify decision support to accommodate the coming change from 4th generation to high-sensitivity troponin. A grant proposal is under review.

22. Objective cardiac testing following ED evaluations for chest pain: associations between emergency physician-associated referral for non-invasive cardiac testing and 2-year adverse outcomes

Principal Investigators: **Dustin G. Mark** (Oakland/Richmond)

Co-investigators: Jamal Rana (Cardiology, Oakland), Mary E. Reed, Jie Huang, and Adina S. Rauchwerger (DOR and the KP CREST Network)

Sites: KP Northern California

Funding: KPNC Community Health Program

Summary: We will investigate whether emergency physician-level variation in non-invasive cardiac test (NICT) referral (exercise electrocardiography, myocardial perfusion, stress echo or CT coronary angiography) following ED encounters for chest pain, where AMI has been excluded, correlates with the incidence of major adverse cardiac events (MACE) within the following 2 years. This investigation will be conducted using an existing dataset of ED chest pain patients (totaling 281,454 patients) presenting to KPNC EDs between 2013 and 2019. We hypothesize that patients evaluated by emergency physicians in the highest NICT referral intensity tertile will have a lower incidence of MACE within 2 years as compared to patients evaluated by physicians in the lowest NICT referral intensity tertile. We further hypothesize that stratified analyses will reveal this association to be principally driven by patients at high coronary risk, with no residual significant difference in the incidence of 2-year MACE incidence among low or intermediate-risk patients. These findings would impact practice within EDs, cardiology lab services, nuclear medicine and hospital-based medicine.

Status: Undergoing analysis

23. Point of care ultrasound for the evaluation of low-risk chest pain in the ED

Principal Investigator: **Gabriel Rose** (San Diego)

Co-Investigators: Dasia Esener and Eric Abrams (San Diego)

Study Site: San Diego

Summary: Prospective observational study to determine the diagnostic value of POCUS and CXR in the evaluation of adults with low-risk chest pain presenting to the ED. Inclusion criteria are adult patients presenting to the emergency department with a complaint of chest pain determined to be low-risk based on a HEART score of 5 or less. We hypothesize that an integrated POCUS protocol performs with greater sensitivity and equal specificity compared to CXR for narrowing the diagnosis of these patients. We also hypothesize that POCUS would significantly shorten patient length of stay in the emergency department.

Status: Enrollment is underway.

24. POCUS for detecting retinal detachment vs vitreous hemorrhage in ED patients

Principal Investigator: **Gabriel Rose** (San Diego)

Co-Investigators: Dasia Esener and Eric Abrams (San Diego), Greg Dorilus (KP Downey)

Study Site: San Diego

Summary: In this study we will retrospectively evaluate the sensitivity and accuracy of POCUS for retinal detachment and vitreous hemorrhage by emergency physicians vs ophthalmologists for retinal detachment and vitreous hemorrhage

Status: Data collection underway.

25. ED utilization of ultrasound versus computed tomography for patients with suspected renal colic

Principal Investigator: **Gabriel Rose** (San Diego)

Co-investigators: Eric Abrams, Dasia Esener, and William Swanson (San Diego)

Study Site: San Diego

Summary: This retrospective study will evaluate patients presenting to the ED with possible renal colic. They will be categorized as either “low risk” or “high risk” patients who would be eligible for either CT or ultrasound, respectively. With this study we hope to identify a population of patients thought to be low risk who could safely undergo an ultrasound-first approach to the diagnosis of renal colic.

Status: Data collection is underway.

26. RISTRIAGE: Standardizing ED triage

Principal Investigator: **Dana R. Sax** (Oakland/Richmond)

Co-Investigators: Dustin G. Mark (Oakland/Richmond), Dustin W. Ballard (San Rafael), Mamata V. Kene (San Leandro/Fremont), David R. Vinson (Roseville/Sacramento), Mary E. Reed and Adina S. Rauchwerger (DOR) of the KP CREST Network

Funding: The Lokahi Foundation

KP Study Sites: KPNC

Summary: Patients presenting to most EDs in the US and to all EDs in KPNC are triaged by a standardized protocol into one of five levels of acuity. About 10% of patients who are initially triaged to a lower acuity group (usually with a significant wait time in a low acuity unit) are later found to have a more serious condition that should have had a higher triage classification. This is a

significant quality problem which causes delay in diagnosis and treatment and preventable adverse outcomes. The consequence of this triage error is the need for additional patient hand-offs, avoidable rework, excessive resource use, patient dissatisfaction, and significantly increased liability risk. This study will determine the characteristics of patients who are mis-triaged to a lower acuity level and then identify a data-driven computer-based process to improve triage accuracy. Phase I is a retrospective analysis that will be followed by Phase II real-time building, testing and implementing a machine-based learning triage instrument in our EDs for integration into KP HealthConnect.

Status: We recently published an abstract from the American College of Emergency Physicians annual meeting in San Francisco in October: Rates and predictors of emergency department mis-triage: a multiyear, multicenter study. We submitted our first ms earlier this summer (in peer review) and plan to submit a second ms this month.

27. Assessing frequency and predictors of under- and overtriage of <u>pediatric</u> ED patients

Principal Investigators: **Dana R. Sax** (Oakland/Richmond)

Co-Investigators: **Mamata V. Kene** (San Leandro/Fremont), **Jenna Timm and Eloa Adams** (Oakland/Richmond), Tina Vitale-McDowell and Katie Rose McGauhey (ED RNs, Oakland), Mary E. Reed, E. Margaret Warton, and Adina S. Rauchwerger (DOR) and the KP CREST Network

Sites: KPNC

Funding: KP Northern California Community Health Program

Summary: ED triage systems exist to sort patients based on acuity and expected resource use. We seek to understand current triage practices of pediatric ED patients across KPNC. The study will include over one million ED patients <18 years old seen between 2016-2020. Based on input from a panel of physician and nurse experts in pediatric emergency medicine, general emergency medicine, and pediatric critical care and through iterative chart review, we will develop and clinically validate a classification algorithm to identify cases of significant mis-triage based on resource use and critical illness. We will then apply this algorithm to our full study population to estimate the frequency of significant under- and overtriage. Lastly, we will identify patient characteristics (presenting complaint, demographic data, co-morbidities, medications, and prior healthcare utilization) and setting characteristics (including time and day of visit and pediatric capabilities of facility) that are associated with mis-triage. Knowledge gained from this study will provide insight on current pediatric ED triage practices and highlight opportunities to improve triage accuracy across KPNC.

Status: Recently launched.

28. Emergency department triage of high-risk conditions

Principal Investigators: **Dana R. Sax** (Oakland/Richmond)

Co-Investigators: Dustin G. Mark (Oakland/Richmond), Michael O'Neal (Diablo Service Area), Tina Vitale-McDowell and Aaron Beardsley (RNs, Oakland), Oleg Sofrygin, Mary E. Reed, E. Margaret Warton, Adina S. Rauchwerger (DOR) and the KP CREST Network

Sites: KPNC

Funding: The Lokahi Foundation

Summary: This retrospective cohort study will tap into the large database of all ED encounters from 2016-2020 and study patients with three potential high-risk conditions: acute coronary syndrome, aortic dissection, and subarachnoid hemorrhage. We will describe the frequency of under-triage among patients who present to a KPNC ED with one of these diagnoses, assess patient- and setting-level characteristics associated with under-triage, including presenting complaint, triage nurse free test documentation of triage assessment, patient demographics (gender, race, age, primary language, socioeconomic/ education level at county level), co-morbidity score, time of day/day of week, and facility where patient received care. Lastly, we will assess delays in care associated with under-triage of patients with possible acute coronary syndrome, aortic dissection, and subarachnoid hemorrhage, including time to initial EKG, room, placement of relevant laboratory, imaging orders, and therapeutic orders, and placement of relevant specialty consults.

Status: Data collection in process.

29. KP-specific heart failure risk prediction: KPNC Standardizing Emergency Work-ups Around Risk Data (STEWARD) heart failure project

Principal Investigator: **Dana R. Sax** (Oakland/Richmond) and Mary E. Reed (DOR)

Co-investigators: Dustin G. Mark (Oakland/Richmond), Jamal Rana (Oakland), Mamata V. Kene (San Leandro/Fremont), David R. Vinson (Roseville/Sacramento), Dustin W. Ballard (San Rafael), and the KP CREST Network, with collaborators from Vanderbilt.

Funding: TPMG DARE's Delivery Science Grant Program

Study Sites: KP Northern California

Summary: There are over one million ED visits across the U.S. each year for acute heart failure (AHF), with an average admission rate of 84%. EDs play a major role in the care of AHF patients through symptom management, coordination of care, and risk stratification to identify sicker patients needing admission. A clinical decision support tool to help predict AHF disease severity, employing accurate KPNC-specific risk estimates, would allow for more informed recommendations around venues and intensity of care customized to the KPNC setting. We propose a retrospective cohort study of adult patients presenting to a KPNC ED between 2015-2017 with AHF to validate clinical decision tools and determine KPNC-specific risk estimates for 30-day serious adverse events. We will also assess the feasibility of an EHR-linked clinical decision support system to extract heart failure-relevant data and efficiently present these to ED providers.

Status: We presented an abstract at the 2020 American College of Cardiology meeting and published our first ms in *ESC Heart Fail*: Outcomes among AHF ED patients by preserved vs reduced ejection fraction. Our second ms was just published in *JACEP Open*: Risk adjusted 30-day mortality and serious adverse event rates among a large, multi-center cohort of ED patients with acute HF.

30. Improving risk stratification of ED patients with acute heart failure: building and testing a machine-learning platform for personalized, accurate, real-time risk prediction

Principal Investigator: **Dana R. Sax** (Oakland/Richmond)

Co-Investigators: Dustin G. Mark and Jamal Rana (Oakland/Richmond), Dustin W. Ballard (San Rafael), Mary Reed and Jie Huang (Division of Research), Vinnie Liu (Division of Research and Santa Clara Critical Care), and Lilian Sturmer (MS4, Touro University)

Study site: Oakland, Richmond, and San Rafael

Summary: We will build on our recent work deriving and retrospectively validating a KPNC acute heart failure (AHF) risk stratification tool for ED patients. We are collaborating with Vinnie Liu and the Hospital Advanced Analytics Team to build the risk tool within KPNC's electronic health record. We will assess technical feasibility, and then validate the risk estimates in a silent phase (tool not yet visible to ED providers) in a prospective population of ED patients with AHF. Simultaneously, we are collecting qualitative data through interviews and surveys with frontline ED providers, IT leadership, and operational and clinical leads to identify barriers and opportunities for implementation of the risk tool. We are also working with cardiology and hospital-based specialist leads to develop care pathways based on patient risk. After adjusting the tool as needed after validation, we plan to pilot test the tool in a live phase at three EDs: Oakland, Richmond, and San Rafael.

Status: Data collection in process. We presented an abstract at the American College of Emergency Physicians Research Forum in San Francisco in October: Opportunities to optimize implementation of an emergency department acute heart failure risk tool: a mixed-method study of physician openness to clinical decision support. We recently submitted a ms which is undergoing peer review.

31. Assessment of sociodemographic disparities in management of ED patients with acute abdominal pain

Principal Investigator: Zeenat Khan, KPNC Patient Safety Fellow

Co: Investigators: **Dana R. Sax** (Oakland/Richmond) and Lue-Yen Tucker (Division of Research)

Funding: KPNC Graduate Medical Education and the Office of Risk Management and Patient Safety.

Sites: KPNC

Summary: In this retrospective, data-only cohort study of adult emergency department patients with acute abdominal pain from 2019-2020, we sought to evaluate if specific sociodemographic characteristics are associated with a decreased likelihood of receiving an opioid pain reliever as part of acute pain management. After controlling for confounding variables, including severity of illness, co-morbidities, vital signs, pain score, ED disposition, as well as multiple patient sociodemographic variables, we found that Asian, Black, and Hispanic patients (compared to White patients), non-English primary language speakers (compared to English language speakers), patients > 75 years (compared to 18-30 years), and non-KP members (compared to KP members) had a lower odds of receiving an opioid pain reliever.

Status: Data analysis complete. We will be presenting an abstract at the Institute for Healthcare Improvement Scientific Symposium in Orlando in December. We just presented an abstract at the American College of Emergency Physicians Research Forum in October in SF: Assessment of sociodemographic disparities in ED pain management.

32. Transgluteal sciatic nerve block for treatment of sciatica in ED patients

Principal investigator: **Drew Silver** (San Diego)

Co-investigators: Gabe Rose, Dasia Esener, Eric Abrams, and Kate Anderson (San Diego)

Site: KP San Diego

Summary: Our goal is to perform a case series of patients undergoing transgluteal sciatic nerve block under ultrasound guidance. In this project, rather than using traditional anesthetic agents, we will target the fascial plane with D5W to perform hydrodissection. Patients will be followed up immediately after the procedure in intervals of 30 min up to 2 hours and subsequently at 24 and 72 hr to assess effect.

Status: Recently launched

33. ACTIV-2/A5401. Adaptive Platform Treatment Trial for Outpatients with COVID-19 (Adapt Out COVID). A multicenter trial of the AIDS Clinical Trials Group (ACTG)

Principal Investigator: David Smith (UC San Diego)

Co-Investigators: **Adam Schwartz** (site lead for KP San Diego), with the help of Paul Dohrenwend, David Neison, Jonathan Kei, Brent Lorenzen, Jeff Lapoint, J. Matt Edwards, Jenny Chua-Tuan, Matthew Silver, Cliff Swap, and Don Mebust

Funding: National Institute of Allergy and Infectious Diseases, Eli Lilly and Company

KP Study Site: San Diego

Summary: Adapt Out COVID will evaluate the safety and efficacy of investigational agents for the treatment of symptomatic non-hospitalized adults with COVID-19. It begins with a phase II evaluation, followed by a transition into a larger phase III evaluation for promising agents. The

trial is a randomized, blinded, controlled adaptive platform that allows agents to be added and dropped during the course of the study for efficient testing of new agents against placebo within the same trial infrastructure. The primary outcome measures in the phase II evaluation will be duration of symptoms, loss of detection of SARS-CoV-2 RNA by nasopharyngeal (NP) swab, and safety. The phase III evaluation is a continuation of the phase II trial for agents that meet study-defined criteria for further evaluation and for which sufficient investigational agent is available. The fully powered phase III trial will evaluate the efficacy of each selected investigational agent compared to placebo to prevent hospitalization and death in non-hospitalized adults with COVID-19. https://clinicaltrials.gov/ct2/show/NCT04518410

Status: Enrollment currently on hold. Revision of inclusion criteria being considered.

34. A randomized, double-blind, placebo-controlled, phase 2 study to evaluate the efficacy and safety of LY3819253 and LY3832479 in participants with mild-to-moderate COVID-19 illness (BLAZE-1)

Principal Investigator: Daniel M. Skovronsky (Eli Lilly)

Co-Investigators: **Adam Schwartz** (site lead at KP San Diego), with help from Brent Lorenzen, Clifford J Swap, David Neison, Donald P Mebust, Jeff Lapoint, Jenny Chua-Tuan, J Matthew Edwards, Jonathan Kei, Matthew A Silver, and Paul B Dohrenwend

Funding: Eli Lilly and Co.

KP Study Sites: Zion Medical Center, San Diego Medical Center

Summary: This is a phase II randomized, double-blind, placebo-controlled trial for patients with mild to moderate COVID-19. Objectives include, but are not limited to, viral clearance, hospitalization, ED visit and death. The therapeutic is a potent, neutralizing IgG1 monoclonal antibody (mAb) directed against the spike protein of SARS-CoV-2. It is designed to block viral attachment and entry into human cells, thus neutralizing the virus, potentially preventing and treating COVID-19. Treatment arms initially include varying doses of LY3819253. A further amendment included an additional arm with two mAbs. Interim analyses have demonstrated safety and a relative risk reduction for hospitalization/ED visit of 72%.

Status: Results from the interim analysis have been published. Chen P, et al; BLAZE-1 Investigators. SARS-CoV-2 Neutralizing Antibody LY-CoV555 in Outpatients with Covid-19. *N Engl J Med*. 2021; 384:229-237.

35. Utility of fluid resuscitation in low-risk patients with severe sepsis

Principal Investigator: **Todd A. Seigel** (Oakland)

Co-Investigators: Vincent Liu (DOR and Critical Care, Santa Clara) and John Morehouse (Oakland/Richmond)

Funding: KP Northern California Community Health Program

KP Study Sites: KPNC

Summary: This retrospective cohort study from 1/1/2012-12/31/18 will determine whether current protocolled interventions to treat severe sepsis (defined as clinical syndrome of suspected infection and serum lactate values between 2-3.99 mmol/L) in ED can be further refined based upon patients' presenting severity of illness. We hypothesize that patients with severe sepsis and lowest severity of illness (projected mortality less than 3%) will not have additional benefit from ED IV fluid administration. We hope to characterize more refined treatment algorithms for patients with severe sepsis, and specifically aim to demonstrate that current approaches to this heterogenous patient cohort may be resulting in overtreatment.

Status: Data collection is complete. The manuscript will soon be submitted.

36. *Getting busy:* Effect of patient volume on resident point-of-care ultrasound.

Principal Investigator: **William Swanson** (San Diego)

Co-Investigators: Dasia Esener, Gabriel Rose, Eric Abrams, Olga Diaz, and Peter Sacci (all San Diego)

Study Site: San Diego

Summary: The objective of this study was to investigate the impact of patient volume in the emergency department (ED) on the amount of point-of-care ultrasound (POCUS) performed by emergency medicine residents. This study was a retrospective chart review that included 24 emergency medicine residents in the year 2018. Data analysis is finished, and the manuscript is in process for submission. We found that the percentage of POCUS performed by EM residents decreased when the number of patients the residents saw increased on a given shift.

Status: A poster was presented at the March 2022 American Institute of Ultrasound in Medicine annual assembly. Manuscript has been submitted for peer-review.

37. Diagnosing acute pediatric appendicitis: Factors associated with inconclusive ultrasound studies

Principal Investigator: **Lauren Van Woy** (San Diego)

Co-Investigators: Dasia Esener, Olga Diaz, and Peter Sacci (all San Diego)

Study Site: San Diego

Summary: Due to the risk of radiation associated with CT, the American College of Emergency Physicians recommends considering ultrasound as the initial radiologic modality in diagnosing pediatric appendicitis. When ultrasound is inconclusive, children may be observed or further testing such as CT may be undertaken. This can incur cost, prolong time to diagnosis, and expose the child to ionizing radiation. The aim of this study is to identify factors in pediatric patients that are associated with inconclusive ultrasound in diagnosing acute appendicitis in pediatrics.

Status: Two abstracts were presented in October at the 2021 Research Forum of the American College of Emergency Physicians. Full manuscript in preparation.

38. Ambulance transport to the ED of patients with acute pulmonary embolism

Principal Investigators: **David R. Vinson** (Roseville/Sacramento)

Co-Investigators: Samuel Rouleau (resident, UC Davis), Aidan Campbell (pre-med research intern, NYU), Jie Huang and Mary E. Reed (KP DOR) and the KP CREST Network

Sites: KPNC

Summary: Arrival at U.S. EDs by EMS is a marker of acuity, associated with three times the rate of hospitalization compared with other transports. But ED EMS arrivals are not a homogenous group. EMS is often engaged because of worrisome symptoms, requiring timely care and transport for ED management. This is usually the case with ambulatory patients who go on to receive an ED diagnosis of acute PE. Some patients arriving at the ED by EMS, however, had just completed an outpatient-based diagnostic evaluation with pulmonary imaging at an off-site radiology clinic. The newly discovered PE may prompt the clinician to call 911 for EMS transport, simply because the diagnosis can be high-risk, even if the patient is not clinically unstable. It is unknown how the origin of EMS transport (radiology vs not) may be associated with subsequent ED/hospital management. We hypothesized (1) that ED patients with acute PE who arrived by ambulance were higher risk than their non-EMS counterparts and (2) that patients coming from off-site radiology were a lower acuity group than those who arrive by ambulance from other origins, as measured by the incidence of expedited discharge (<24h) from the hospital. This secondary analysis of a PE database will help us evaluate these hypotheses.

Status: We presented an abstract at the American College of Emergency Physicians in San Francisco in October. We are writing the manuscript now as a brief report and hope to submit in the fall.

39. Surveillance in the management of patients with subsegmental pulmonary embolism

Principal Investigator: Maheswari Balasubramanian (Adult Hospital Medicine, Roseville)

Co-Investigators: Tad Antognini (Adult and Family Medicine, Santa Clara), **David R. Vinson** (Roseville/Sacramento), Samuel Rouleau (UC Davis), Mary E. Reed and Adina S. Rauchwerger (DOR)

Sites: KPNC

Funding: KP Northern California Community Health Program

Summary: The management of ambulatory patients with isolated subsegmental pulmonary embolism (PE) is undergoing seismic shifts. The benefit of routine anticoagulation in select low-risk patients is uncertain and believed by many not to outweigh the known hemorrhage risks. The

2016 and 2021 CHEST guidelines recommended that patients meeting simple criteria should not be anticoagulated but undergo structured surveillance with compression ultrasonography and close follow-up to monitor for emerging venous thromboembolism. The surveillance criteria, however, have been poorly studied. How prevalent is surveillance in the years following the CHEST guidelines and what elements of surveillance are included (Aim 1)? How do the management populations (surveillance vs anticoagulation) compare in terms of patient characteristics and clinical outcomes? How many patients with subsegmental PE would have met CHEST criteria (Aim 2)? What are the groups' respective 30-day outcomes regarding venous thromboembolism, major hemorrhage, and all-cause mortality (Aim 3)? The results of our study will fill major gaps in the literature, help inform the development of a KPNC clinical care pathway and prepare us to participate in future trial validation studies.

Status: We published a case report in December in *Perm J* and a letter in *Ann Intern Med*. We are in the midst of data collection.

40. Improving management of ED patients with unexplained syncope: prospective validation of the Canadian Syncope Risk Score

Principal Investigators: **David R. Vinson** (Roseville/Sacramento) and Mary E. Reed (KP Division of Research)

Co-Investigators: **Dana R. Sax** (Oakland), Howard Dinh and **Erik R. Hofmann** (South Sacramento), Jie Huang (Division of Research), **Stephen Gamboa** (San Francisco and Santa Rosa), Annie Ma (UC Davis EM residency), Leyla Farshidpour (UCD SOM) and the KP CREST Network

Sites: Oakland, Richmond, Roseville, Sacramento, South Sacramento

Funding: The Permanente Medical Group Delivery Science and Physician Researcher Programs

Summary: The Canadian Syncope Risk Score looks promising as an accurate means of risk stratifying emergency department patients with acute unexplained syncope. But it has not been validated in a diverse U.S. population. This prospective study will combine the Risk Score with multispecialty treatment recommendations in a web-based clinical decision support system and test its discrimination and calibration among 5 KPNC emergency departments. If the tool performs well, we will expand its use across the region.

Status: We implemented our electronic decision-support tool in 5 EDs March 1. We are testing our data collection tool to identify 30-day outcomes.

41. Identifying barriers and facilitators to the outpatient management of low-risk pulmonary embolism from the ED

Principal Investigator: Lauren Westafer (University of Massachusetts Medical School)

Co-Investigators: **David R. Vinson** (Roseville/Sacramento), Peter Lindenauer and Mihaela Stefan (University of Massachusetts Medical School)

Summary: This is a prospective, qualitative study using semi-structured interviews of emergency physicians in varied practice settings with two aims: (1) To identify barriers and facilitators to the decision to discharge low-risk patients with acute PE from the ED; and (2) To develop and refine a set of implementation strategies for improved uptake of outpatient management of low-risk PE based on the barriers and facilitators identified in Aim 1.

Status: We are completing physician interviews. We presented an abstract at the Society of Academic Emergency Medicine meeting in New Orleans in May 2022.

42. Understanding Cold Drink Heart: A telephone-based patient survey

Principal Investigators: **David R. Vinson** (Roseville/Sacramento) and Mary E. Reed (DOR)

Co-Investigators: Judy Shan, Jennifer Zhang and Adina S. Rauchwerger (DOR, CREST)

Funding: TPMG DARE's Physician Researcher Program

KP Study Sites: Sacramento, Roseville, and South Sacramento

Summary: One means of atrial fibrillation (AF) recurrence prevention is the identification and avoidance of factors known to trigger AF. Among these is the rapid ingestion of icy cold drinks and food. Though this environmental precipitant is not well described, one recent survey from UCSF suggests this may be present in as many as 10% of patients with AF. Little research, however, has been undertaken on this condition; the literature is comprised exclusively of case reports. It is into this gap of knowledge that our patient survey speaks. Eligible patients will be identified through enrollment in a parent study of ED AF management. We are including patients with the condition who have written me in response to our prior publications.

Status: Patient enrollment is underway. Over 60 patients have participated to date.

43. Optimal anticoagulation strategies for patients with newly detected acute atrial fibrillation

Principal Investigators: Bory Kea (OHSU) and **David R. Vinson** (Roseville/Sacramento)

Co-Investigators: E. Margaret Warton and Mary E. Reed (DOR), Ben Sun (Penn), Rochelle Fu (OHSU), Merritt Raitt (Portland VA Medical Center), and Greg YH Lip (University of Birmingham)

Funding: NIH's National Heart, Lung, and Blood Institute (NHLBI)

Study Sites: KP Northern California

Summary: In this retrospective cohort study of patients with newly-detected AF/FL we will describe the incidence, time lag, and predictors of oral anticoagulation (OAC) prescribing after an ED discharge diagnosis of new AF/FL, determine whether validated outpatient risk stratification scores can identify a subgroup of ED patients discharged with new AF/FL who are at high risk for stroke and death, and compare the rates of these events for patients prescribed ED OACs vs patients not prescribed OACs at their index ED visit. These results will improve our understanding

of ED OAC initiation and inform parallel research we are doing (above) on the development of clinical decision support tools and guidelines to aid in management of AF/FL patients in our EDs and inpatient settings.

Status: We presented an abstract at the Society for Academic Emergency Medicine annual meeting, May 2019, and presented another at the American Heart Association meeting in November 2019. The manuscript is being written.

44. Comprehensive primary care clinic-based pulmonary embolism management

Principal Investigator: **David R. Vinson** (Roseville/Sacramento)

Co-Investigators: Erik R. Hofmann (South Sacramento), Suresh Rangarajan (Adult Primary Care) and Dustin G. Mark (Oakland), Dayna J. Isaacs and Elizabeth J. Johnson (UC Davis), Karen L. Wallace (Radiology, San Jose), Jie Huang and Mary E. Reed (ROS) with the KP CREST Network

Funding: KP Northern California Community Health Program

KP Study Sites: KPNC

Summary: The initial site of care of patients with newly diagnosed, acute, symptomatic PE is undergoing a transition away from routine hospitalization for select low-risk patients. Patients with mild symptoms frequently present to their primary care clinicians and have their diagnosis established by pulmonary imaging and some of these are managed without referral to the ED or hospital. This retrospective cohort study will describe and analyze the care of PE patients who are diagnosed and managed in the primary care setting over a 7-year study period (2013-2019).

Status: We have published three cases reports: *European Heart Journal Case Reports, Medicine (Baltimore)* and *Perm J.* We have presented abstracts at the American College of Physicians regional meeting (Oct 2020), their national meeting (2021), and the 2021 American Thoracic Society meeting. The first manuscript was recently published in *J Gen Intern Med*. A letter was published in September in *N Engl J Med*. A second ms is underway. We also have a small letter to the editor in press with *Am Family Physician*.

45. Clinical decision support to Optimize Care of patients with Atrial Fibrillation or flutter in the Emergency department: protocol of a stepped-wedge cluster randomized pragmatic trial (O'CAFÉ trial)

Principal Investigators: **David R. Vinson** (Roseville/Sacramento) and Mary E. Reed (Division of Research)

Co-Investigators: E. Margaret Warton, Mary E. Reed, Adina S. Rauchwerger, Jennifer Zhang (DOR), the incredible Site Leads of the KP CREST Network EDs, along with Alan Go (DOR) and Matthew D. Solomon (Cardiology, Oakland). Thanks also to our students for their work on a review of AF guidelines: Disha Bahl (St. George's University School of Medicine), and Leyla Farshidpour (UC Davis School of Medicine), and Jennifer Zhang (DOR research assistant)

Funding: TPMG DARE's Delivery Science Grants Program

KP Study Sites: KPNC

Summary: Atrial fibrillation/atrial flutter (AF) is a clinical and socioeconomic burden to the U.S. healthcare system and will only worsen with the accelerated aging of the KP membership and U.S. population. The greatest driver of AF costs is hospitalization, the vast majority of which occurs through the emergency department (ED). Our prior research has identified suboptimal rate, rhythm, and stroke prevention treatments across Kaiser Permanente Northern California EDs, along with twofold inter-facility variation in hospitalization rates of ED AF patients (30%-60%). This study will evaluate the impact of a web-based clinical decision support tool to improve the ED management of patients with primary AF.

Status: The clinical decision support tool began a staggered roll-out across CREST EDs on October 1, 2021. We submitted a methods paper in July. We also are working on a review of AF guidelines to see how they speak to the issues that face emergency physicians in the management of AF.

46. Home treatment of acute pulmonary embolism: protocol for a systematic review and individual patient data meta-analysis

Principal Investigators: Pierre-Marie Roy (Angers University Hospital Center, France) and Frederikus A. Klok (Leiden University Medical Center, Netherlands)

Writing committee: O Sanchez, MV Huisman, F Couturaud, BA Penaloza, O Hugli, D Jiménez, S Konstantinides, D Aujesky, R Otero and **David R. Vinson** (Roseville/Sacramento)

Sites: International

Summary: The aim is to evaluate the safety of home treatment in patients with acute pulmonary embolism (PE), focusing on readmission (unscheduled visit to outpatient clinic, ED or hospitalization), major bleeding, recurrent VTE and all-cause mortality, in the overall population as well as in relevant patient subgroups: patients with active cancer, patients treated with varied anticoagulants, patients with prior venous thrombotic disease, symptomatic versus incidental PE, age categories (18-40, 41-60, 61-80, >80), presence of renal insufficiency (eGFR < 60 ml/min), presence of radiological signs of right ventricular overload, presence of echocardiographic signs of right ventricular dysfunction, abnormal versus normal troponin, abnormal versus normal NTproBNP , presence of chronic cardiovascular disease, presence of chronic pulmonary disease, symptomatic or incidental PE, and men versus women.

Status: We are awaiting IRB approval for data sharing.

47. Acute emergency care and outcomes for stroke, myocardial infarction, and surgery during the COVID-19 pandemic in KPNC: Implications for care delivery during COVID-19 recovery phase and future surges

Principal Investigators: Robert Chang (South San Francisco, Vascular Surgery), Mai Nguyen-Huynh (DOR and Walnut Creek, Neurology), Matt Solomon (Oakland, Cardiology), **David R. Vinson** (Roseville/Sacramento)

Co-Investigators: Jeff Klingman, Melissa Meighan, Molly Burnett, Alexander Flint, Xian Nan Tang, Alan Go, Edward McNulty, Jeffrey Douaiher, and Giye Choi

Funding: Garfield Memorial Fund

KP Study Sites: KPNC

Summary: We have two aims: (1) To assess the decreased trends in acute presentation to KPNC emergency departments (EDs) for chest pain and acute MI, stroke symptoms, and acute surgical emergencies during the COVID-19 pandemic, and compare the presenting patient characteristics, processes of care, and short and long-term outcomes (i.e., all-cause mortality, condition-specific outcomes) for patients who presented during the early COVID-19 pandemic to those who presented to the ED before the pandemic; and (2) To evaluate the potential consequences of delayed presentations for chest pain/acute MI, stroke symptoms, and acute surgical emergencies on long-term patient outcomes and healthcare system utilization, by examining the downstream, potential long-term consequences of avoided care.

Status: We are doing data collection.

48. How fast is fast enough? Assessing door-to-needle times and outcomes of stroke patients receiving acute thrombolysis therapy under the KPNC Stroke EXPRESS program

Principal Investigator: Mai Nguyen-Huynh (DOR and Walnut Creek, Neurology)

Co-Investigators: Xian Nan Tang (Sacramento), Jeff Klingman (Walnut Creek), Janet Alexander (DOR), Alexander Flint (Redwood City), and **David R. Vinson** (Roseville/Sacramento)

Funding: TPMG DARE's Delivery Science Grant Program

KP Study Sites: KPNC

Summary: This cohort study will include consecutive members with acute ischemic stroke treated with intravenous alteplase before (2012-2015) and after (2016-2019) the region-wide implementation of the KPNC Stroke EXPRESS program run by telestroke neurologists. We will evaluate the association between door-to-needle times and 90-day functional outcomes and mortality. We hypothesize that the EXPRESS program significantly improved door-to-needle times and 90-day outcomes. We presented an abstract in February at the International Stroke Conference.

Status: Manuscript composition is underway.

Recent Publications (since Jan 2022)[e]

TPMG (Northern CA)

Van Winkle PJ, Lee SN, Chen Q, Baecker AS, **Ballard DW, Vinson DR**, Greenhow TL, Nguyen THP, Young BR, Alabaster AL, Huang J, Park S, **Sharp AL**. Clinical management and outcomes for febrile infants 29-60 days evaluated in community emergency departments. *J Am Coll Emerg Physicians Open*. 2022;3(3):e12754.

Full text: https://doi.org/10.1002/emp2.12754

Ballard D. Medically Clear: Addicted to misinformation: Is there treatment? *Emerg Med News*. 2022;44(4):4-6.

Full text: https://journals.lww.com/em-news/fulltext/2022/04000/medically_clear__addicted_to_misinformation__is.8.aspx

Farshidpour LS, **Caldwell NJ, Vinson DR**. Young woman with black spots and a red rash on her forearm. *J Am Coll Emerg Physicians Open*. 2022;3(3):e12771.

Full text: https://doi.org/10.1002/emp2.12771

Juergens N, Wei J, Cullen E, **Graubard M**, **Gupta V**, Weintraub M, **Sax DR**. Downstream acute care utilization following initial prescription of an opioid pain reliever among emergency department patients with low severity conditions. *Perm J***.** 2022;26:21.036.

Full text: https://doi.org/10.7812/TPP/21.036

Kene M, Bhopale S, Eaton A, Awsare SV, Reed ME. Opioid safety initiative associated with decreased emergency department opioid prescribing. *Am J Manag Care*. 2022;28(6):e203-e211.

Full text: https://www.ajmc.com/view/opioid-safety-initiative-associated-with-decreased-emergency-department-opioid-prescribing

Li K, Bassett H, Fitch B, Lynch K. Mistaken identity: acute respiratory arrest from accidental ingestion of poison hemlock. *Clin Toxicol (Phila).* 2022;60(5):659-661.

Link: https://www.tandfonline.com/doi/abs/10.1080/15563650.2021.2002354

Jarman AF, Ford JS, Maynard MJ, Simmons ZL, **Mackey KE**, Mumma BE, Rose JS. Prehospital testing and surveillance for SARS-CoV-2: A special report from the Sacramento (California USA) Mobile Integrated Health Unit. *Prehosp Disaster Med*. 2022;37(2):265-268.

Full text: https://doi.org/10.1017/s1049023x22000292

[e] A more comprehensive list of publications from the KP CREST Network can be found online: http://www.kpcrest.net/ Select publications.

Mark DG, Shan J, Huang J, **Ballard DW, Vinson DR, Kene MV, Sax DR**, Rauchwerger AS, Reed ME. Higher intensity of 72-hour non-invasive cardiac test referral does not improve short-term outcomes among emergency department patients with chest pain. *Acad Emerg Med*. 2022 Jan 22. Online ahead of print.

Abstract: https://onlinelibrary.wiley.com/doi/10.1111/acem.14448

Sax DR, Mark DG, Rana JS, Reed ME, Lindenfeld J, Stevenson LW, Storrow AB, Butler J, Pang PS, Collins SP. Current emergency department disposition of patients with acute heart failure: an opportunity for improvement. *J Cardiac Fail.* 2022 May 29 [online ahead of print].

Full text: https://www.onlinejcf.com/article/S1071-9164(22)00533-4/fulltext

Sax DR, Mark DG, Rana JS, Collins SP, Huang J, Reed ME. Risk adjusted 30-day mortality and serious adverse event rates among a large, multi-center cohort of emergency department patients with acute heart failure. *J Am Coll Emerg Physicians Open*. 2022;3:e12742.

Full text: https://onlinelibrary.wiley.com/doi/epdf/10.1002/emp2.12742

DOR Spotlight: https://spotlight.kaiserpermanente.org/heart-failure-hospitalization/

Vinson DR, **Casey SD**, Vuong PL, Huang J, **Ballard DW**, Reed ME. Sustainability of a clinical decision support intervention for outpatient care for emergency department patients with acute pulmonary embolism. *JAMA Netw Open*. 2022;5(5):e2212340.

Full text: https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2792364

DOR Spotlight: https://spotlight.kaiserpermanente.org/many-patients-with-blood-clots-can-go-home-from-er-safely/

Reuters news (via MD Edge): https://www.mdedge.com/cardiology/article/255153/pulmonology/decision-support-tool-tied-increased-outpatient-management-pe

Westafer LM, **Vinson DR**. Risk for recurrent venous thromboembolism in patients with subsegmental pulmonary embolism managed without anticoagulation [letter]. *Ann Intern Med*. 2022;175(4):W43.

Link: https://doi.org/10.7326/l22-0037

Zhang JY, Rauchwerger AS, **Vinson DR**. Ten additional cases of atrial fibrillation triggered by the sequence of strenuous exercise and cold drink. *J Emerg Med*. 2022 June 15 [online ahead of print].

Link: https://www.jem-journal.com/article/S0736-4679(22)00356-0/fulltext

Vinson DR, **Hofmann ER**, Johnson EJ, Huang J, Isaacs DJ, Rangarajan S, Shan J, Rauchwerger AS, Reed ME, **Mark DG**. Management and outcomes of patients diagnosed with acute pulmonary embolism in primary care: retrospective cohort study. *J Gen Intern Med*. 2022 Jan 12 [Epub ahead of print].

Abstract: https://link.springer.com/article/10.1007%2Fs11606-021-07289-0

KP PR: https://spotlight.kaiserpermanente.org/some-pulmonary-embolism-patients-effectively-treated-in-primary-care/

Klingman J, Alexander J, **Vinson DR,** Nguyen-Huynh MN. The need for speed: treating stroke in the golden hour in a large community cohort. *Stroke*. 2022;53(S1):A62.

Abstract: https://www.ahajournals.org/doi/10.1161/str.53.suppl_1.62

Coralic Z, Staub E, **Vinson DR**, Wilson MP. Haloperidol versus ziprasidone with concomitant medications and other predictors of physical restraint duration in the emergency department. *J Emerg Med*. 2022 Mar 29. Online ahead of print.

Abstract: https://doi.org/10.1016/j.jemermed.2021.12.018

SCPMG (Southern CA)

Raper JD, Thomas AM, Lupez K, Cox CA, **Esener D**, Boyd JS, Nomura JT, Davison J, Ockerse PM, Leech S, Johnson J, Abrams E, Murphy K, Kelly C, O'Connell NS, Weekes AJ. Can right ventricular assessments improve triaging of low-risk pulmonary embolism? *Acad Emerg Med*. 2022 Mar 15. Online ahead of print.

Abstract: https://onlinelibrary.wiley.com/doi/10.1111/acem.14484

Gaspari RJ, Gleeson T, Alerhand S, et al, **Rose G**, Russell F, Schafer J, Scheatzle M, Schnittke N, Shpilko M, Soucy Z, Stowell JR, Vryhof D, Gottlieb M. A multicenter, prospective study comparing subxiphoid and parasternal views during brief echocardiography: Effect on image quality, acquisition time, and visualized anatomy. *J Emerg Med*. 2022 Jan 19. Online ahead of print.

Abstract: https://doi.org/10.1016/j.jemermed.2021.10.032

Sharp AL, Pallegadda R, Baecker A, Park S, Nassery N, Hassoon A, Peterson S, Pitts SI, Wang Z, Yuxin Z, Newman-Toker DE. Are mental health or substance use disorders risk factors for missed acute myocardial infarction diagnoses among chest pain or dyspnea encounters in the emergency department? *Ann Emerg Med.* 2022;79(2):93-101.

Abstract: https://www.annemergmed.com/article/S0196-0644(21)00803-9/fulltext

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KP News Release: https://www.kpwashingtonresearch.org/our-research/research-areas/social-determinants/sonnet/sonnet-newsletter/sonnet-newsletter-spring-2022/social-risks-do-patients-want-health-systems-help

Abstracts Presented at the Society of Academic Emerg Medicine Mtg 2022

Ballard DW, Huang J, **Sharp AL**, **Vinson DR**, Young BR, Nguyen T, **Mark DG, Kene MV**, Rauchwerger AS, Park S, Zhang JY, Van Winkle P, Reed ME, Greenhow TL. All-inclusive model for predicting invasive bacterial infection in febrile infants age 7-60 days. *Acad Emerg Med*. 2022;29(S1):S33 [abstract 53].

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Casey S, Vuong P, Huang J, Ballard D, Reed M, **Vinson D**. Sustained effects of champion-promoted decision support on outpatient management of low-risk pulmonary embolism. *Acad Emerg Med*. 2022;29(S1):S164 [abstract 336].

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Ma AA, **Durant E**, Engelhart DC, Warton M, Arasu V, Bernal R, Rauchwerger AS, Reed ME, **Vinson DR**. CT Use Reduction In Ostensive Ureteral Stone (CURIOUS). *Acad Emerg Med*. 2022;29(S1):S147 [abstract 299].

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