Research and Academics in KP California Emergency Medicine

Quarterly Report: 2025 Q2

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Hot Off the Press[a]

TPMG (Northern CA)

Brophy S, Hitomi N, **Bains G**. Beyond the usual age: a case report on segmental colitis associated with diverticulitis in a young patient. *Cureus*. 2025;17(3):e80661.

Shteyler VM, Feldmeier M, Bagay RJG, **Ballard D**, Colwell C, Hsia RY. Racial and socioeconomic disparities in California ambulance patient offload times. *JAMA Netw Open.* 2025;8(5):e2510325.

Greenhow TL, Nguyen TH, Somers MJ, **Vinson DR, Mark DG**, Van Winkle PJ, Reed ME, DiLena DD, Rauchwerger A, **Ballard DW**. Assessing the risk of urinary tract infections and invasive bacterial infections in febrile infants aged 7-90 days with COVID-19. *Cureus.* 2025;17(4):e82405.

> Study results used to revise the KPNC/KPSC clinical guidelines, updated on the KP Clinical Library (KPNC intranet link): California Febrile Infant Risk Stratification Tool: Clinical Reference | NCAL Clinical Library

Kea B, Warton EM, Kutz CE, Kinney E, **Ballard DW**, Reed ME, Lip GYH, Raitt M, Sun BC, **Vinson DR**; KP CREST Network. Stroke prophylaxis after US emergency department diagnosis and discharge of patients with atrial fibrillation and flutter from 21 hospitals. *Int J Emerg Med.* 2025;18(1):97.

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[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. Updates for coming quarterlies can be sent to David R. Vinson, KP CREST Network: david.r.vinson@kp.org

Stubblefield WB, Rouleau SG, **Casey SD.** Low risk pulmonary embolism and outpatient management from the emergency department. In: Grodzin CJ, Merli GJ, Ross CB, Rosovsky R. (eds) PERT Consortium Handbook of Pulmonary Embolism, 2025. Springer, Cham.

Durell K, **Hooley A**. Utility of combining a simulation-based method with lecture for retinopathy training in emergency medicine residency. *Spartan Med Res J*. 2025;10(1):1-11.

Kene MV, Sax DR, Bhargava R, Somers MJ, Warton EM, Zhang JY, Rauchwerger AS, Reed ME. Post-telemedicine acute care for undifferentiated high-acuity conditions: is a picture worth a thousand words? *Telemed J E Health*. 2025;31(5):569-578.

Mark DG, Huang J, Lee KK, **Sax DR, Ballard DW, Vinson DR**, Reed ME. Implementation of a high-sensitivity cardiac troponin assay and algorithm for suspected acute coronary syndrome in an integrated health system. *Am J Cardiol.* 2025;251:25-33.

Meyer M. Sabbatical, Interrupted—I crafted the break I needed—and you can too. *MedPage Today*. Posted May 6, 2025.

Meyer M. A Watershed Moment for Texas—The recent flood offers some tough lessons on disaster preparedness. *MedPage Today*. Posted July 11, 2025.

Meyer M. Blazing a Trail Against Wildfires: New research helps unlock the secret to staying safe from wildfire smoke. *The Scientist*. Posted July 13, 2025.

Sax DR, Warton EM, **Mark DG**, Reed ME. Emergency department triage accuracy and delays in care for high-risk conditions. *JAMA Netw Open.* 2025;8(5):e258498.

> **Editorial:** Trueger NS, Friedman AB. Triage, the tip of the shears. *JAMA Netw Open*. 2025;8(5):e258508.

Sax DR, Huang J, **Mark DG**, Rana JS, Solomon MD, **Norris RP**, Reed ME. Prospective validation and implementation pilot study of an emergency department heart failure risk stratification tool: STRIDE-HF. *JACC Heart Fail.* 2025;13(6):958-969.

> **DOR Spotlight:** Risk tool improves ED care for patients with heart failure
>
> **AMA Video Interview** (10m): https://youtu.be/ti-3HTWoLgY?si=8sqUsvYlnl3DUA2g

DiLena DD, Zhang JY, Rauchwerger AS, Reed ME, Marcus GM, Warton EM, **Vinson DR**. Characterizing patients with cold drink-triggered atrial fibrillation. *J Cardiovasc Electrophysiol.* 2025 June 12. Online ahead of print.

> **DOR Spotlight:** Cold drinks can trigger atrial fibrillation
>
> **MedPage Today:** People Are Swearing Off Cold Drinks to Prevent Afib

Landman AB, Tilak SS, **Walker GA**. Artificial intelligence-generated emergency department summaries and hospital handoffs. *JAMA Netw Open.* 2024;7(12):e2448729.

Antevy P, Scheppke KA, Coyle C, Tenenbaum S, Aran G, Leser J, Burdett N, Farcy DA, **Zitek T**. Prehospital sepsis recognition and antibiotic administration: a retrospective analysis. *Prehosp Emerg Care.* 2025 Apr 14. Online ahead of print.

SCPMG (Southern CA)

Kawatkar AA, Baecker AS, **Sharp AL,** Redberg RF, Lee MS, Ferencik M, Goodacre S, Thokala P, Wu YL, Zheng C, Shen E, Sun BC. Association of early noninvasive cardiac stress testing with acute myocardial infarction and mortality. *Ann Emerg Med.* 2025 Apr 7. Online ahead of print.

Kawatkar AA, Thokala P, Goodacre S, Baecker AS, **Sharp AL**, Redberg RF, Lee MS, Ferencik M, Sun BC. Cost-effectiveness of early noninvasive cardiac testing for suspected acute coronary syndrome. *Acad Emerg Med.* 2025 May 24. Online ahead of print.

Regional and National Abstract Presentations

Pediatric Academic Societies 2025 Meeting

- **Kene MV**, Somers M, **Ballard D**, Rauchwerger A, DiLena DD, **Sax D**, Reed M, Greenhow TL. ED visits for acute respiratory illness: epidemiologic changes pre- to post-COVID-19. [abstract 97]
- DiLena DD, **Casey SD**, Greenhow TL, Somers M, Rauchwerger A, Nguyen T, Reed M, **Vinson DR**, **Ballard DW**. Diagnostic yield of chest radiography among febrile infants aged 91-365 days in the emergency department [abstract 276]

Society for Academic Emergency Medicine 2025 Meetings

- Akkad J, Somers MJ, Rouleau SG, Reed ME, Pai AP, Roubinian NH, Sperling JD, **Vinson DR**. Early discharge of pregnant patients with acute PE across 21 community EDs. Presented at the Western Regional SAEM Meeting, Irvine, CA, April 2025.
- DiLena DD, Huang J, Rauchwerger AS, **Mark DG, Vinson DR, Durant EJ**. Identifying lower-risk patients among the intermediate-risk group of a hs-cTn algorithm for chest pain evaluation. *Acad Emerg Med*. 2025;32(S1):39-40 [abstract 67].
- Vora N, Do T, Alavi M, Reed ME, Gilbert A, Vora R, **Sax DR**. Fundoscopic cameras in emergency department improve care delivery and efficiency for acute vision change patients. *Acad Emerg Med*. 2025;32(S1):102 [abstract 202].
- Bui JN, Yusvirazi L, Herout K, Stram D, Lew V, River G, **Durant EJ**. Emergency department ultrasound-guided nerve blocks for hip fracture analgesia: a retrospective cohort study. *Acad Emerg Med*. 2025;32(S1):157 [abstract 321].
- Heringer GV, Campbell AR, Florio CJ, Qiao E, Middleton CE, Somers MJ, Reed ME, Stubblefield WB, **Casey SD, Vinson DR**. Preemptive anticoagulation during antenatal pulmonary embolism diagnostics across 21 community medical centers. *Acad Emerg Med*. 2025;32(S1):185-186 [abstract 383].
- Westafer LM, Walsh PT, Helderman R, Strokes N, Stubblefield W, **Vinson DR**. Clinician insight Into uncertainty communicated in pulmonary embolism diagnostic imaging: a qualitative analysis. *Acad Emerg Med*. 2025;32(S1):244 [abstract 509].
- Huckleberry A, Hegardt M, **Tafoya C, Chiang C, Matulis C**. Simulation-Based Aquatic Emergency Curriculum for Emergency Medicine Resident Education. Presented at the Western Regional SAEM Meeting, Irvine, CA, April 2025.

- Hegardt M, Huckleberry A, **Tafoya C, Chiang C, Matulis C.** Understanding Emergency Physicians' Knowledge and Attitudes toward Aquatic-related Emergencies. Presented at the Western Regional SAEM Meeting, Irvine, CA, April 2025.

American College of Obstetricians and Gynecologists 2025 Annual Clinical & Scientific Meeting

- Woldemariam ST, Campbell AR, Florio CL, Heringer GV, Sperling JD, **Vinson DR**. Preemptive anticoagulation during antenatal PE diagnostics in a community setting: prevalence and eligibility. *Obstet Gynecol.* 2025;145(6S):39S [abstract ID 1213].
- Bindra A, Torres-Rodriguez J, Bolton E, Huang J, Reed M, **Sax D**, Zaritsky E. Evaluating e-visit utilization and efficacy for contraception in a large, integrated healthcare system. 2025;145(6S):39S [abstract ID 1192]. *First prize oral abstract!*

The American Society of Clinical Oncology Meeting

- Zang MZ, Somers MJ, Dang A, Huang T, Triplett C, Reed M, Sakoda LC, **Vinson DR**, Liu R, Ragavan M. Impact of diagnostic workup location on time to treatment for patients with non-small cell lung cancer seen in the emergency department. Abstract #e13518
- Anderson B, Zhang V, Zhu S, Tamima S, **Vinson D**, Liu R. Unveiling the hidden burden: Prevalence and disparities of cancer diagnosed in emergency and hospital settings. Abstract #e13748.

International Society on Thrombosis and Haemostasis 2025 Annual Congress

- Stubblefield WB, Grewall K, **Casey SD, Vinson DR**, de Wit K, Roy PM, Kabrhel C, Hugli O. An International Survey of Emergency Physicians to Assess Stress from Uncertainty and Risk Taking in Preemptive Anticoagulation for Patients with Acute Pulmonary Embolism. Abstract OC 01.4

Council of Residency Directors in Emergency Medicine (CORD)

- Shekem N, **Matulis C,** Sigal A, Li-Sauerwine S, Grabow Moore K. Foundations of Emergency Medicine: Development, Use, and Satisfaction of a Novel Curriculum Focusing on Lower Acuity Conditions.

Just Launched or Added

1. Evidence-based risk stratification of patients with acute pulmonary embolism: Communication from the ISTH SSC Subcommittee on Predictive and Diagnostic Variables in Thrombotic Disease

Principal Investigator: Erik Klok (Leiden University Medical Center, Netherlands)

Co-investigators: The ISTH SSC Subcommittee on Predictive and Diagnostic Variables in Thrombotic Disease, including Rosa Talerico, Kerstin de Wit, Stefano Barco, Jose Bonorino, Corstiaan den Uil, Carlos Elzo Kraemer, Federico Germini, Aaron Iding, Aubrey Jones, Stavros Konstantinides, Camila Masias, Anna L. Parks, Helia Robert-Ebadi, Tobias Tritschler, Maria Cristina Vedovati, **David R. Vinson**, and Scott C. Woller,

Summary: We aim to provide evidence-based guidance on the use of risk stratification tools for four critical management decisions in acute PE:

- Determining the need for hospitalization;
- Deciding whether the patient requires admission to an intensive/high care unit;
- Initiating reperfusion therapy;
- Timing of discharge from hospitalization.

2. Comparing Guideline Documents for Atrial Fibrillation: Focus on Emergency Medicine

Principal Investigator: Clare L Atzema (Institute of Health Policy, Management, and Evaluation, University of Toronto, Toronto, ON, CAN)

Co-investigators: Jafna L Cox (Cardiology, Nova Scotia), Christopher C Cheung (Cardiology, Toronto), Blanca Coll-Vinent (Emergency Medicine, Madrid), Emelia J. Benjamin (Medicine and Epidemiology, Boston), Cynthia A. Jackevicius (Pharmacology, Toronto), **David R Vinson**

Summary: The European Society of Cardiology and the American College of Cardiology, American Heart Association, American College of Clinical Pharmacy, and Heart Rhythm Society have both recently updated their guidelines on the management of atrial fibrillation (AF), while the Canadian Cardiovascular Society (CCS) and Canadian Heart Rhythm Society (CHRS) published their most recent guidelines in 2020. Overall, these guidelines are more specific in their recommendations than in previous iterations, particularly with respect to emergency department care. While the principles that underpin each group's recommendations are similar, some of the details vary, which may lead to provider confusion. In addition, no publication has compared all three specifically on the recommendations that are specific to emergency medicine, nor contextualized them with the recommendations made by two national emergency medicine groups. In this Concepts paper, we compare and contrast the different guideline documents, highlighting differences as well as contextualizing the underlying rationale provided by each group, while providing practical insights for implementation in the ED setting.

Ongoing Research Projects[b]

1. 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

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

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: Abstract presented at KP San Diego Emergency Medicine/Family Medicine Research Symposium 2024.

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

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

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

Study Sites: KP Northern California

Funding: The Permanente Medical Group Delivery Science Research initiative

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 undergoing peer-review, as is our third, examining health utilization associated with PASC.

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

3a. Infant Fever Study (original study)

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

Co-Investigators: KP CREST Network, Adam L. Sharp (DRE[c] 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 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 deployed these incidence data in a structured electronic clinical decision support (CDS) module that 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. The project continues in the expansions below (3b and 3c)

3b. California Febrile Infant Risk Stratification Tool (CA FIRST) Study

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 latest American Academy of Pediatrics (AAP) guidelines. 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. In this second phase, we are (1) retrospectively validating the CA FIRST protocol in a large cohort febrile infants in KPSC and compare its performance with the AAP guidelines; (2) prospectively evaluating the performance of the CA FIRST protocol in KPNC for key safety and diagnostic outcomes; and (3) expanding decision support in KPNC to promote best

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

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 presented an abstract in May 2023 on the diagnostic yield of blood cultures in the 91-365-day population. Aim 2 data collection continues with over 6,400 prospective enrollments for infants aged 7-90 days.

3c. 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 is expanding our ongoing work (see studies 5a/5b above) to improve the care of febrile infants with the following four aims: (1) We will retrospectively validate CA FIRST in KPNC and KPSC outpatient settings using data from 2021-2024. (2) We will 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) 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 will 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.

Status: We are starting prospective analysis/validation of our algorithms and completing retrospective validation in the KPSC population. An abstract has been submitted to Pediatric Hospital Medicine. Another manuscript examining the risk profiles of febrile infants with COViD-19 is undergoing peer review. We plan to extend our investigation to the outpatient setting -- this extension is under IRB review.

4. 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're presenting an abstract at Digestive Disease Week in San Diego in May. The ms is being written.

5. Clinical guideline-discordant ED bronchiolitis management: incidence, predictors, and impact

Principal Investigator: **Scott D. Casey** (Vallejo and Vacaville)

Co-investigators: Dustin W. Ballard (San Rafael), Tara L. Greenhow (Pediatric Infectious Diseases, San Francisco), Tran H. Nguyen (Pediatric Hospital Medicine, Roseville), Stuart Dalziel (Pediatric Emergency Medicine, New Zealand), Ross M. Perry (Pediatrics resident, Oakland), Madeline J. Somers and Mary E. Reed (DOR), and the KP CREST Network

Funding: KPNC Community Health Research Program

Study Sites: KPNC

Summary: Bronchiolitis is a pediatric respiratory infection commonly diagnosed in the ED. Although bronchiolitis has clear diagnosis and treatment guidelines, preliminary data from KPNC suggest that >40% of children with bronchiolitis received ED testing or treatment that did not conform to clinical guidelines. This retrospective study will determine the prevalence of clinical guideline discordant care of ED patients ≤2 years of age with a primary diagnosis of bronchiolitis over an 8-year period. First, we will describe key characteristics of our cohort. Second, we will stratify the cohort by guideline discordant treatment and examine bivariate associations between discordant treatment and characteristics of interest. Third, we will test our hypotheses regarding the associations of characteristics of interest and clinical guideline discordant care using modified Poisson multivariate regression analyses to report results as adjusted relative risks. Finally, we will compare characteristics of patients with and without clinical guideline discordant care and the length of time spent in the ED. We hypothesize that clinical guideline discordant care will be associated with longer LOS, due to time required for treatment. The results will inform the design

and implementation of a physician-level intervention to decrease clinical guideline discordant bronchiolitis care.

Status: We are analyzing data and writing the manuscript.

6. 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: EDs across several countries

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 have completed data collection and are composing the ms. We presented an abstract at the 2025 Congress of the International Society of Thrombosis and Haemostasis in DC.

7. 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.

8. Safety of atrial fibrillation antiarrhythmic regimen using IV calcium and beta blockers

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

Co-investigators: Taylor Liu (Electrophysiology, Santa Clara), Mary Reed, Margaret Warton, and Adina Rauchwerger (KP DOR), and David R. Vinson (Roseville and Sacramento), and the KP CREST Network

Funding: KPNC Community Health Research Program

Study Sites: KPNC

Summary: We will determine the prevalence and outcomes in the use of combined IV rate-reducers for the acute treatment of atrial fibrillation (AF) with rapid ventricular response. Our research question is: among adult patients in the ED receiving combined therapy with IV beta blockers and calcium channel blockers for AF with rapid ventricular response, what is the 4-hour incidence of adverse events (e.g., bradycardia or hypotension requiring IV medications, cardiopulmonary resuscitation, death) compared with patients receiving monotherapy with either medication? This is a retrospective cohort study of adult patients who were treated with IV beta blockers or calcium channel blockers for a primary diagnosis of AF in the ED from 1/1/2010 to 12/31/2024. The study addresses a clear and pressing knowledge gap, as there are currently limited data on the safety of combined IV beta blockers and calcium channel blockers compared with monotherapy for rapid AF.

Status: We have begun data collection.

9. 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*. Our prediction rule manuscript was published in *Am J Emerg Med*: CT Use Reduction In Ostensive Ureteral Stone (CURIOUS). We are now undertaking a complementary study to evaluate how the magnitude of hydronephrosis correlates with clinically important ureteral stones.

10. 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.

11. 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.

12. 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 funduscopic images.

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

13. 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 Sacci (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.

14. 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.

15. 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, Pleasanton), 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.

16. 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 gave an oral presentation at the American College of Emergency Physicians Research Forum, Philadelphia, PA, October 2023. The ms is undergoing peer-review.

17. 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: Latrodetus 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.

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

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

Co-investigators: 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.

19. 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.

Status: Data collection completed. Abstract presented at 2025 KP San Diego Emergency Medicine/Family Medicine Research Symposium.

20. 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, Pleasanton), 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

21. 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, Pleasanton), 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

22. 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: The Permanente Medical Group Delivery Science Research initiative

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 5 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*); (4) Pilot trial of an electronic decision support to improve care for patients with acute heart failure treated in the ED (*ESC Heart Failure).* (5) Prospective validation and implementation pilot study to assess safety of an emergency department risk stratification tool for patients with acute heart failure: KPCARES-HF in

JACC Heart Fail. STRIDE-HF has been deployed across all 21 EDs. We are training all ED physicians across the region on use and will soon evaluate the impact of the risk tool on patient outcomes and utilization.

23. Evaluating diuresis strategies for ED patients with acute heart failure

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

Co-investigators: Dustin G. Mark (Oakland and Richmond), Jamal Rana (Cardiology, Oakland), Mary Reed and Jie Huang (DOR), and the KP CREST Network

Funding: KPNC Community Health Research Program

Study Sites: KPNC

Summary: We seek to understand current ED practice in diuresis of patients with acute heart failure (AHF), and to evaluate how different diuretic dosing strategies, after adjusting for other factors, are associated with patient outcomes. We plan a retrospective cohort study of all ED encounters by KPNC members with AHF who received an IV diuretic from January 1,2023 – December 31, 2024. Patients will be identified using the natural language processing algorithm our study team previously developed and validated to improve case identification of ED patients with AHF. In Aim 1, we will use descriptive statistics to to evaluate current practice around timing, dosing, and monitoring for ED diuresis; in Aim 2, we will use a multivariate logistic regression model (high versus non-high initial diuretic dose) to assess whether any patient or visit characteristics are significantly associated with initial dosing selection; in Aim 3, we will compare otherwise similar patients who receive different initial diuretic doses to assess how the dose selection is associated with patient outcomes using inverse probability weighting. Information from this study could help inform protocols for ED diuresis, as well as strategies for effective decongestion in alternate care spaces.

Status: We are collecting data. We submitted an abstract to the American Heart Association National Meeting (New Orleans, November 2025).

24. 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 Research initiative

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.

25. 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: We presented an abstract at SAEM in 2025. Manuscript is undergoing peer-review.

26. 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: Manuscript is undergoing peer-review. We presented an abstract at ACOG: Evaluating e-visit utilization and efficacy for contraception in a large, integrated healthcare system.

27. To walk-In or not to walk-In: Understanding mode of arrival choices among acute stroke patients in KPNC and their effects on stroke care processes and outcomes

Principal Investigator: Mai N. Nguyen-Huynh (Neurology, Walnut Creek)

Co-PI: **Dana R. Sax** (Oakland/Richmond), Molly Burnett, Patricia Zrelak, Navdeep Sangha

Study Sites: KPNC and KPSC

Funding: Garfield Memorial Fund

Summary: There is less understanding about why patients with acute stroke symptoms choose to arrive at an ED via "walk-in" instead of via ambulance or emergency medical services (EMS), or what the effects of that decision on stroke care processes and outcomes. Aim 1 is to assess predictors of ED mode of arrival among stroke patients. Aim 2 is to determine the effects of ED arrival mode on acute stroke alert processes including thrombolytic treatment time and outcomes at discharge and at 90-day. Aim 3 is to survey patients' knowledge about stroke risk factors, signs and symptoms, factors influencing their choice of ED arrival mode, and identify areas with opportunity for improvement.

Status: Data collection and analysis are ongoing. We presented two abstracts at the 2025 International Stroke Conference in LA in February.

28. 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.

29. 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 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 have published a letter in *JAMA,* a study of consent in *Acad Emerg Med*, and a study of preemptive anticoagulation in *Res Pract Thromb Haemost*. A study of imaging-reduction strategies is under revision for *JAMA Netw Open*. A study of advanced imaging preference and performance is undergoing peer review. A study of diagnostics in pregnant patients with COVID-19 is being written.

30. Outpatient management of pregnancy-associated pulmonary embolism

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), Ashok P. Pai (Hematology/anticoagulation, Oakland), Jemma Akkad and Sam Rouleau (UC Davis resident and fellow, respectively), Audrey Mvemba (KP Oakland OB/GYN resident), and the KP CREST Network

Funding: KPNC Community Health Research Program

Study Sites: KPNC

Summary: Emergency physicians and obstetricians across KPNC discharge home select pregnant and postpartum patients with acute pulmonary embolism (PE) within 24 hours of their arrival to the ED and Labor and Delivery, respectively. This practice of rapid diagnostics, brief observation, and expedited discharge with close follow-up is known as outpatient management. Strangely, such a practice, though recommended by professional society guidelines, has never been described in the literature. With a 14-year retrospective cohort study across 21 medical centers from 2011 through 2024, our established multidisciplinary team (emergency medicine, maternal-fetal medicine, pulmonology, and hematology) will address 3 unexplored questions: (1) What is the prevalence of outpatient management of pregnancy-associated PE across KPNC? (2) What patient- and facility-level variables characterize those selected for outpatient care? (3) How safe is the practice as measured by the 7-day incidence of PE-related hospitalization and all-cause mortality? Results of this first-of-its-kind study will inform quality improvement measures within KPNC recommendations by professional societies.

Status: Data collection is underway. We recently published a small case series as a teaser: Expanding outpatient management of low-risk pulmonary embolism to the pregnant population. *Eur Heart J Case Rep.* An interim analysis of 6-years of ED-only data was presented at a regional academic emergency medicine conference in April and will be presented at the annual PERT Symposium in September.

31. 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/Richmond), Howard Dinh and **Erik R. Hofmann** (South Sacramento), **Nachi Gupta** (Redwood City), Madeline J. Somers (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 Research initiative

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 EDs. 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. Enrollment is complete. We continue to collect outcome data. We presented an abstract describing CDS impact on physician decision-making at ACEP in October 2024 and presented interim tool performance metrics at UC Davis in April.

32. 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 (UCSF Fresno), and Jennifer Zhang (Harvard MPH student)

Study Sites: KP Northern California

Funding: The Permanente Medical Group Delivery Science Research initiative

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. Our prior research has identified suboptimal rate, rhythm, and stroke prevention treatments across KP Northern California EDs, along with twofold inter-facility variation in hospitalization rates of ED AF patients. 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*. Our ms on stroke prevention was published in *JAMA Netw Open*. We are undertaking analysis on a rate reduction study. 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.

33. 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 we describe the incidence, time lag, and predictors of oral anticoagulation (OAC) prescribing after an ED discharge diagnosis of new AF, determine whether validated outpatient risk stratification scores can identify a subgroup of ED patients discharged with new AF 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.

Status: We have presented several abstracts. The first manuscript was recently published in *Inter J Emerg Med*. The second study will address stroke outcomes.

34. Trends in initial anticoagulation of acute pulmonary embolism during hospitalization 2014-2024: Report from the RIETE registry

Principal Investigators: **David R. Vinson** (Roseville/Sacramento), Manuel Monreal (Universidad Catholica de Murcia, Murcia, Spain) and David Jimenez (Ramon and Cajal University Hospital, Madrid)

Co-investigators: William Bo Stubblefield (Vanderbilt), **Scott D. Casey** (Vallejo/Vacaville), and Manuel Monreal (Universidad Católica San Antonio de Murcia)

Study Sites: 179 sites from 29 countries across Europe, Latin America, and Asia.

Summary: RIETE is an ongoing, prospective multinational observational study of patients with objectively confirmed acute venous thromboembolism (VTE). The registry was begun in Spain in 2001 with the goal of gathering a large sample of patients with VTE, with specific attention to those excluded from typical randomized trials of anticoagulant therapy. This proposed study will address the selection of initial anticoagulation for hospitalized patients, anticoagulation trends over time, and variation between countries. Findings are expected to contrast with the overuse of unfractionated heparin in the United States.

Status: Data collection is underway.

35. 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, Pleasanton), 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. We will be presenting an abstract at the CHEST annual meeting this October in Chicago.

36. Physician perceptions of risk of pulmonary embolism diagnosis using case vignettes

Principal investigator: Brandon Maughan (OHSU)

Co-investigators and study sites include, among others, 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: We will assess physician perceptions of pulmonary embolism (PE) risk using a randomized factorial experiment with a set of hypothetical patient cases with varying levels of risk for PE. We hope to (1) identify the influence of gender and racial bias in ED physicians' perceptions of PE risk and decisions to pursue diagnostic testing and (2) gather pilot data on how physicians perceive the PE risk associated with different elements of ED patient presentations (e.g., symptoms characteristics; medical history; vitals and exam). Ultimately, this study will provide pilot data for a larger study on improving PE diagnosis.

Status: We have included 650 participants across the US and Canada who have evaluated 3,000 hypothetical vignettes. We are working first on a methods paper, then will write up our findings on how patient sex affects PE diagnostics.

37. 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 Delivery Science Research initiative

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. The study period closed March 31, 2025. We are examining outcomes of study patients and will submit an abstract for presentation at the International Stroke Conference.

38. ED care of oncology patients from a new ED/oncology collaboration

38A. 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 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 describe the study population and analyze pain characteristics prior to and at the time of the ED visit. We also examine associations between patient characteristics with the risk and outcomes of ED visits for pain. Results 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.

38B. Preventing Emergency Department Presentations of Lung Cancer in an Integrated Health System (PREVENT ED Study)

Principal Investigators: Brandon Anderson (resident, KP SFO) and Raymond Liu (medical oncology, San Francisco)

Co-investigators: Lori Sakoda, Mary E Reed, Madeline J Somers (DOR), Arun Dang, Tina Huang, Seema Pursnani , and Cynthia Triplett (Santa Clara), **David R. Vinson** (Roseville/Sacramento)

Study Sites: KP Northern California

Funding: TPMG DARE Targeted Analysis Program

Summary: Lung cancer is the main cause of cancer mortality in the United States, contributing to more deaths than breast cancer, prostate cancer, and colon cancer combined. Studies have shown that patients who present and have their lung cancer diagnosed in the ED generally have a lower socioeconomic status, more advanced cancer stage, and higher rates of 1-year mortality. Smoking cessation efforts, newer treatments, and screening for lung cancer can improve patient outcomes; however, it is unknown whether these advances have had an equitable impact on ED diagnosis of lung cancer. We aim to characterize the population who presents to the ED for lung cancer diagnosis to understand if improved screening or early symptom identification would impact lung cancer outcomes and equity of care.

Status: Analysis is underway. Our first ms on patient demographics is being written. We presented two abstracts at the 2025 meeting of American Society of Clinical Oncology.

39. 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: The Permanente Medical Group Delivery Science Research initiative

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 ED 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 is complete. We have been presenting preliminary findings to various departments across KPNC as well as at national meetings. The first manuscript will be submitted in the coming months: "E-visit use for sexually transmitted infection (STI) screening in a large integrated healthcare system."

40. Incidence and characteristics of cervical spine fractures in young children presenting to community hospitals

Principal Investigator: **Tony Zitek** (Modesto/Manteca)

Co-investigators: Zaid Alazawi and Edward Durant (Modesto/Manteca)

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

Study Sites: KPNC

Summary: In 2024, the Pediatric Emergency Care Applied Research Network (PECARN) published a cervical spine injury prediction rule for injured children. While reasonable, their data came entirely from level 1 pediatric trauma centers. It is unclear if this rule is applicable to patients who present to community hospitals where these injuries may be exceedingly rare, and mechanisms of injury may differ. We are conducting a retrospective assessment of patients aged 0-7 years old who presented to a KPNC ED for a cervical spine injury between October 1, 2010, and December 31, 2024. We will determine the incidence of cervical spine injuries in this population. We will summarize the clinical characteristics of these patients and compare presentations for patients aged <2 to those 2-7 years old.

Status: A brief report was recently submitted for peer review in an emergency medicine journal.

Recent Publications (since Jan 2025)[d]

TPMG (Northern CA)

Davis GA, Anderson N, Babl FE, **Ballard DW**, et al. International Consensus Definition of 'Sport & Exercise' in Toddlers and Young Children, Children, and Adolescents. *Acta Paediatr.* 2025;114(7):1653-1659

DiLena DD, **Bouvet SC**, Somers MJ, Merchant M, Levin TR, Rauchwerger AS, **Sax DR**. Oakland score to identify low-risk patients with lower gastrointestinal bleeding performs well among emergency department patients. *Int J Emerg Med.* 2025;18(1):19

Servent M, **Casey SD**, Stubblefield WB, Douillet D, Germini F, Penaloza A, Kabrhel C, Huisman MV, **Vinson DR**, Roy PM; Emergency Advisory and Research international board on Thrombosis and Hemostasis (EARTH). Criteria for home treatment of patients with acute pulmonary embolism (the EARTH rule): an international Delphi consensus study. *J Thromb Haemost*. 2025;23(6):1758-1766.

Campbell AR, Florio CJ, Heringer GV, Woldemariam ST, **Casey SD**, Stubblefield WB, Westafer LM, Qiao E, Middleton CE, Zekar L, **Gupta N**, Somers MJ, Reed ME, Roubinian NH, Pai AP, Sperling JD, **Vinson DR**. Preemptive anticoagulation during antenatal pulmonary embolism diagnostics in a community setting. *Res Pract Thromb Haemost.* 2025;9(1):102695.

Durant EJ, Copos S, Folck BF, Anderson M, **Ghiya MS**, **Hofmann ER,** Vuong P, Shan J, **Kene M**. Diagnostic delays are common, and classic presentations are rare in spinal epidural abscess. *West J Emerg Med*. 2025;26(3):692-699.

Multani A, Leon MA, Lee-Haynes L, **Durant EJ.** Miller Fisher Syndrome as a stroke mimic: a case report. *Cureus.* 2025;17(3):e79997.

Meyer MC. What would you do if an Ebola patient checked into your hospital? — The cavalry isn't coming, but the infectious diseases are. *MedPage Today*. 2025 April 1.

Recent coverage of our January publication in *JAMA Netw Open* describing physician perspectives on their overuse of IV heparin for ED patients being hospitalized with pulmonary embolism.

- Westafer LM. Anticoagulant Selection Is Cornerstone of Pulmonary Embolism Treatment. *ACEP Now.* March 11, 2025.
- *ACP Hospitalist*: Thinking Harder about Heparin: Hospitalists, ED physicians, and interventionalists could benefit from a chat about how they treat pulmonary embolism.

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

SCPMG (Southern CA)

Kei J, **Eurick T, Hauck TA**. Intubation Practices in Community Emergency Departments. *Ann Emerg Med.* 2025 Jan 10. Online ahead of print.

Kei J, Jang N, Silver M. National Survey of Airway Management Practices and Training Among Emergency Medicine Residency Programs in the United States. *Perm J.* 2025:29(1):50-60.