

Research and Academics in KP California Emergency Medicine

Quarterly Report: 2024 Q3

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Hot Off the Press^a

TPMG (Northern CA)

Ballard D, Vinson D. [End the delay in adopting Electronic Record Exchange between EMS and EDs.](#) *Emerg Med News.* 2024;46(8):1,22.

Casey SD, Zekar L, Somers MJ, Westafer LM, Reed ME, **Vinson DR.** [In reply to Satici's letter re: predictors of low-risk PE hospitalization.](#) *Ann Emerg Med.* 2024;84(3):330-331.

Source study: **Casey SD,** et al. [Embolism laterality and highest heart rate predict hospitalization of emergency department patients with acute, low-risk pulmonary embolism.](#) *Ann Emerg Med.* 2023;82(3):369-380.

Rouleau SG, **Casey SD,** Kabrhel C, Long B, **Vinson DR.** [Systemic thrombolysis is still the first-line treatment for unstable pulmonary embolism.](#) *JACC Adv.* 2024;3(8):101068.

Israelyan A, **Chiang J, Cooper KC, Lew VL,** Murphey GC, **Durant E.** [Isolated volar radioulnar joint dislocation with associated ulnar styloid fracture.](#) *Cureus.* 2024;16(6):e61977.

^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

Costales B, Lu Y, Young-Wolff KC, **Cotton DM**, Campbell CI, Iturralde E, Sterling SA. [Prevalence and trends of suspected cannabinoid hyperemesis syndrome over an 11-year period in Northern California: An electronic health record study](#). *Drug Alcohol Depend*. 2024;263:112418.

Pulcini CD, Barton DJ, Cassara M, Davis JJ, DeMasi SC, **Durant EJ**, Garg N, Greineder C, McMillian M, Paxton JH, Puskarich MA, Vogel JA, Wong AH, Sharp WW. [Assessment of an organizational effort to increase emergency medicine faculty on National Institutes of Health study sections](#). *Acad Emerg Med*. 2024 Jul 26. Online ahead of print.

Sabouri AH, Yurgionas B, Khorasani S, **Durant EJ**, Kafaie J, Hung YY, Klingman JG, Nemazie S. [Acute kidney injury in hospitalized patients with exertional rhabdomyolysis](#). *JAMA Netw Open*. 2024;7(8):e2427464.

KP DOR Spotlight: [Acute kidney injury less common than believed in patients with exercise-induced muscle tissue breakdown](#).

Chaudhry AS, Shiu JW, Varela NS, Newton GW, **Durant EJ**. [Squamous cell carcinoma of the nail bed](#). *Perm J*. 2024 Sep 20. Online ahead of print.

Brophy S, Combs J, **Hutchison J**. [Thermal pharyngeal injury resulting from vaping: a case report](#). *Cureus*. 2024;16(6):e61718.

Meyers MC. [If You Build It, They Will Come: EDs are victims of induced demand. We cannot simply build our way out of the overcrowding and boarding crisis](#). *MedPage Today*. 2024 July 23.

Quincy Moore P, Ellis K, Simmer P, Waetjen M, Almirol E, Salisbury-Afshar E, Pho MT. [Accessibility of naloxone in pharmacies registered under the Illinois Standing Order](#). *West J Emerg Med*. 2024;25(4):457-464.

Sax DR, Warton EM, **Kene MV**, **Ballard DW**, Vitale TJ, **Timm JA**, Adams ES, McGauhey KR, Pines JM, Reed ME; Kaiser Permanente Clinical Research on Emergency Services & Treatments (CREST) Network. [Emergency Severity Index version 4 and triage of pediatric emergency department patients](#). *JAMA Pediatr*. 2024;178(10):1027-1034

AHRQ's Digital Healthcare Research: [Machine Learning to Improve Patient Triage in the Emergency Department | Digital Healthcare Research \(ahrq.gov\)](#)

Parallel study of **adult** triage: Sax DR, et al. [Evaluation of the emergency severity index in US emergency departments for the rate of mistriage](#). *JAMA Netw Open*. 2023;6(3):e233404.

Sax DR, **Kene MV**, Huang J, Gopalan A, Reed ME. [Downstream emergency department and hospital utilization comparably low following in-person versus telemedicine primary care for high-risk conditions](#). *J Gen Intern Med*. 2024;39(13):2446-2453.

[Related telemedicine research](#) by Reed ME, et al.

Sax DR, Mark DG, Rana JS, Huang J, Casey SD, Norris RP, Tillage V, Reed ME. [Pilot trial of an electronic decision support to improve care for emergency department patients with acute heart failure.](#) *ESC Heart Fail.* 2024 Jul 25. Online ahead of print.

[Related ED heart failure research](#) by Sax DR, et al.

Silva F, Gouin E, Lindholm P. [Mucosal petechiae and hemorrhage in pulmonary barotrauma in breath-hold diving: Direct observation of a suspected pathophysiologic mechanism.](#) *Am J Respir Crit Care Med.* 2024 Jul 16. Online ahead of print.

Yu E, Silva F, Lussier A, Lindholm P. [Lung ultrasound as an adjunct to pulse oximetry and respiratory symptoms in the diagnosis of freediving-induced pulmonary syndrome.](#) *Wilderness Environ Med.* 2024 Sep 16. Online ahead of print.

Yu E, Valdivia-Valdivia JM, Silva F, Lindholm P. [Breath-hold diving injuries - a primer for medical providers.](#) *Curr Sports Med Rep.* 2024;23(5):199-206.

Vinson DR, Rouleau SG, Casey SD, Stubblefield WB, Westafer LM. [Optimizing the use of Pulmonary Embolism Severity Indices in electronic clinical decision support.](#) *Ann Emerg Med.* 2024;84(3):333-334.

[Other CREST PE research](#)

Luijten D, Douillet D, Luijken K, et al, Vinson DR, Wells P, van Smeden M, Roy PM, Klok FA. [Safety of treating acute pulmonary embolism at home: an individual patient data meta-analysis.](#) *Eur Heart J.* 2024;45(32):2933-2950.

Editorial: Kadakia KT, Bikdeli B. [Triaging early discharge for pulmonary embolism: home is where the heart\(/lung\) is.](#) *Eur Heart J.* 2024;45(32):2951–2953.

SCPMG (Southern CA)

Fuchs J, Rose G. [Alternative treatment of carpal tunnel syndrome with ultrasound-guided median nerve hydrodissection in the emergency department.](#) *Am J Emerg Med.* 2024;84:189.e5-189.e7.

Stellpflug SJ, Stolbach A, Ghorayeb J, Magraken E, Twohey E, Lapoint J, deWeber K. [Cannabis in combat sports: position statement of the Association of Ringside Physicians.](#) *Phys Sportsmed.* 2024 Jul 9:1-12.

Rose G, Fuchs J. [Authors' response to comments regarding ultrasound-guided median nerve hydrodissection in the emergency department.](#) *Am J Emerg Med.* 2024 Aug 22. Online ahead of print.

Xu J, Silver MA, Kim J, Mazotti L. [Using the electronic health record to provide audit and feedback in medical student clerkships.](#) *JAMIA Open.* 2024;7(3):ooae090.

Abstract presentations at National Meetings

A. 2024 Research Forum of the American College of Emergency Physicians Research Forum, Las Vegas, NV.

KP Northern California

- **Casey SD**, Lieu T, Reed ME, Huang J, Parry DD. [Pediatric telemedicine care is associated with minimal increases in subsequent emergency department visits](#). *Ann Emerg Med.* 2024;84(4S):S64 [abstract 137].
- Nguyen T, Farshidpour LS, **Gupta N**, Somers MJ, Ma AA, **Hofmann ER**, **Sax DR**, Zhang JY, DiLena DD, Reed ME, **Vinson DR**, for the KP CREST Network. [Effect of Canadian Syncope Risk Score recommendations on emergency physician management of unexplained syncope](#). *Ann Emerg Med.* 2024;84(4S):S80-S81 [abstract 172].
- Middleton CE, Zekar L, Woldemariam ST, Qiao E, Somers MJ, **Gupta N**, **Poth LS**, Sperling JD, Roubinian NH, **Vinson DR**, for the KP CREST Network. [Radiation-sparing strategies in antenatal pulmonary embolism diagnostics: specialty-specific differences in use and effectiveness](#). *Ann Emerg Med.* 2024;84(4S):S81 [abstract 173].
- Qiao E, Campbell AR, Heringer GV, Florio CJ, Somers MJ, Sperling JD, Roubinian NH, **Vinson DR**, for the KP CREST Network. [Prevalence, characteristics, and outcomes of patients who decline pulmonary vascular imaging during antenatal pulmonary embolism diagnostics](#). *Ann Emerg Med.* 2024;84(4S):S131 [abstract 282].
- Stubblefield WB, Helderman R, Strokes N, Greineder CF, **Vinson DR**, Westafer LM. [Determinants of guideline-directed anticoagulation in emergency department patients admitted with acute pulmonary embolism](#). *Ann Emerg Med.* 2024;84(4S):S7-S8 [abstract 17].

KP Southern California

- **Fuchs J**, **Gonzalez-Cobos C**, **Esener D**, **Rose G**. Diagnostic Accuracy of Ocular Pathology by Emergency Physicians Comparing Ocular Ultrasound and Digital Fundoscopic Imaging. *Ann Emerg Med.* 2024;84(4S):S125 [abstract 270].
- **Schwartz A**, Hauck T. The Use of a Data Mart for the Instantaneous Availability of Emergency Department Clinical Information. *Ann Emerg Med.* 2024;84(4S):S163 [abstract 357].
- **Gonzalez-Cobos C**, **Fuchs J**, **Abrams E**, **Sacci P**, **Esener D**, **Rose G**. Retrospective Analysis on the Current Use of Bedside Ultrasound in the Diagnosis of Acute Heart Failure in the Emergency Department. *Ann Emerg Med.* 2024;84(4S):S210 [abstract 471].
- Kawatkar A, Thokala P, Goodacre S, Baecker A, **Sharp A**, Redberg R, Lee M-S, Ferencik M, Sun B. Cost-Effectiveness of Early Non-Invasive Cardiac Testing for Suspected Acute Coronary Syndrome. *Ann Emerg Med.* 2024;84(4S):S82 [abstract 175].

B. 2024 World Conference on Lung Cancer, San Diego, CA.

- Ragavan M, Somers MJ, Reed M, Dan A, Yang M, Huang T, **Vinson D**, Sakoda L, Triplett C, Liu R. Sociodemographic and clinical predictors of diagnosis of lung cancer in ED in a large, integrated health system. [PT01.17.06](#). Select "View Abstract"

In Preparation^b

1. Improving clinical decision support for the care of febrile infants: expanding CA FIRST research (California Febrile Infant Risk Stratification Tool)

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

Co-investigators: From **KP Northern CA**: Dustin G. Mark (Oakland/Richmond), Mamata V. Kene (San Leandro/Fremont), David R. Vinson (Roseville/Sacramento), Tran H. P. Nguyen (Pediatric Hospital Medicine, Roseville), Madeline J. Somers, Adina S. Rauchwerger, and Mary E. Reed (DOR), with the KP CREST Network; from **KP Southern CA**: Margaret Stone (Pediatric Infectious Diseases, Woodland Hills), Joseph Colli (Pediatric Hospital Medicine, Harbor City), Sonya Negriff (Department of Research and Evaluation)

Funding: Garfield Memorial Fund (who has generously supported this project from its inception)

Study Sites: KPNC and KPSC

Summary: This study will expand our ongoing work (see ongoing studies 6a and 6b below) to improve the care of febrile infants with the following four aims: (1) Following data collection and analysis, we aim to retrospectively validate CA FIRST in KPNC and KPSC outpatient settings using data from 2021-2024. (2) We plan to implement enhanced Clinical Decision Support (CDS) in RISTRA (KPNC) with a focus on the age 91-365 day febrile infant population and the goal to decrease unnecessary utilization and treatment, specifically chest x-rays, blood cultures and antibiotics for respiratory conditions. We will prospectively track utilization and safety outcomes to assess the impact of this decision support. (3) Based on retrospective validation, we will determine the utility of obtaining a urine culture in the setting of negative urinalysis (UA) in infants 7-60 days. For infants 61 days to 2 years in outpatient clinics and ED, we will explore the feasibility of implementing UTICalc on the Clinical Library and embedding it into the RISTRA clinical decision support tool. We also plan to provide additional recommendations to providers on how to obtain appropriate specimens. (4) We plan to disseminate the data and guidelines developed in Aims 1 and 2 across KP National. The information will be shared via Clinical Library, promotion at regional chiefs meetings, webinars and presentations with continuing medical education and social media.

[CA FIRST publications to date.](#)

Just Launched or Added

1. Ruling out pulmonary embolism safely: standardized reporting of the failure rate

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

Principal Investigators: Yonathan Freund (Hôpital Pitié-Salpêtrière, Paris, France) and Kerstin de Wit (McMaster University and Queen's University, Canada)

Co-investigators: **Scott D. Casey** (DOR and Vallejo/Vacaville), **David R. Vinson** (DOR and Roseville/Sacramento), Christopher Kabrhel (MGH); William B. Stubblefield (Vanderbilt); Jeff Kline (Wayne State), Delphine Douillet (University Hospital of Angers, France), Federico Germini (IRCCS Humanitas Research Hospital, Milan, Italy), Andrea Penaloza (UC Louvain, Brussels, Belgium); Olivier Hugli (Lausanne University Hospital, Switzerland), Pierre-Marie Roy (University Hospital of Angers, France), for the Emergency Advisory and Research international board on Thrombosis and Hemostasis (EARTH)

Summary: The optimal diagnostic work-up of pulmonary embolism (PE) in ED is debated, and traditionally uses a sequential approach with the evaluation of the clinical probability, followed by D-dimer testing, chest imaging, or both. Studies have demonstrated the safety of excluding PE without the use of diagnostic imaging, often combining a low clinical probability score with low-to-negative D-dimer testing. Evidence that the rule-out strategy was safe was provided by a 3m follow-up period without diagnosis of lower limb DVT or PE. The rate at which lower limb DVT or PE were diagnosed in those who initially tested negative for PE has become known as the 'failure rate' and is interpreted as the true safety measure of the diagnostic strategy. We aim to argue that the term 'failure rate' as a primary outcome is not well defined, with studies reporting overly optimistic or else pessimistic failure rates, depending on the approach used. The variation in definition is problematic as it could influence the adoption of specific PE testing strategies into clinical practice based on misinterpretation of safety.

2. Ultrasound guided transgluteal sciatic nerve hydrodissection for the treatment of sciatica in the emergency department: a case control cohort study.

Principal Investigators: **Gabriel Rose** (San Diego).

Co-investigators: Dasia Esener, Sara Amen (San Diego)

Summary: This study will evaluate the efficacy of using ultrasound-guided transgluteal sciatic nerve hydrodissection (TGSNH) to treat ED patients with a chief complaint of sciatica pain. Traditional practice patterns of emergency physicians (EP) to treat sciatica include a combination of NSAIDs, opioids, topical analgesics, and acetaminophen. Given the concerns related to opioid use in certain populations and the efficacy of acute relief, these treatments can provide, there is a need to investigate further acute treatments for sciatica pain. Ultrasound-guided regional anesthesia is within the scope of practice of EPs for the treatment of musculoskeletal pain. Specifically, ultrasound-guided transgluteal sciatic nerve block has been shown as an effective treatment of sciatica in the ED; however, safety concerns regarding the potential for falls due to motor blockade or local anesthetic systemic toxicity (LAST) due to absorption of local anesthetic cannot be overlooked. Nerve hydrodissection is a technique in which a solution (e.g. D5W) is injected circumferentially around a nerve to separate it from surrounding connective tissue, which can effectively help to alleviate pain resulting from compressive neuropathy. Unlike nerve

blockade with local anesthetics, nerve hydrodissection lacks the aforementioned risks of falls and LAST. Hydrodissection has been shown in numerous studies to be an effective treatment in conditions such as carpal tunnel syndrome, cervical radiculopathy, cervicogenic headache, and more recently in a case series describing its use in sciatica. Large-scale prospective studies on this technique for the treatment of sciatica in the ED are still lacking. Here we set out to study whether TGSNH is an effective and safe method to treat patients who present with sciatica to the ED.

Ongoing Research Projects^c

1. Evaluation of ligamentous injury in traumatic knee injuries using bedside point-of-care ultrasound (POCUS) in the ED

Principal Investigator: **Eric Abrams** (San Diego)

Co-investigators: Gabriel Rose, Dasia Esener (San Diego)

Study Site: San Diego

Summary: ACL tears are a common pathology following knee injuries presenting to the ED. However, typical imaging modalities used during the ED visit, including x-ray and POCUS, are not reliable or accurate in the diagnosis as compared to MRI. MRI is performed after the index ED visit on an outpatient basis in accordance with an orthopedics follow up appointment. Our group will evaluate whether the presence of a knee effusion, as detected on POCUS examination, increases the likelihood of ligamentous injury (ACL) after acute knee injury. Patients will be scanned by one of the ultrasound faculty or fellows during their visit and outpatient follow up imaging and orthopedics visit summary will be referenced as the gold standard.

Status: Enrollment is underway.

2. Evaluation of the clinical impact and safety of focused transesophageal echocardiography during resuscitation of critically ill patients in the ED and ICU

Principal Investigator: Benjamin Abella (University of Pennsylvania)

KP Co-Investigator: **Eric Abrams** (San Diego)

Study Site: KP San Diego

Summary: This is a multi-center, prospective study evaluating clinical outcomes in critically ill patients in the ED who undergo a transesophageal echocardiogram (TEE) by an emergency medicine clinician.

Status: Enrollment is underway.

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

3. Evaluation of physician-performed musculoskeletal ultrasound after implementation of QR code digital reference cards in the ED: the “Musculoskeletal Ultrasound Assist in Demand” (MSKAiD) project

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

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

Study Site: KP San Diego

Summary: EM physician-performed musculoskeletal (MSK) ultrasound (diagnostic and procedural) is part of the core applications of point of care ultrasound training during residency per national society guidelines. However, EM physicians often defer performing MSK ultrasound-guided diagnostics and procedures in favor of other imaging modalities or consultant management, due to low comfort and/or experience with MSK ultrasound. This prospective study will evaluate physician comfort level pre- and post-implementation of rapid reference QR digital cards placed on every point of care ultrasound machine within the ED. Further, we will assess the number of non-ultrasound fellowship trained physician-performed MSK ultrasound (diagnostic and/or procedural) prior to and following QR code card placement.

Status: Enrollment and data analysis are ongoing.

4. 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: Gabriel Rose, Dasia Esener, Drew Silver, and Eric Abrams (San Diego)

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

Status: We are creating the simulation model.

5. 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 Daniel DiLena and Adina S. Rauchwerger, the KP CREST Network

Study 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: Our brief report on anosmia was published in *J Intern Med*. Our second manuscript, addressing predictors of PASC, led by Ed Durant, is under peer-review. We are working on two abstracts to submit for national conference presentation.

6a. 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

Study Sites: KP Northern California and KP Southern California

Funding: Garfield Memorial Fund

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 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 is in use across most KPNC facilities, used for patient care and for collecting prospective data. We have published [four manuscripts](#) to date: (1) Clinical management and outcomes for febrile infants 29-60 days evaluated in community EDs; (2) Using AAP guidelines to manage febrile infants without C-reactive protein and procalcitonin; (3) CA-FIRST (California Febrile Infant Risk Stratification Tool) algorithm development in a learning health system and (4) An all-inclusive model for predicting invasive bacterial infection in febrile infants aged 7-60 days.

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

Tara Greenhow gave an oral presentation at the American College of Emergency Physicians Research Forum, Philadelphia, PA, October 2023: Risk of serious bacterial infections in febrile infants aged 7-90 days with COVID-19.

6b. 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)

Study Sites: KP Northern California and KP Southern California

Funding: Garfield Memorial Fund

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 EDs across KPNC. This new study will (1) retrospectively validate the CA FIRST protocol in a large cohort febrile infants in KPNC 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.

Status: We are in analysis phase for Aims 1 and 3 and had an abstract presentation in May 2023 on the diagnostic yield of blood cultures in the 91-365-day population. Aim 2 data collection continues with over 2,600 prospective enrollments for infants aged 7-90 days as of July 2024.

7. Non-endoscopic management of acute esophageal food impaction in the ED

Principal Investigator: Linda Lee (Gastroenterology, Sacramento)

Co-Investigators: **Sean C. Bouvet** (San Francisco) and Dan Li (Gastroenterology, Santa Clara)

Study Sites: KP Northern California

Funding: KP Northern California Community Health Program

Summary: Esophageal food impaction is one of the most common gastrointestinal emergencies. These patients usually require urgent endoscopy in the ED to remove the impacted food and avoid esophageal necrosis or perforation. Research regarding non-endoscopic management remains

limited and the current endoscopy guidelines are over 10 years old. If non-endoscopic treatments can successfully treat patients with esophageal food impaction, it can avoid the risk, time, and expense of endoscopy. In this study, we will assess the rate of successfully resolving food impaction without endoscopy, the predictors and efficacy of non-endoscopic therapy, and the incidence of adverse events related to treatment type.

Status: We have completed the analysis. The ms is being written.

8. Risk stratification of ED patients with lower GI 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, Madeline Somers, Adina S. Rauchwerger (DOR), Daniel DiLena, and the CREST Network

Study 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 identify 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 presented an abstract to the Society of Academic Emergency Medicine annual meeting in Austin, Texas, in May 2023. The ms is undergoing peer-review.

9. Emergency physicians' attitudes towards presumptive anticoagulation for suspected acute pulmonary embolism

Investigators: Keerat Grewal (Schwartz/Reisman Emergency Medicine Institute, Toronto, ON), **Scott D. Casey** (Vallejo/Vacaville), and Olivier Hugli (Lausanne University, Switzerland)

Funding: None

Study sites: Pending

Summary: Consensus guidelines recommend consideration of presumptive anticoagulation in patients with a high pre-test probability of acute pulmonary embolism while pursuing diagnostic confirmation. Poor adherence to these recommendations is incompletely understood and studies

assessing physicians' attitudes towards presumptive anticoagulation may illustrate barriers and facilitators to increasing presumptive anticoagulation practices through implementation science initiatives.

Status: We are writing the survey and hope to begin enlisting participants later this year.

10. Healthcare utilization with telemedicine and in-person visits in pediatric primary care

Principal investigator: **Scott D. Casey** (Vallejo/Vacaville)

Co-investigators: Jie Huang, Tracy Lieu, and Mary E. Reed (KPNC Division of Research)

Funding: Agency for Healthcare Research and Quality

Study sites: KP Northern California

Summary: Telemedicine is a rapidly emerging yet understudied vehicle to deliver pediatric healthcare. Evidence for differences in follow-up health care utilization and safety between telemedicine and in-person primary care visits is needed. This retrospective cohort study of pediatric patients who had primary care appointments in 2022 will compare visits conducted via telemedicine (video or telephone) with in-person office visits. Outcomes will include physician prescribing and orders as well as downstream follow-up office visits, ED visits, and hospitalizations.

Status: The manuscript is in press.

11. 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)

Study Site: KP 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 have been collected and analysis completed. Initial abstract completed and will be submitted for presentation at national meeting.

12. 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), Aidan Campbell (NYU), Zev Minow (Kaiser Central Valley), Cynthia Kim (California Northstate University), and David R. Vinson (Roseville/Sacramento) of the KP CREST Network.

Funding: KP Northern California Community Health Program

Study Sites: KP Northern California

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 published our methods paper in *Am J Emerg Med*. We presented abstracts in 2022 at the American College of Radiology annual meeting in Washington, DC, and the Society of Academic Emergency Medicine annual meeting in New Orleans. Our prediction rule manuscript was published in *AJEM*: CT Use Reduction In Ostensive Ureteral Stone (CURIOUS). We are now undertaking a secondary analysis to evaluate how the magnitude of hydronephrosis correlates with clinically important ureteral stones.

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 (San Diego)

Study Site: KP 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: Abstract was presented at the Research Forum of the American College of Emergency Physicians meeting in San Francisco in October, 2022. Manuscript in preparation.

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: KP 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 in October at the 2021 Research Forum of the American College of Emergency Physicians. The manuscript is undergoing peer-review.

15. Diagnostic accuracy of retinal pathology by emergency physicians comparing ocular ultrasound and direct fundoscopic imaging

Principle Investigator: **Joshua Fuchs** (San Diego)

Co-investigators: Carlos Gonzalez-Cobos, Gabriel Rose, Dasia Esener (San Diego)

Summary: Fundoscopy can be challenging in the ED. Point-of-care ultrasonography (POCUS) offers an accurate way to diagnose emergent conditions of the eye that can replace the need for fundoscopy. Recently iCARE technology has been introduced as a more user-friendly method of performing fundoscopy. We are performing a prospective, quiz-based survey study to evaluate whether emergency physicians across a broad range of training can distinguish various pathologies of the eye based on POCUS images and iCARE fundoscopic images.

Status: Study completed. Abstract was presented at the 2024 American College of Emergency Physicians Research Forum in Las Vegas in October.

16. A retrospective analysis on the current use of bedside ultrasound in the diagnosis of acute heart failure in the emergency department

Principle Investigator: **Carlos Gonzalez-Cobos** (San Diego)

Co-investigators: Gabriel Rose, Joshua Fuchs, Dasia Esener, Peter Sacchi (San Diego)

Study Site: San Diego

Summary: Congestive heart failure (CHF) is a common admitting diagnosis from the ED. Point-of-care ultrasonography (POCUS) can be highly accurate in diagnosing patients with acute CHF. POCUS for CHF using echocardiography and lung imaging is taught to residents as part of the standard core principles of training and is considered an ACGME requirement. We are performing a retrospective analysis of all CHF admissions from the ED over one year and assessing the percentage of patients who did/did not undergo POCUS as part of their diagnostic assessment.

Status: Study completed. Abstract was presented at the 2024 American College of Emergency Physicians Research Forum in Las Vegas in October.

17. Risk of short-term vital sign deterioration in low-risk pulmonary embolism patients presenting to the ED 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)

Study Site: KP Northern California

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

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: Analysis is complete. We are working now on the manuscript.

18. National survey on airway management practices among US emergency medicine residency programs

Principle Investigator: **Jonathan Kei** (San Diego)

Co-investigators: Nathan Jang, Matthew Silver (San Diego)

Study Sites: EM residency programs nationwide.

Summary: Airway management practices have changed dramatically over the past 10 years with the widespread use of new technology, pharmacology, and difficult airway techniques. This study is a survey focused on emergency medicine residency programs in the United States. Residency Program Directors were asked to answer 19 questions related to airway management techniques and how they are taught at their institution. Temporal trends will be described and analyzed.

Status: Manuscript is undergoing peer review.

19. Multicenter study evaluating airway management practices among community ED in Southern California.

Principle Investigator: **Jonathan Kei** (San Diego)

Co-investigators: Travis M Eurick (San Diego)

Study site: KP San Diego and beyond

Summary: There have been several studies published evaluating airway management practices among academic and trauma centered EDs in the United States through the NEAR (National Emergency Airway Registry) database. But to date, there has not been similar research focused on community based EDs. This is a retrospective study evaluating 11,000 intubations performed across 12 community EDs in Southern California. Trends in intubation techniques, pharmacological choices, first pass success rates, the use of airway adjuncts, and use of advanced airway management techniques including surgical airways will be explored.

Status: An abstract was presented at the American College of Emergency Physicians Research Forum, Philadelphia, PA, October 2023. Manuscript submitted for review.

20. Assessing the optimal hand placement for cardiopulmonary resuscitation (CPR) by finding the point of maximal compression of the left ventricle on CT imaging

Principle Investigator: **Jonathan Kei** (San Diego)

Co-investigators: AJ Mannarino, Steve Aguilar, Lauren Van Woy (San Diego)

Study site: KP San Diego

Summary: Traditional CPR techniques advise performers place their hands on the mid sternum. Recent studies using transesophageal echo during CPR suggest that traditional hand placement is actually compressing the left outflow tract which can hinder forward movement of blood from the heart. A more optimal approach would be to move the hands more inferior and left lateral to fully compress the left ventricle. This study uses CT chest scans to identify the direct center of the left ventricle and then measures how far this point of optimal maximum compression is to the traditional location of hand placement. This study will provide recommendations for optimal hand placement during CPR based on gender and body mass characteristics in hopes of improving future outcomes in patients with cardiac arrest.

Status: Abstract presented at SAEM 2024 in Phoenix, AZ. Manuscript in progress.

21. Pediatric respiratory illnesses in the post-COVID era: epidemiology, ED care, and outcomes

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

Co-investigators: Dana R. Sax (Oakland/Richmond), Tara L. Greenhow (Pediatric ID, San Francisco), Mary E. Reed, E. Margaret Warton, and Adina S. Rauchwerger (Division of Research, Oakland), and the KP CREST Network

Study Sites: KP Northern California

Funding: KP Northern California Community Health Program

Summary: Pediatric respiratory illnesses are a common reason for U.S. ED visits. The COVID-19 pandemic shifted the incidence and epidemiology of respiratory diseases among children, especially in the last two years, when non-COVID respiratory infections rebounded from a pandemic dip. The rebound-associated surge tested hospital and ED capacity both at community and children's hospitals. The burden on health systems and hospitals of this changing epidemiology is not well understood. This retrospective study will evaluate pediatric respiratory-illness-related ED visits and outcomes from the pre-pandemic to current year. We seek to understand how rates of serious illness may have changed, and to identify predictors of serious illness. Our primary outcome is hospitalization; secondary outcomes include intensive respiratory support and ICU admission. We will also evaluate facility- and patient-level factors associated with serious illness and patterns of health care utilization prior to ED visits for respiratory illness. Results will inform operational planning and patient outreach and educational efforts.

Status: Data collection is complete. We are doing the analysis and working on the manuscript.

22. 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

Study Sites: KP Northern California

Funding: Garfield Memorial Fund

Summary: KPNC rapidly increased virtual care services (video and telephone visits) and decreased in-person visits in March 2020 at the start of the 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 beyond the pandemic.

Status: We presented an abstract in October 2022 at the American College of Emergency Physicians Research Forum: Short-term ED encounters following primary care telemedicine visits in the era of COVID-19. Our first ms was recently published in *J Gen Intern Med*: "Downstream emergency department and hospital utilization comparably low following in-person versus telemedicine primary care for high-risk conditions." This second ms is undergoing peer-review.

23. 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. Macey (EM resident, Stanford); Erik R. Hofmann (South Sacramento), Meena Ghiya (South San Francisco), Edward J. Durant (Manteca/Modesto), Sean C. Bouvet (San Francisco)

Study Sites: KP Northern California

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

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: We presented an abstract in October 2022 at the American College of Emergency Physicians Research Forum. The manuscript is undergoing peer-review.

24. Utilization of CT pulmonary angiograms for PE 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)

Study Sites: KP Northern California

Funding: KP Northern California Community Health Program

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.

25. 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)

Study Sites: KP Northern California

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 writing the ms. We gave an oral presentation at the American College of Emergency Physicians Research Forum, Philadelphia, PA, October 2023.

26. Validation of a novel algorithm for ED patients with possible acute coronary syndromes following the transition to a high-sensitivity troponin (hsTn) assay

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

Co-Investigators: Keane K. Lee (Cardiology, Santa Clara), Dana R. Sax (Oakland/Richmond), Dustin W. Ballard (San Rafael), Mamata V. Kene (San Leandro/Fremont), David R. Vinson (Roseville/Sacramento)

Study Sites: KP Northern California

Funding: The Permanente Medical Group Delivery Science Program

Summary: As part of a multidisciplinary hsTn implementation workgroup, we designed the “KPNC hsTn diagnostic algorithm” for evaluation of possible non-ST elevation acute coronary syndromes (NSTEMI-ACS) using Access hsTnI values. Our research questions are: 1) is the KPNC hsTn diagnostic algorithm internally valid, and 2) will adoption of hsTn impact resource utilization within KPNC? Our aims are to: 1) assess the predictive accuracy of the KPNC hsTn diagnostic algorithm among ED patients with possible NSTEMI-ACS for a composite outcome of 30-day AMI or death and 2) examine associations between hsTn adoption within KPNC and hospital admission rates, ED length of stay, and downstream cardiac testing among ED patients with possible NSTEMI-ACS. We hypothesize that 1) the algorithm will accurately identify patients at very low risk (< 0.5%), low risk (1-2%), intermediate risk (10-20%) and high risk (>60%) of 30-day MI or death; and 2) that hsTn adoption will not affect hospital admission rates but will be associated with decreases in ED length of stay and downstream cardiac testing as well as lower 30-day MI or death amongst discharged patients.

Status: We launched the new tool in early 2023. We published our first study with *JACC Adv*: Diagnostic performance of high-sensitivity cardiac troponin I in a multicenter US ED cohort. We are continuing to collect data.

27. Safety of treating black widow spider envenomation with antivenom

Principal Investigator: **Steve R. Offerman** (Toxicology Service; South Sacramento)

Co-investigators: Patrick X. Whiteley (Toxicology Service; San Jose)

Funding: None

Summary: Black widow spider (BWS) antivenom (Antivenin: *Latrodectus mactans*; Merck) is a horse serum-derived product available since 1954. Concerns about side effects and allergic reactions limit its use. There is one reported case of death following BWS antivenom. There continues to be controversy related to spider antivenom and a lack of data regarding safety. We present a retrospective, data-only cohort study of patients who received BWS antivenom after consultation from the Kaiser Permanente Northern California (KPNC) Medical Toxicology service between 9/1/2014 through 9/30/2023. The KPNC Medical Toxicology service provides consultation throughout 22 facilities in Northern California. All cases were extracted from existing Toxicology service patient logs.

Status: We have identified 57 eligible study patients. We presented an abstract of our findings at the 2024 annual meeting of the American College of Medical Toxicology in Washington, DC, in April. The manuscript is in preparation.

28. 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, Eric Abrams (San Diego)

Study Site: KP 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.

29. Safety and operational impacts of ED mis-triage

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

Co-investigators: Dustin G. Mark (Oakland/Richmond), Mary E. Reed, E. Margaret Warton, and Adina S. Rauchwerger (KP Division of Research, Oakland), and the KP CREST Network

Study Sites: KP Northern California

Funding: KP Northern California Community Health Program

Summary: ED triage systems exist to sort patients based on acuity and expected resource use. Our study team previously developed and validated novel measures to identify mis-triage for patients triaged using the Emergency Severity Index. Mis-triage can be under-triage (under-recognition of disease severity or resource needs) or over-triage. Using these measures, we estimate that one-third of KPNC adult ED patients and nearly two-thirds of KPNC pediatric ED patients were mis-triaged across KPNC from 2016-2020. In this current proposal, we will build on this work to broadly characterize the potential safety, quality, and operational implications of under- and over-triage among adult and pediatric patients. Specifically, we will conduct adjusted analyses to study the association of under-triage with delays in care and downstream patient outcomes (safety and quality outcomes) and the association of over-triage with ED length of stay and delays in care (operational outcomes). We plan to conduct a sub-analysis of the impact of under-triage specifically among patients with an ED diagnosis of severe sepsis or septic shock, for whom delays in care are associated with worse patient outcomes.

Status: Data collection ongoing

30. Improving safety and quality of emergency care using machine learning-based clinical decision support at triage

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

Co-investigators: Dustin W. Ballard (San Rafael), Mamata V. Kene (San Leandro/Fremont), Dustin G. Mark (Oakland/Richmond), Mary E. Reed and E. Margaret Warton (KP Division of Research, Oakland), and the KP CREST Network

Study Sites: KP Northern California

Funding: Agency for Healthcare Quality and Research

Summary: To manage patient visits every year, U.S. EDs prioritize allocation of limited health care resources to patients in greatest need. Most EDs use a flawed, subjective triage system which leads to mis-triage in up to one-third of patient encounters, worsening ED crowding and contributing to delays and disparities in care. ED triage research has been largely limited, having focused on hospital admission outcomes (even though 80-90% of ED visits do not result in hospital admission), and having not included pediatric visits (which represent 1 in 4 ED visits), health equity in design or prediction model evaluation, a user-centered design, or key patient safety and quality measures. This study will address these unmet needs by creating and testing a novel digital health solution using advanced predictive analytics and patient EHR data to better prioritize patient needs and acuity in the ED setting. First, we will refine triage models that predict critical illness, hospital admission, and fast-track eligibility; then measure algorithm biases and explore strategies to improve equity in triage model predictions. Second, we will map probability thresholds for each outcome into clinically relevant triage category recommendations. Using a human factors framework, we will design, build, and evaluate clinician-facing triage clinical decision support (CDS) and build the models and CDS into our EHR to efficiently display triage recommendations as part of standard workflows. Third, in a pragmatic trial across 21 hospital-based EDs and one free-standing ED, we will assess the real-time impact of CDS, measuring timeliness of care for critically ill patients, appropriate early identification of fast-track eligible patients, and ED length of stay. In addition, to test equity-driven model calibrations, we will assess bias by race, gender, and socioeconomic status. Overall, we aim to demonstrate how advanced predictive analytics and an effective user interface can be utilized at the point of care to improve ED triage by accurately predicting acuity and care complexity and prioritizing equity. Ultimately, our research will limit crowding, streamline operational flow, mitigate disparities, and lead to safer, higher quality care and better outcomes in the ED setting.

Status: Undertaking data collection

31. Assessing frequency and predictors of under- and overtriage of pediatric 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

Study Sites: KP Northern California

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: We presented an abstract Society of Academic Emergency Medicine annual meeting in Austin, Texas, May 2023. The ms is undergoing peer-review. Manuscript in press at *JAMA Pediatrics*: "Evaluation of Version 4 the Emergency Severity Index among pediatric emergency department patients"

32. ED triage of high-risk conditions

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

Co-Investigators: Dustin G. Mark (Oakland/Richmond), 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

Study Sites: KP Northern California

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 and analysis complete; manuscript in preparation

33. 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.

Study Sites: KP Northern California

Funding: TPMG DARE's Delivery Science Grant Program

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. We recently developed a clinical decision support tool to help predict AHF disease severity and in collaboration with Vinnie Liu and the Hospital Advanced Analytics Team and the HealthConnect team; the tool is now built into our EHR and ready to provide real-time risk estimates and clinical decision support. We also collected 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 worked with cardiology and hospital-based specialist leads to develop care pathways based on patient risk.

We ran a pilot study of the risk tool with decision support in two EDs (Oakland and Richmond) to assess feasibility of extracting HF-relevant data and efficiently presenting these to ED clinicians, assess provider uptake of the tool, and assess safety of patients identified as low risk and discharged home. We collected feedback from clinicians via interviews and surveys, and updated the tool as needed prior to regional implementation and prospective evaluation.

Status: We have published three manuscripts (mss): (1) Outcomes among AHF ED patients by preserved vs reduced ejection fraction (*ESC Heart Fail*) (2) Risk adjusted 30-day mortality and serious adverse event rates among a large, multi-center cohort of ED patients with acute HF (*JACEP Open*). (3) Barriers and opportunities regarding implementation of a machine-learning-based acute HF risk stratification tool in the ED (*Diagnostics*). A fourth ms is in press with *ESC Heart Failure*: "Pilot trial of an electronic decision support to improve care for patients with acute heart failure treated in the ED." Our fifth ms with findings from prospective validation of the risk model (STRIDE:HF) is under peer-review.

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

Principal Investigator: Zeenat Khan, former [KPNC Patient Safety Fellow](#)

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

Study Sites: KP Northern California

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

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 lower odds of receiving an opioid pain reliever.

Status: Data analysis is complete. We presented an abstract at the Institute for Healthcare Improvement Scientific Symposium in 2021 and another at the American College of Emergency Physicians Research Forum in October 2022: Assessment of sociodemographic disparities in ED pain management. We are currently exploring strategies to standardize pain management and will soon pilot test these strategies in the Oakland and Richmond EDs.

35. Improving Care by Defining the Role of Electronic Health Record-Based Alerts In a Fully Integrated Health Care Delivery System for Worsening Heart Failure (IDENTIFY-WHF)

Principal Investigators: Andrew P. Ambrosy (Cardiology, San Francisco) and Alan S. Go (Division of Research)

Co-investigators: **Dana R. Sax** (Oakland/Richmond), Justin J. Slade, Van N. Selby, Jana Svetlichnaya, Ankeet S. Bhatt, and Edward J. McNulty (Cardiology, San Francisco), Amir W. Axelrod (Cardiology, Vallejo), Sirtaz Adatya and Keane K. Lee (Cardiology, Santa Clara), Harshith R. Avula (Cardiology, Walnut Creek), and Howard H. Dinh (Cardiology, South Sacramento)

KP Study Sites: KP Northern California

Funding: The Permanente Medical Group Delivery Science Program

Summary: IDENTIFY-WHF is a prospective, virtual, parallel-group, randomized, quality improvement intervention of EHR-based alerts for WHF to improve the adoption of goal-directed medical treatments (GDMTs) within KPNC. Approximately 1,000 participants will be identified at

KP San Francisco and Santa Clara Medical Centers during an index hospitalization or ED visit for WHF and randomized 1:1 to the intervention or usual care, stratified by service area and left ventricular ejection fraction (LVEF) category. Best practice alerts will be sent to the treating outpatient provider(s) and include (1) the most recent LVEF, vital signs, and laboratory values, (2) current GDMT, and (3) eligible GDMT. Eligible GDMT will be based on regional standards and national HF guidelines and will include the Class (Strength) of and Level (Quality) of Evidence. The primary outcome is the proportion of adults experiencing WHF with an increase in the number of prescribed GDMT classes at 30 days post-discharge from the hospital or ED.

Status: We are collecting data.

36. Impact of fundoscopic cameras in the ED on diagnostic efficiency and accuracy for patients with vision loss

Principal Investigator: **Dana R. Sax** (Oakland/Richmond), Mary Reed (DOR), and Robin Vora (Ophthalmology, Oakland/Richmond)

Co-investigators: Mubarika Alavi

Funding: DARE's Rapid Analytics Unit Program

Study sites: KP Northern California

Summary: Among adult (age ≥ 40 years) patients who were seen in KPNC EDs with an eligible vision-related chief complaint, this study aims to evaluate the impact of deployment of fundoscopic cameras on key process and outcome measures, including ED length of stay, need for in-person ophthalmology consultation, need for 72-hour ophthalmology follow up, and timely diagnosis of high-risk ophthalmologic conditions.

Status: Data collection and analysis are underway

37. Comparing timeliness of care for women seeking contraceptive care by visit modality: in-person, telephone, video, and e-visits

Principal Investigators: **Dana R. Sax** (Oakland/Richmond), Mary Reed (DOR), Eve Zaritsky (OB/Gyn, Oakland/Richmond)

Co-investigators: Jie Huang, Scott Campbell, and CREST Investigators

Funding: Agency for Healthcare Research and Quality

Study sites: KP Northern California

Summary: Among women 18-50 years of age who had an encounter for contraception in 2023 via e-visit, in-person office visit, video visit, or phone visit with the gynecology department, we will

compare timeliness of contraceptive orders and medication receipt as well as need for 7-day gynecology follow up by visit modality.

Status: Data collection and analysis are underway

38. 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)

Study 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: Enrollment is ongoing.

39. 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 (San Diego)

Study Site: KP 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 is undergoing peer-review.

40. Evaluation of a Geriatric Emergency Department program

Principal investigators: Vincent Liu (DOR; pulmonology, Santa Clara)

Co-investigators: Karen A Hauser (Adult hospital medicine, San Francisco), **Jeremy Swartzberg** (Oakland/Richmond), David Schlessinger (DOR), Sites: KP Northern California

Study Site: KP Northern California

Funding: A grant provided by the Dolby Family Foundation.

Summary: Geriatric Emergency Department (GED) programs are designed to improve the care of older adult patients in the ED. These programs identify higher risk older adults in the ED and target geriatric-specific assessments and interventions, with the goal of reducing morbidity and future hospital and ED utilization. For example, GED programs frequently include screening for common geriatric syndromes like falls and delirium. In 2022, we implemented a GED program in KP San Francisco that used a multi-faceted approach to identify and treat higher-risk older adult patients (aged ≥ 70 years) to reduce the downstream impact of emergency care. In this evaluation, we will assess the impact of the KP SFO GED program relative to care delivered in other EDs throughout Northern California among patients who met criteria for potential GED inclusion.

Status: The GED evaluation is currently in data collection and design phase.

41. Physician diagnostic strategies for acute cardiovascular disease

Principal investigator: Brandon Maughan (OHSU)

Co-investigators and study sites: Angela Jarman (UC Davis), Lauren Westafer (U Mass Baystate), Mike Pulia (UW Madison), Elizabeth Goldberg (U Colorado), Chris Baugh (Brigham), Chris Kabrhel (Mass General), Tracy Madsen (Brown), Susan Peterson (Johns Hopkins), Lauren Stewart (Indiana), and **David R. Vinson** (Roseville/Sacramento)

Summary: Using a brief online survey, the study is assessing physician risk perceptions using a randomized factorial experiment via hypothetical patient cases.

Status: Surveys are nearly complete. We hope to submit a manuscript for peer review at the turn of the year.

42. Antenatal pulmonary embolism diagnostics (APED): patients, physicians and diagnostic strategies in the COVID era

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

Co-Investigators: Madeline J. Somers and Mary E. Reed (DOR), Nareg Roubinian (Pulmonology and Critical Care, Oakland), Jeffrey D. Sperling (Maternal and Fetal Medicine, Modesto), Nachi Gupta (Redwood City), Luke S. Poth (South San Francisco), Lara Zedak and Cydney Middleton (UC Davis EM residents), Sara Woldemariam (KP Oakland OB/GYN resident), Ed Qiao (California Northstate medical student), Aidan Campbell (recent NYU undergraduate), Grace Heringer and Cole Florio (UCD pre-meds), Scott D Casey (Vacaville/Vallejo), W. Bo Stubblefield (Vanderbilt), Lauren Westafer (U Mass—Baystate), and the KP CREST Network

Imaging Advisory Panel: Ryan Niederkohr (Nuclear Medicine, Santa Clara) and Thomas Urbania (Chest Radiology, Oakland)

Study Sites: KP Northern California

Funding: KP Northern California Community Health Program

Summary: The diagnosis of acute pulmonary embolism (PE) is challenging, more so in pregnancy, where reducing radiation exposure is paramount. Our multispecialty team utilized the KPNC Perinatal Obstetric Database to identify 720 gravid patients undergoing PE diagnostics over 18 months. We will describe the use of D-dimer levels to direct imaging decisions; the role of compression ultrasonography to avoid pulmonary vascular imaging; and the inter-specialty preferences for CT pulmonary angiography over V/Q scintigraphy. We will also explore issues of informed consent. Results of this large, contemporary community-based study will fill gaps in the literature and inform next steps within KPNC to direct physician education efforts to improve our approach to antenatal PE diagnostics.

Status: We published a letter in *JAMA* and presented three abstracts at the 2024 Western Regional meeting of the Society for Academic Emergency Medicine and two abstracts to ACEP in early October. We published a case series in *Eur Heart J Case Rep* and have a manuscript on consent undergoing peer-review for *Acad Emerg Med*. We just submitted one ms on preemptive anticoagulation for peer review and are currently working on a study of radiation-reduction strategies.

43. Criteria for outpatient management of ED patients with acute PE: A Delphi consensus from EARTH

Principal Investigators: Pierre-Marie Roy (Centre Hospitalier Universitaire, Institut Mitovasc, Université d'Angers, France) and Mathieu Servent (Resident, France)

Co-investigators: Emergency Advisory and Research board on Thrombosis and Hemostasis (EARTH), including ED PE researchers from Belgium, Canada, England, France, Italy, Spain, Sweden, and United States. EARTH Steering Committee: Pierre-Marie Roy and Delphine Douillet (France), Andrea Penaloza (Belgium), Federico Germini (Canada), Chris Kabrhel (MGH), **David R. Vinson** (Roseville/Sacramento), **Scott D. Casey** (Vallejo/Vacaville), and William "Bo" Stubblefield (Vanderbilt)

Summary: Using a Delphi method, we identified 7d outcomes for outpatient PE research and created a set of criteria to aid in the identification of ED patients with acute PE who may be eligible for outpatient care.

Status: We presented an abstract at the annual Congress of the International Society of Thrombosis and Haemostasis in Bangkok, June 2024: "International expert consensus on criteria to assess the safety of home treatment of patients with acute pulmonary embolism". The manuscript is undergoing peer-review.

44. 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), Annie Ma and Tracy Nguyen (UC Davis EM residency), Leyla Farshidpour (UCSF Fresno) and the KP CREST Network

Study Sites: KP Oakland, Richmond, Roseville, Sacramento, and 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 combines 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 in early 2022. We are continuing to enroll patients and collect data. We presented an abstract describing CDS impact on physician decision-making at ACEP in early October.

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)

Study Sites: KP Northern California

Funding: TPMG DARE's Delivery Science Grants Program

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 is in use across 16 of 21 EDs. Our methods paper was published in *Trials*. 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. We presented an abstract to the Society of Academic Emergency Medicine annual meeting in Austin, Texas, in May 2023. We presented an abstract on stroke prevention for presentation at the 2024 annual meeting of the Society for Academic Emergency Medicine in May. Our ms on this topic will be published in November in a general medicine journal. We are undertaking analysis on a rate reduction study.

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

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

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

Study Sites: KP Northern California and beyond

Funding: TPMG DARE's Physician Researcher Program

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 were 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 recently closed with 103 participants. We have published one letter to the editor and hope in the coming months to submit the manuscript for peer review.

47. 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)

Study Sites: KP Northern California

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

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 abstracts at the Society for Academic Emergency Medicine annual meeting, and the American Heart Association meeting in 2019. We presented an abstract to the Society of Academic Emergency Medicine annual meeting in Austin, Texas, in May 2023. The first manuscript will be submitted soon.

48. A qualitative study exploring the experiences of undomiciled adults seeking care in a large urban ED

Principal Investigators: Nichole Zinn, LCSW (Sacramento) and **David R. Vinson** (Roseville/Sacramento)

Co-Investigators: Qais Alemi, PhD, MPH, MBA (Doctoral Advisor, Department of Social Work and Social Ecology, Loma Linda University)

Study Sites: KP Sacramento Medical Center

Summary: Senate Bill (SB) 1152, implemented in 2019, requires hospitals to have a written policy and process for patients experiencing homelessness. Homelessness has increased 67% in Sacramento County since 2019 and almost half of patients experiencing homelessness in Sacramento County have one or more chronic health conditions, mental health issues, and substance use disorders, often using the ED as a safety net. There is a dearth of research regarding the impacts of the bill and no research to date about patients' understanding and view of SB 1152. Our patient survey will provide a descriptive account of patients experiencing homelessness who visit a large urban ED; gain a nuanced understanding of this vulnerable population's needs; examine the impact, if any, that SB 1152 has had on undomiciled patients' well-being; and explore how existing social work interventions implemented in the ED could be augmented/adapted to best serve this population's needs. Our results could inform policy makers and guide social work interventions in the ED for this vulnerable population.

Status: We are working now on the manuscript.

49. Extending IV Tenecteplase Beyond 4.5-hour Window for Patients with Acute Ischemic Stroke

Principal Investigator: Mai N. Nguyen-Huynh (Neurology, Walnut Creek; DOR, Oakland) and Jeffrey Klingman (Neurology, Location)

Co-investigators: **David R. Vinson** (Roseville/Sacramento); Anne C Kim (Radiology, Walnut Creek) Molly Burnett (Neurology, Oakland); Sheila Chan (Neurology, Redwood City); Patricia Zrelak (Nursing Research); Catherine Lee (DOR); Joeffrey R. Hatton (Hospital Quality and Operations); Hemali Sudhalkar (Adult Hospital Medicine, San Jose).

Study Sites: KP Northern California

Funding: The Permanente Medical Group's Delivery Science Program

Summary: This retrospective cohort study will answer this question: In a real-world practice setting, what are the effects on stroke care processes and clinical outcomes when IV tenecteplase (TNKase) is used to treat patients with potential acute ischemic stroke presenting with wake-up stroke or within 4.5 to 9 hours from last known well?

Status: The new pathway launched June 1, 2023. We are examining the outcomes of enrolled patients.

50. Characteristics of pain-related ED visits in patients with cancer receiving treatment within an integrated health system

Principal Investigator: Raymond Liu (medical oncology, San Francisco)

Co-investigators: Andy Avins (DOR and primary care), Jenny Wei (internal medicine residency, KP San Francisco), Prince Wang (student, KP School of Medicine, Pasadena), **David R. Vinson** (Roseville/Sacramento)

Study Sites: KP Northern California

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

Summary: Adult patients with active cancer undergoing systemic therapy often have challenging symptoms from their treatment or cancer itself. One especially burdensome symptom is pain: up to 50% of patients undergoing active therapy have cancer pain. Frequently, cancer pain prompts patients to seek acute medical care in the ED for pain relief. However, some patients may be better served in a different care setting. In this retrospective cohort study, we will analyze KPNC patients with active cancer who have received systemic therapy at an infusion center from 2017 to through 2019 who subsequently (<30d) visited the ED with a chief complaint of pain and were treated with opioids. We will describe the study population and analyze pain characteristics prior to and at the time of the ED visit. We will also examine associations between patient characteristics with the risk and outcomes of ED visits for pain. Results of this study may help identify individuals receiving infusion center care who are at risk of short-term ED presentations for pain treatment and may help guide future studies on care gaps contributing to inadequate pain control among our patients with cancer.

Status: Data collection is underway.

51. Sexual health e-visit as a tool to improve access to prevention and treatment of sexually transmitted infections

Principal Investigators: Amanda Thornton, Dana Clutter (Infectious Diseases); Jacek Skarbinski (Infectious Diseases and Division of Research)

Co-investigators: Jonathan Volk, MD; Michael Silverberg, PhD; Christian Lee-Rodriguez, MD; Mitchell Luu, MD; Christine Bruno, PharmD; **David R. Vinson** (Roseville/Sacramento); Anne Srisuro, MD; Joshua Nugent, PhD

Funding: TPMG's Delivery Science Program

Study Sites: KP Northern California

Summary: Despite the clinical and public health importance of testing and treatment of sexually transmitted infections (STIs), including HIV, gonorrhea, chlamydia, and syphilis, and HIV pre-exposure prophylaxis (PrEP) use among at-risk individuals, STI testing and PrEP uptake rates remain low. To reduce barriers and increase access to sexual health services, the sexual health e-visit was launched in KPNC in February 2022 and is now used by our members approximately 10,000 times per month. The e-visit can be accessed through an online portal (KP.org) and allows members to obtain information on STIs, request appropriate STI testing after answering questions about sexual exposures, and self-refer for PrEP initiation. However, it remains unknown whether the sexual health e-visit increases access to care, STI testing, and PrEP uptake among at-risk individuals more efficiently and effectively than traditional office, telephone or email interactions with primary care providers and/or reduces emergency department utilization sexual health services. This retrospective cohort study will evaluate the role of the sexual health e-visit in members' access to sexual health services. Results will inform future e-visit development within KPNC and the use of similar platforms in other health care systems.

Status: Data collection underway. We have been presenting preliminary findings to various departments across KPNC as well as at national meetings. The first manuscript is underway: "Access to STI testing services after implementation of e-visit."

52. Predictors of early hospital discharge in patients admitted with pulmonary embolism

Principal Investigator: Nareg H. Roubinian (Pulmonology/Critical Care, Oakland/Richmond)

Co-investigators: **David R. Vinson** (Roseville/Sacramento), Mahesh J. Balasubramanian (Adult Hospital Medicine, Roseville), Mary E. Reed, Madeline J. Somers, and Adina S. Rauchwerger (KP Division of Research, Oakland), and the KP CREST Network

Study Sites: KP Northern California

Funding: KP Northern California Community Health Program

Summary: Increasing outpatient management of stable ambulatory clinic and ED patients has changed the population of those being hospitalized with acute pulmonary embolism (PE). With fewer low-risk patients requiring hospitalization, patients admitted are now more complex, with higher severity of illness and more serious comorbidities. This proposal will assess the contemporary characteristics of patients requiring hospitalization for acute PE (Aim 1) and identify characteristics associated with early hospital discharge (<48h) (Aim 2). In Aim 1, we will examine characteristics of hospitalized patients admitted with PE, including trends in vital signs, oxygen requirements, and diagnostic testing at admission and during hospitalization. In Aim 2, we will examine predictors of early hospital discharge vs. prolonged hospitalization at admission and on a daily basis as part of a multivariable model. These results may inform resource allocation to support early hospital discharge or even outpatient management of patients with acute PE in the future. We hope to identify processes of care associated with safe, early discharge (e.g., early discharge on home oxygen for mildly hypoxic patients) that could be streamlined in patients who experienced prolonged hospitalization to facilitate more timely discharge.

Status: We are collecting and analyzing data.

Recent Publications (since Jan 2024)^e

TPMG (Northern CA)

Ballard DW, Huang J, Sharp AL, **Mark DG**, Nguyen THP, Young BR, **Vinson DR**, Van Winkle P, **Kene MV**, Rauchwerger AS, Zhang JY, Park SJ, Reed ME, Greenhow TL. [An all-inclusive model for predicting invasive bacterial infection in febrile infants aged 7-60 days](#). *Pediatr Res*. 2024 Apr 4. Online ahead of print.

DiLena DD, Warton EM, **Vinson DR**, Siqueiros MH, Rauchwerger AS, **Mark DG**, Skarbinski J, Choletti SM, **Durant EJ**, Reed ME, **Ballard DW**; on behalf of the Kaiser Permanente CREST Network. [Smells like a variant: How the association between COVID-19 and olfactory dysfunction changed between 2019 and 2022](#). *J Intern Med*. 2024;295(4):569-571

Bridwell RE, **Barlow JA**, Jacobson AR, Curell A, Long B. [Hereditary Creutzfeldt-Jakob Disease: A case presentation of a rare stroke mimic](#). *Cureus*. 2024;16(3):e55559.

Rouleau SG, **Casey SD**, Kabrhel C, **Vinson DR**, Long B. [Management of high-risk pulmonary embolism in the emergency department: a narrative review](#). *Am J Emerg Med*. 2024;79:1-11.

Casey SD, Stubblefield WB, Luijten D, Klok FA, Westafer LM, **Vinson DR**, Kabrhel C. [Addressing the rising trend of pulmonary embolism mortality: Clinical and research priorities](#). *Acad Emerg Med*. 2024;31(3):288-292.

^e A more comprehensive list of publications from the KP CREST Network can be found online: <http://www.kpcrest.net/>

Casey SD, Sax DR, Mark DG, Rana JS, Solomon MD, Huang J, Reed ME. [Comparison of short-term health care utilization between telemedicine-delivered versus in-person care visits for heart failure.](#) *JACC Adv.* 2024;3(6):100969.

Editorial: Tersalvi G, et al. [Telemedicine-delivered primary care in heart failure: promises and pitfalls of real-world data.](#) *JACC Adv.* 2024;3(6):100971.

[Related telemedicine research](#) by Reed ME, et al.

Li K, Whitely P, Offerman S. [Treatment of Black Widow spider envenomation with antivenom \(antivenin: *Latrodectus mactans*\) did not result in adverse events.](#) *J Med Toxicol.* 2024 Mar 08 [abstract 027].

Israelyan A, Ludlow J, Pyatka N, Durant EJ. [A 78-year-old woman with sudden onset of left-sided hemiballismus.](#) *Am J Case Rep.* 2024;25:e941840.

Mark DG, Horton BH, Reed ME. [Shifts in diagnostic testing for headache in the emergency department, 2015 to 2021.](#) *JAMA Netw Open.* 2024;7(4):e247373.

KP DOR Spotlight: [ER physicians moving away from lumbar puncture for headache evaluation](#)

[Related CREST publications](#)

Mark DG, Huang J, Ballard DW, Vinson DR, Rana JS, Sax DR, Rauchwerger AS, Reed ME. [Emergency department referral of patients with chest pain for noninvasive cardiac testing and 2-year clinical outcomes.](#) *Circ Cardiovasc Qual Outcome.* 2024;17(6):e010457.

KP DOR Spotlight: [More testing may not benefit most patients with CP but no signs of a heart attack](#)

[Related CREST publications](#)

Roubinian NH, Green J, Liu VX, Lee C, **Mark DG, Vinson DR,** et al, for the NHLBI Recipient Epidemiology and Donor Evaluation Study-IV-P (REDS-IV). [Clinical outcomes in hospitalized plasma and platelet transfusion recipients prior to and following widespread blood donor SARS-CoV-2 infection and vaccination.](#) *Transfusion.* 2024;61(1):53-67.

Stapleton SN, Cassara M, Roth B, **Matulis C,** Desmond C, Wong AH, Cardell A, Moadel T, Lei C, Munzer BW, Moss H, **Nadir NA.** [The MIDAS touch: Frameworks for procedural model innovation and validation.](#) *AEM Educ Train.* 2024;8(Suppl 1):S24-S35.

Hassid BG, Wei J, **Sax D,** Velayos FS. [Risk factors for recurrent emergency care utilization for flares in inflammatory bowel disease.](#) *Acad Emerg Med.* 2024;31(1):28-35.

Leung CJ, Bhatt AS, Go AS, et al, **Sax DR,** Goyal P, Varshney AS, Sandhu AT, Gustafson SE, Ambrosy AP. [Sex-based differences in the epidemiology, clinical characteristics, and outcomes associated with worsening heart failure events in a learning health system.](#) *J Card Fail.* 2024;30(8):981-990

Hamilton SA, Ambrosy AP, Parikh RV, Tan TC, Fitzpatrick JK, Avula HR, Sandhu AT, Ku IA, Go AS, **Sax D**, Bhatt AS. [Applying natural language processing to identify emergency department and observation encounters for worsening heart failure](#). *ESC Heart Fail*. 2024;11(5):2542-2545.

Campbell AR, Heringer GV, Yamagata AS, **Vinson DR**. [Child with right eye pain following streptococcal pharyngitis](#). *Ann Emerg Med*. 2024;84(1):84-85

Najarro M, Rodríguez C, Morillo R, Jara-Palomares L, **Vinson DR**, Muriel A, Álvarez-Mon M, Yusen RD, Bikdeli B, Jimenez D. [C-reactive protein and risk of right ventricular dysfunction and mortality in patients with acute symptomatic pulmonary embolism](#). *Arch. Bronconeumol*. 2024;60(6):344-349.

Abstracts Presented at the National Society for Academic Emergency Medicine Meeting

- **Casey SD**, Greenhow TL, DiLena DD, Somers MJ, Nguyen T, Reed ME, **Ballard DW**. Predictors of blood culture results and ordering decision for febrile children in the emergency department. *Acad Emerg Med*. 2024;31(S1):337 [abstract 762].
- DiLena DD, **Durant EJ**, Warton M, Reed ME, Rauchwerger AS, Skarbinski J, Siqueiros MH, Cholleti SM, **Mark DG**, **Vinson DR**, **Ballard DW**. Clinical and patient characteristics associated with long-haul symptoms following an acute COVID-19 infection. *Acad Emerg Med*. 2024;31(S1):348-349 [abstract 788].
- **Kei J**, Van Woy L, Mannarino A. Using computed tomography to assess optimal hand placement during cardiopulmonary resuscitation. *Acad Emerg Med*. 2024;31(S1):22 [abstract 31].
- Zanaboni A, Blustein EC, **Lew V**, Lothet E, Maxwell N, Theodoro DL, Ablordeppey E. Change is hard: Fascia iliaca compartment block utilization for hip fractures. *Acad Emerg Med*. 2024;31(S1):371 [abstract 839].
- **Vinson DR**, Warton M, **Durant EJ**, Rauchwerger AS, DiLena DD, Solomon MD, Kea B, Reed ME, **Mark DG**. Impact of emergency department decision support on initiation of atrial fibrillation thromboprophylaxis. *Acad Emerg Med*. 2024;31(S1):189 [abstract 397].

Abstract Presented at the International Society of Thrombosis and Hemostasis Congress

- Servant M, **Casey SD**, Stubblefield WB, Douillet D, Germini F, Penaloza A, Kabrhel C, Huisman MV, **Vinson DR**, Roy P. International expert consensus on criteria of home treatment of patients with acute pulmonary embolism. *Res Pract Thromb Haemost*. 2024;8(Suppl. 2): in press for Oct.

SCPMG (Southern CA)

Tin D, Granholm F, **Guirguis M**, Almulhim M, Ciottone G. [Integrating disaster and dignitary medicine principles into a medical framework for organizational travel health and security planning](#). *Prehosp Disaster Med*. 2024 May 17:1-3. Online ahead of print.

Hess S, Knopov A, **Matulis C**, Ebert E, Kerrigan D, Lipner K, Savarino J, Clyne B. Creation of a resident-led medical student education committee. *AEM Educ Train*. 2024;8(3):e11004.

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