



# The Permanente Journal

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social science in medicine, and medical humanities*

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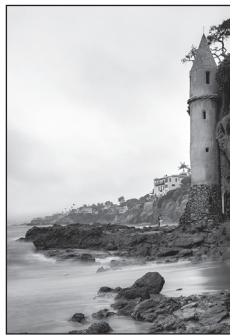
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**Circulation:** 27,000 print readers per quarter, 15,350 eTOC readers, and in 2018, 2 million page views of *TPJ* articles in PubMed from a broad international readership.



**Pirate Tower—Victoria Beach, CA**  
photograph  
**Jorge A Ramirez, MD**

Only accessible at low tide, and currently kept under lock and skeleton key, the 60-ft tall Pirate Tower was built in 1926 as a private enclosed staircase for LA-senator-turned-acclaimed-painter, William E Brown, to make the journey from his home at the top of the cliff down to Victoria Beach. The property has since gone on to be owned

by a cast of characters including actress Bette Midler and a retired naval captain and pirate enthusiast, Harold Kendrick, who dressed in pirate regalia and hosted treasure hunts that included hiding coins in the tower's cracks and crevices.

This photograph is a single long-exposure image, using a 10 f-stops neutral-density filter which produces the "dreamy" appearance of the water. The image was captured in RAW format and processed using Adobe Lightroom Classic.

Dr Ramirez is the Family Medicine Chief at the Downey Medical Center in Southern California.



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Jason Y Adams, MD, MS; Angela J Rogers, MD, MPH; Alejandro Schuler, MS, PhD; Gregory P Marelich, MD; Jennifer M Fresco, MD; Sandra L Taylor, PhD; Albert W Riedl, MS; Jennifer M Baker, MA; Gabriel J Escobar, MD; Vincent X Liu, MD, MSc

This retrospective, observational cohort study of mechanically ventilated patients at 21 community and 2 academic hospitals demonstrated that in 28,758 derivation cohort admissions, every 10% increase in SpO<sub>2</sub>/FiO<sub>2</sub> time at risk (SF-TAR) was associated with a 24% increase in adjusted odds of hospital mortality. The SF-TAR can identify ventilated patients at increased risk of death, offering modest improvements compared with single SpO<sub>2</sub>/FiO<sub>2</sub> and P/F ratios. This longitudinal, noninvasive, and broadly generalizable tool may have particular utility for early phenotyping and risk stratification.

#### 11 Aspirin Use, Compliance, and Knowledge of Anticancer Effect in the Community.

Gurpreet Singh Ranger, MD; Cindy McKinley-Brown, RN; Emma Rogerson; Krystal Schimp-Manuel

Little is known about the use of aspirin in our community. Among aspirin users (n = 137), mean age was 65.8 years. Most (76.6%) received an 81-mg daily dose of aspirin. Compliance was 25.6% and was associated with diabetes mellitus. Only 9.5% were aware of the medication's anticancer effect. Among nonusers (n = 383; mean age 53.3 years) only 4.7% knew of the anticancer effect, and more likely to be women younger than 40 years, and have comorbidities or polypharmacy.

#### 16 Identifying Patients with Rare Disease Using Electronic Health Record Data: The Kaiser Permanente Southern California Membranous Nephropathy Cohort.

Amy Z Sun, MD; Yu-Hsiang Shu, PhD; Teresa N Harrison, SM; Aviv Hever, MD; Steven J Jacobsen, MD, PhD; Michelle M O'Shaughnessy, MD; John J Sim, MD

A retrospective cohort study (6/1999-6/2015) was performed among 4723 patients with kidney biopsy results; they were manually reviewed and designated membranous nephropathy (MN) or non-MN. One year after biopsy, the sensitivity and specificity of an MN diagnosis were 86% and 76%, respectively, but the positive predictive value was 26%. The authors' findings suggest that ICD-9 diagnosis codes might be a convenient tool to identify patients with MN using electronic health record and/or administrative claims

information. Codes selected from supervised learning achieved better overall performance, suggesting the potential of developing data-driven methods.

#### 21 Challenging the Surgical Axiom: Albumin Level Does Not Reliably Predict Development of Wound Complications in Patients Undergoing Body Contouring.

Efstathios Karamanos, MD; Pridvi Kandagatla, MD; Howard Wang, MD; Arielle Hodari Gupta, MD; Aamir Siddiqui, MD

Hypoalbuminemia has traditionally been associated with a poor nutritional status and subsequent high incidence of post-operative wound complications in surgical patients. All 4496 patients undergoing body contouring (2015-2017) were identified using the American College of Surgeons National Surgical Quality Improvement Program database. Wound complications developed in 202 patients (4.5%). Albumin levels were not associated with the development of wound complications, nor with the need for a repeated operation, with readmission, or with the total hospital length of stay.

#### 25 Immunotherapy Outcomes in Advanced Melanoma in Relation to Age.

Krishna Joshi, MD; Dinesh Atwal, MD; Rahul Ravilla, MD; Yadav Pandey, MD; Naveen Yarlagadda, MD; Sunil Kakadia, MD; Issam Makhoul, MD; Laura Hutchins, MD; Fade Mahmoud, MD

Older age is a melanoma risk factor. Elderly individuals are likelier to have immunosenescence, which could help melanoma cells escape immune surveillance. The authors retrospectively identified patients with stage IV melanoma who received at least 1 dose of ipilimumab, pembrolizumab, nivolumab, or combined ipilimumab and nivolumab. In 29 patients (age < 65 years) and 31 patients (age > 65 years), time to progression was comparable, as well as overall survival and overall immunotherapy-related adverse events. Aging does not seem to affect response to checkpoint inhibitors. Elderly patients with metastatic melanoma should be treated similarly to younger patients.

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## ORIGINAL RESEARCH &amp; CONTRIBUTIONS

**Prostate Cancer and Asbestos: A Systematic Review and Meta-Analysis.**

Frédéric Duthiel, MD, PhD; Laetitia Zaragoza-Civale, MD; Bruno Pereira, PhD; Martial Mermillod, PhD; Julien S Baker, PhD; Jeannot Schmidt, MD; Fares Moustafa, MD, PhD; Valentin Navel, MD

The authors included 33 studies with 15,687 cases of prostate cancer among 723,566 individuals. Asbestos exposure, and respiratory inhalation, increased the risk of prostate cancer. Both environmental and occupational exposure increased the risk of prostate cancer. The risk was higher in Europe, without significant results in other continents.

**A Novel Instrument for Integrated Measurement and Assessment of Intrinsic Motivation, Team Climate, and Burnout in Multidisciplinary Teams.**

Maya Khazei; Ali Rafik Shukor, M Biotech, MSc  
There is increasing recognition of the importance of intrinsic motivation, team dynamics, and burnout in multidisciplinary teams striving to achieve the Quadruple Aim. An online survey was administered to a 38-member multidisciplinary team working at an urgent primary care center in Vancouver, Canada. Only 8% of 25 respondents met the threshold level of burnout, with no respondents indicating severe or complete burnout. These ratings align with the scores for team climate and intrinsic motivation.

**Effects on Medical Students of Longitudinal Small-Group Learning about Breaking Bad News.**

Edlaine Faria de Moura Villela, PhD; Luana Kronit Bastos; Wanderson Sant'ana de Almeida; Andressa Oliveira Pereira; Matheus Silva de Paula Rocha; Fábio Morato de Oliveira, PhD; Valdes Roberto Bollela, PhD

An exploratory study using a qualitative approach was done at a Brazilian public university's medical school (30 medical students per semester). Two focus groups in 2018 (15 per group) before and after training—a 6-month (4 h/wk) course. Preintervention, only 30% of the students were aware of the importance of breaking bad news and of the existence of specific protocols to guide physicians in these situations. Postintervention, 90% understood the importance and applied protocols in their practice.

## REVIEW ARTICLES

**Primary Breast Carcinoma of the Vulva Metastatic to Lymph Nodes and Bones: A Case Report and Literature Review.**

Aneesha Ananthula, MD; Blake Lockwood, MD; John Savage, MD; Sharp Malak, MD; Chien Chen, MD; Issam Makhoul, MD; Angela Pennisi, MD

Primary breast carcinoma can occur at ectopic sites. In a 47-year-old premenopausal woman, a vulvar adenocarcinoma was positive for estrogen receptor and negative for progesterone receptor and human epidermal growth factor receptor 2/neu. For a diagnosis of primary breast cancer of the vulva, a thorough metastatic workup should be performed, with attention directed toward detecting a breast primary disease to confirm the vulvar lesion is the primary site.

**Negative-Pressure Wound Therapy to Reduce Wound Complications after Abdominoperineal Resection.**

Rebecca Gologorsky, MD<sup>1</sup>; Shruti Arora<sup>2</sup>; Anahita Dua, MD, MS, MBA

The authors performed a systematic review (PubMed database 1990-2019) including English-language studies using incisional negative-pressure wound therapy (NPWT) for closed wounds from abdominoperineal resection in malignancy cases (5 studies with 76 patients). Their findings showed reduced rates of surgical site complications with the use of incisional NPWT. Another 2 studies describing the use of prophylactic NPWT to expedite secondary closure of the surgical wound followed by incisional wound therapy were separately categorized and included 8 patients, none of whom experienced wound complications.

## CLINICAL PRACTICE

**Trauma-Informed Care in Pediatrics: A Developmental Perspective in Twelve Cases with Narratives.**

Joshua Strait, DO; Sean Meagher, MD

The dose-response relationship of adverse childhood experiences (ACEs) with chronic morbidities is recognized as prevalent. During pediatric residency training, the author implemented routine universal screening using ACE questionnaires. Clinical vignettes describe 12 cases. Addressing ACEs opened crucial conversations with some patients, which promoted efficacious, developmentally sensitive care. Implementing trauma-informed care in the pediatric setting, especially in training, is feasible and vital to understand the patient population. With clinical knowledge and experience in addressing ACEs, practitioners will empower patients and their families to improve health outcomes.

## NARRATIVE MEDICINE

**Narrative Approaches to North American Indigenous People Who Attempt Suicide.**

Lewis Mehl-Madrona, MD, PhD; Barbara Mainguy, MA, MSW

Case files from an academically affiliated, rural psychiatric practice focused on indigenous patients were reviewed for 54 indigenous patients who attempted suicide. Nine major successful strategies were: Introducing novel contradictory ideas to the beliefs people held about suicide, using stories to introduce that desired effects of suicide might not be forthcoming, including story to find means other than attempting suicide to reach the same, creating stories of a positive future, and finding ways to bring humor into the discussion. Of 29 patients in this narrative approach, 26 had no further suicide attempt. In a comparison population, 90% attempted again

**31 Awareness of Heterotopic Ossification in Total Joint Arthroplasty: A Primer.**

Michelle J Lespasio, DNP, JD, ANP; AJ Guarino, PhD

Heterotopic ossification (HO) is the presence of normal bone in soft tissue where bone should not exist. Acquired HO related to total joint arthroplasty (TJA) of the hip and knee forms outside the joint capsule and can be a challenging condition when it impairs the essential healing process after elective surgery. Ultimately, patients with clinically relevant HO after elective TJA may require additional treatment, including medication, radiation therapy, manipulation under anesthesia, surgical excision of the HO, and possibly revision TJA.

**35 Fostering Partnerships with the Safety Net: An Evaluation of Kaiser Permanente's Community Ambassador Program in the Mid-Atlantic States.**

Lorella Palazzo, PhD; Juno Matthys; Craig Sewald, MPA; Natasha Arora, MS; Maggie Jones, MPH; Jacqueline Bradley, MSN, MSS, CRNP; Sallie Eissler, RN, MSN, CPNP; Mindy R Rubin; Tanya M Edelin; Maya Nadison, PhD, MS

From 2013 to 2017, Community Ambassadors (CAs) filled 32.8 full-time equivalent positions and conducted 294,436 patient encounters in 19 clinics. In certain years and for subsets of clinics, CAs performed above average on 2 high-priority quality measures: Cervical cancer screening and diabetes (blood glucose) control. Interviews with 15 CAs, 15 health centers leaders, and 7 Kaiser Permanente (KP) Mid-Atlantic States staff members revealed that CAs improved patient access, clinic capacity, and care quality, and also exported KP best practices and supported KP's community relations

## SPECIAL REPORT

**43 Adverse Childhood Experiences (ACEs)****and Community Physicians: What We've Learned.**

Brian R Stork, MD, FACS; Nicholas John Akselberg; Yongmei Qin, MD, MS; David C Miller, MD, MPH

Most physicians surveyed (81%) reported they had never heard of the ACE questionnaire. Even fewer (3%) reported using the questionnaire in clinical practice. Most physicians (55.5%) reported no personal history of ACEs. Physicians reporting a history of childhood trauma reported a wide range of ACE scores (1-9). Women reported a statistically higher number of ACEs. Physicians in this study reported a lower prevalence of ACEs than the population they serve.

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## SPECIAL REPORT

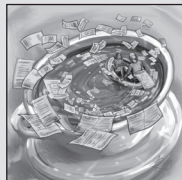
- 51 Working to Achieve the Quadruple Aim.**  
Nancy Gin, MD; Patrick Courneya, MD

Quality improvement activities are essential to achieving the Institute for Healthcare Improvement's Quadruple Aim of improving the health of our patients and members, enhancing members' care experiences, reducing costs, and attaining joy and meaning for our physicians and care teams in the workplace. These activities are also essential in creating a learning health care system.

- 52 Abstracts from the Kaiser Permanente 2020 National Quality Conference.**

## GRAPHIC MEDICINE

Stories and poems written by clinicians in 15 minutes in writing workshops about meaningful moments in their work and life of practicing medicine. To better communicate health care experiences, our intention is to use graphic images with simple clinician or patient stories. Professional artists were asked to create a visual representation of the story.



- 70 Lifeboat.**  
Jim Roldan

- 71 Footsteps on the Floating Dock.**  
Michael Parchman, MD

## REVIEW ARTICLES

- CME 72 Comprehensive Outpatient Management of Low-Risk Pulmonary Embolism: Can Primary Care Do This? A Narrative Review.**  
David R Vinson, MD; Drahomir Aujesky, MD, MS; Geert-Jan Geersing, MD, PhD; Pierre-Marie Roy, MD, PhD

The authors undertook a narrative review of the literature on the outpatient management of acute pulmonary embolism (PE) from 1/1950-7/2019, focusing on the site of care. No studies evaluated PE management in primary care or general practice settings. The site-of-care decision was made with in the Emergency Department or Specialty Clinic. The authors see no formal reason why a trained primary care physician could not provide comprehensive care for select patients with low-risk PE. The obstacles would be access to advanced pulmonary imaging and time constraints of practice.

## CLINICAL PRACTICES

- CME 84 Pharmacist Medication Management of Adults with Attention Deficit: An Alternative Clinical Structure.**  
Rex Huang, MD; Samuel J Ridout, MD, PhD; Brooke Harris, PhD; Kathryn K Ridout, MD, PhD; Kavitha Raja, MD

Attention-deficit/hyperactivity disorder (ADHD) is one of the most common psychiatric conditions in youth. This disorder can persist into adulthood, with an estimated prevalence of 4.4% to 5.2% in the US. This program created a standardized protocol for assessment, referral, and follow-up of adult patients with ADHD, with close monitoring and titration of controlled medications, systematic use of screening measures, and a stimulant treatment contract. We believe this program offers a solution to a component of this growing problem, and other clinical sites would benefit from such a program.

## CASE REPORTS

- 89 Rapid Induction Therapy for Opioid-Use Disorder Using Buprenorphine Transdermal Patch: A Case Series.**  
Daniel Saal, MD; Frank Lee, MD

The authors present a case series involving a novel approach to transdermal induction of buprenorphine or buprenorphine-naloxone therapy that has been demonstrated in inpatient settings but not widely explored in the outpatient setting. A range of patients, from the highly medically complex to relatively straightforward cases, benefited and can be used without the patient having to experience withdrawal or wait to start treatment. This should reduce the risk of lack of return for follow-up as well as decrease the dropout rate caused by inability to tolerate withdrawal symptoms.

- 95 Drug-Induced Lupus, a One-time Hit or a Harbinger of Future Autoimmunity: A Case Report.** David Kirakossian, MD; Pradipta Ghosh, MD

Drug-induced lupus (DIL) can comprise up to 10% of new lupus cases annually, and the list of medications associated with DIL is increasing. However, it can be difficult to recognize the connection between symptoms and a medication-induced autoimmune syndrome, which can lead to an invasive, costly workup. The case highlights how DIL should be on the differential when seemingly disparate symptoms develop in a patient receiving DIL-associated medications. Lupus is one of the "great imitators," in which symptoms can be ascribed to many different underlying causes.

## GRAPHIC MEDICINE

- 100 The Doctor's Day Off: An Encounter with Homelessness and Drug Addiction.**  
Stephen Bachhuber, MD

This graphic submission is the dramatization of a true incident. It is intended to show the shock, surprise, sadness, guilt, futility and resignation I and many physicians feel in the face of the opioid crisis.

## COMMENTARY

- 102 Addressing the Health Needs of the Uninsured: One Community's Solution.**  
Lynne M Hutchison, DNP, FNP-BC; Raymond L Cox, MD, MBA

Volunteers in Medicine on Hilton Head Island, SC, provides free health care, with 28,000 eligible patient visits annually, for the underserved population. Self-funded through donations and charity events, it accepts no federal money. Patients are not asked to pay a fee for service. Most medical specialties are represented in the clinic, with partnerships in place for referrals for advanced procedures like surgery. All health care clinicians (physicians, nurses, dentists, mental health professionals) are volunteers.

## EDITORIAL

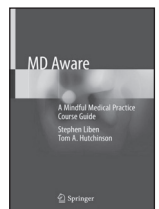
- 106 Let's Care for Those in Need—Today: Collaborating to Solve the Uninsured Crisis in America.** Lee Jacobs, MD

In this issue of *The Permanente Journal*, 2 articles detail strategies for providing care to those in need. Given a choice of standing on the sidelines, listening and watching, these people acted. They chose to deal with today's realities—and to care for the uninsured. They are heroes—and like others across the country also acting. This major crisis must be addressed now. We need a nationwide safety-net movement, led by the health care community, driven by the crisis, and fueled by collaboration and compassion.

## BOOK REVIEWS

- 111 MD Aware: A Mindful Medical Practice Course Guide.**  
Patricia Lynn Dobkin, PhD

It describes a course rolled out in 2015 that aims to reinforce positive qualities inherent in medical students that will help them maintain their enthusiasm for medicine and provide them with the means to hold onto their humanity.



## EDITORIAL

- 112 Transition at TPJ.**  
Stephen Tarnoff, MD, Editor in chief (interim)

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## ORIGINAL RESEARCH &amp; CONTRIBUTIONS

# Association Between Peripheral Blood Oxygen Saturation (SpO<sub>2</sub>)/Fraction of Inspired Oxygen (FiO<sub>2</sub>) Ratio Time at Risk and Hospital Mortality in Mechanically Ventilated Patients

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## ABSTRACT

**Introduction:** Acute respiratory failure requiring mechanical ventilation is a leading cause of mortality in the intensive care unit. Although single peripheral blood oxygen saturation/fraction of inspired oxygen (SpO<sub>2</sub>/FiO<sub>2</sub>) ratios of hypoxemia have been evaluated to risk-stratify patients with acute respiratory distress syndrome, the utility of longitudinal SpO<sub>2</sub>/FiO<sub>2</sub> ratios is unknown.

**Objective:** To assess time-based SpO<sub>2</sub>/FiO<sub>2</sub> ratios ≤ 150—SpO<sub>2</sub>/FiO<sub>2</sub> time at risk (SF-TAR)—for predicting mortality in mechanically ventilated patients.

**Methods:** Retrospective, observational cohort study of mechanically ventilated patients at 21 community and 2 academic hospitals. Association between the SF-TAR in the first 24 hours of ventilation and mortality was examined using multivariable logistic regression and compared with the worst recorded isolated partial pressure of arterial oxygen/fraction of inspired oxygen (P/F) ratio.

**Results:** In 28,758 derivation cohort admissions, every 10% increase in SF-TAR was associated with a 24% increase in adjusted odds of hospital mortality (adjusted odds ratio = 1.24; 95% confidence interval [CI] = 1.23-1.26); a similar association was observed in validation cohorts. Discrimination for mortality modestly improved with SF-TAR (area under the receiver operating characteristic curve [AUROC] = 0.81; 95% CI = 0.81-0.82) vs the worst P/F ratio (AUROC = 0.78; 95% CI = 0.78-0.79) and worst SpO<sub>2</sub>/FiO<sub>2</sub> ratio (AUROC = 0.79; 95% CI = 0.79-0.80). The SF-TAR in the first 6 hours offered comparable discrimination for hospital mortality (AUROC = 0.80; 95% CI = 0.79-0.80) to the 24-hour SF-TAR.

**Conclusion:** The SF-TAR can identify ventilated patients at increased risk of death, offering modest improvements compared with single SpO<sub>2</sub>/FiO<sub>2</sub> and P/F ratios. This longitudinal, noninvasive, and broadly generalizable tool may have particular utility for early phenotyping and risk stratification using electronic health record data in ventilated patients.

## INTRODUCTION

Acute hypoxemic respiratory failure (AHRF) requiring mechanical ventilation is associated with substantial morbidity and mortality.<sup>1-3</sup> Although intensive care unit (ICU) severity of illness scoring systems such as the Acute Physiology and Chronic Health Evaluation (APACHE), Simplified Acute Physiology Score (SAPS), and Sequential Organ Failure Assessment (SOFA) are widely used to identify patients at increased risk of mortality, they are not explicitly used to characterize the severity of AHRF.<sup>3</sup> Thus, inexpensive, noninvasive, and readily available markers of disease severity are needed for diagnosis, phenotyping, and prognostication in patients with AHRF.

Research in AHRF severity has focused primarily on the acute respiratory distress syndrome (ARDS) using arterial blood gas (ABG) analysis of partial pressure of arterial oxygen (PaO<sub>2</sub>)/fraction of inspired oxygen (FiO<sub>2</sub>) (PaO<sub>2</sub>/FiO<sub>2</sub>) ratios, with mortality inversely proportional to PaO<sub>2</sub>/FiO<sub>2</sub> ratios.<sup>4,5</sup> However, despite widespread familiarity with use of PaO<sub>2</sub>/FiO<sub>2</sub> ratios, clinical recognition of ARDS remains poor. In a recent large multinational study, clinicians failed to recognize ARDS in 40% of patients, and recognized only 1 in 3 patients when ARDS criteria were first met.<sup>6</sup> Therapies, including lung protective ventilation,<sup>7</sup> and early use of paralysis<sup>8,9</sup> have shown mortality benefit in ARDS, but not surprisingly, when recognition is poor, so is adoption of these strategies.<sup>10</sup> Selected prior studies also suggest that similar therapies could have benefit in isolated AHRF.<sup>11-13</sup>

Inconsistent use of PaO<sub>2</sub>/FiO<sub>2</sub> ratios may be a barrier to AHRF classification and prognostication. Several studies suggest that repeated measurements of the PaO<sub>2</sub>/FiO<sub>2</sub> ratio 24 or more hours after ARDS onset may improve the accuracy of classification and prognosis.<sup>5,14-17</sup> However, the absence of standardized practices regarding ABG use and the increasing focus on early identification and treatment of patients with AHRF limit the utility of ABG-based, reactive evaluation strategies. Furthermore, there is a surprising paucity of information regarding severity of illness classification and risk stratification in patients with non-ARDS AHRF, and recent work suggests mortality rates may be comparable in patients with ARDS and non-ARDS AHRF, with similar degrees of hypoxemia.<sup>2</sup> These studies highlight the need for more readily available severity classification methods to facilitate early recognition, phenotyping, and assessment of therapeutic response in both patients with ARDS AHRF and patients with non-ARDS AHRF.

These issues could be addressed through use of pulse oximetry-based peripheral blood oxygen saturation (SpO<sub>2</sub>)/FiO<sub>2</sub>

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(SpO<sub>2</sub>/FiO<sub>2</sub>) ratios, which are ubiquitously available and noninvasive. Studies suggest that SpO<sub>2</sub>/FiO<sub>2</sub> and PaO<sub>2</sub>/FiO<sub>2</sub> ratios are reasonably well correlated, particularly when PaO<sub>2</sub>/FiO<sub>2</sub> ratios are less than 300,<sup>18–22</sup> and ARDS mortality and ventilator days are similar when disease severity is defined by SpO<sub>2</sub>/FiO<sub>2</sub> ratios.<sup>22</sup> Because SpO<sub>2</sub>/FiO<sub>2</sub> ratios can be measured frequently, they can be used to calculate an SpO<sub>2</sub>/FiO<sub>2</sub> ratio time-at-risk (SF-TAR) profile—the duration of time during which the patient's SpO<sub>2</sub>/FiO<sub>2</sub> ratios are under a certain hypoxemic threshold. The SF-TAR may help identify patients with persistent hypoxemia and mitigate misclassification issues resulting from transient clinical worsening or isolated errors in charting. This is particularly salient because the severity of respiratory failure is dynamic, with patients experiencing both worsening and improving hypoxemia even within a single day.

We hypothesized that the SF-TAR would be significantly associated with mortality among unselected ventilated patients, with similar discrimination compared with PaO<sub>2</sub>/FiO<sub>2</sub> ratios, facilitating its use as a dynamic and ubiquitously available prognostic measure.

## METHODS

This retrospective cohort study was approved by the institutional review boards of Kaiser Permanente Northern California (KPNC) and the University of California, Davis (UCD).

### Derivation Cohort

We retrospectively evaluated all adult, mechanically ventilated ICU patients in 21 hospitals in the KPNC integrated health care delivery system between 2010 and 2013, using a previously validated algorithm.<sup>23–27</sup> We included patients whose hospitalizations included an overnight stay, began in a KPNC hospital, and were not for peripartum care.

### Hourly Oxygenation Ratios and Correlation

During mechanical ventilation, we calculated patients' hourly oxygenation ratios (PaO<sub>2</sub>/FiO<sub>2</sub> ratio and SpO<sub>2</sub>/FiO<sub>2</sub> ratio) using electronic medical record (EMR)-derived data. When patients had multiple PaO<sub>2</sub>/FiO<sub>2</sub> or SpO<sub>2</sub>/FiO<sub>2</sub> ratios recorded during a single hour, we calculated an hourly weighted average. We truncated PaO<sub>2</sub>/FiO<sub>2</sub> and SpO<sub>2</sub>/FiO<sub>2</sub> values at the 0.05th percentile (28.0 and 52.3, respectively) and the 99.95th percentile (743 and 480, respectively) to remove nonphysiologic extreme values that may result from data entry errors during clinical charting in the EMR.

We assessed the correlation between all hourly PaO<sub>2</sub>/FiO<sub>2</sub> and SpO<sub>2</sub>/FiO<sub>2</sub> ratios using Pearson correlation coefficients when the PaO<sub>2</sub>/FiO<sub>2</sub> and SpO<sub>2</sub>/FiO<sub>2</sub> ratios were limited to values less than or equal to 400 and oxygen saturations less than or equal to 96%, assuming that these ranges would be associated with more accurate assessment of hypoxemia.<sup>18</sup> To help visualize the relationship between PaO<sub>2</sub>/FiO<sub>2</sub> and SpO<sub>2</sub>/FiO<sub>2</sub> ratios over time, we randomly selected 6 patients ventilated for 5 or more days with PaO<sub>2</sub>/FiO<sub>2</sub> values of 5 or greater and displayed oxygenation ratios over the first week of ventilation (see Supplemental Figure 1<sup>a</sup>).

### SpO<sub>2</sub>/FiO<sub>2</sub> Ratio Time at Risk

We calculated the SF-TAR value as the proportion of time during the first 24 hours of mechanical ventilation that a patient had severe hypoxemia, defined by an SpO<sub>2</sub>/FiO<sub>2</sub> ratio less than 150 (corresponding to a PaO<sub>2</sub>/FiO<sub>2</sub> ≤ 100).<sup>20</sup> An SpO<sub>2</sub>/FiO<sub>2</sub> ratio threshold < 150 was used to calculate the SF-TAR after an exploratory analysis of the SpO<sub>2</sub>/FiO<sub>2</sub>-TAR using SpO<sub>2</sub>/FiO<sub>2</sub> ratios corresponding to mild (SpO<sub>2</sub>/FiO<sub>2</sub> ratio 235–314), moderate (SpO<sub>2</sub>/FiO<sub>2</sub> ratio 150–234), and severe (SpO<sub>2</sub>/FiO<sub>2</sub> ratio < 150) revealed a more linear relationship between the SF-TAR and hospital mortality using the severe threshold (see Supplemental Figure 2<sup>a</sup>). We thus grouped the continuous SF-TAR values into 11 categories: 0%, 1% to 10%, 11% to 20%, 21% to 30%, 31% to 40%, 41% to 50%, 51% to 60%, 61% to 70%, 71% to 80%, 81% to 90%, and 91% to 100% of the time with an SpO<sub>2</sub>/FiO<sub>2</sub> ratio less than 150. We determined hospital mortality and 95% confidence intervals for each.

### Multivariable Logistic Regression Analysis

We estimated the independent effect of increasing SF-TAR values (as ordinal categories based on 11 groups) on the prespecified primary outcome of hospital mortality with a multivariable logistic regression model adjusted for age, sex, ICU severity of illness as measured by the SAPS3 score,<sup>28</sup> total duration of ventilation, and additional measures of acute and chronic severity of illness: the Laboratory and Acute Physiology Score, version 2 (LAPS2) and the COMorbidity Point Score, version 2 (COPS2).<sup>23–25,27</sup> We compared the discrimination of this model against an identical model replacing SF-TAR with the worst PaO<sub>2</sub>/FiO<sub>2</sub> and SpO<sub>2</sub>/FiO<sub>2</sub> ratios in the first 24 hours of ventilation when available. We compared model discrimination using area under the receiver operating characteristic curve (AUROC). In post hoc analyses, we also calculated the AUROC of models using SF-TAR values from only the first 6 or 12 hours of ventilation.

### Validation Cohorts

We used similar experimental procedures with data from the Medical Information Mart for Intensive Care (MIMIC) III database<sup>29</sup> and UCD Health. We identified patients from the MIMIC and UCD study cohorts from a larger inpatient sample of adult patients (≥ 18 years) whose hospitalizations included an overnight stay. We then identified a subset of ICU patients who underwent invasive mechanical ventilation on the basis of previously validated algorithms (<https://github.com/MIT-LCP/mimic-code/blob/master/concepts/durations/ventilation-durations.sql>). Analysis was limited to the first episode of mechanical ventilation during a hospitalization. Patient characteristics are described in Supplemental Table 1.<sup>a</sup>

For each patient in the validation cohorts, SpO<sub>2</sub>/FiO<sub>2</sub> (and PaO<sub>2</sub>/FiO<sub>2</sub>) ratios were calculated by feeding forward all charted SpO<sub>2</sub> (or PaO<sub>2</sub>) and FiO<sub>2</sub> measurements until a replacement value for either was recorded during times when patients were classified as under mechanical ventilation by the just-mentioned algorithm. A new SpO<sub>2</sub>/FiO<sub>2</sub> (or PaO<sub>2</sub>/FiO<sub>2</sub>) ratio was thus calculated every time that either the SpO<sub>2</sub> (or PaO<sub>2</sub>) or FiO<sub>2</sub>, or

both were changed. Each PaO<sub>2</sub>/FiO<sub>2</sub> measurement was paired with the most recent SpO<sub>2</sub>/FiO<sub>2</sub> measurement taken within the previous hour. All PaO<sub>2</sub>/FiO<sub>2</sub> measurements taken more than an hour after any SpO<sub>2</sub>/FiO<sub>2</sub> measurements were discarded. These PaO<sub>2</sub>/FiO<sub>2</sub>-SpO<sub>2</sub>/FiO<sub>2</sub> pairs were used to calculate the correlation between the 2 measures. We truncated the averaged PaO<sub>2</sub>/FiO<sub>2</sub> and SpO<sub>2</sub>/FiO<sub>2</sub> ratios at the 0.05th (45 and 65, respectively) and 99.95th (1100 and 414, respectively) percentiles in MIMIC and the 0.05th (28 and 52.3, respectively) and 99.95th (743 and 480, respectively) percentiles in the UCD cohort. The mortality regression models were adjusted for age, sex, and either hospital length of stay (MIMIC) or highest (SOFA score (UCD)).<sup>30</sup>

Continuous data are presented as the mean and standard deviation (SD) or median (interquartile range [IQR]); categorical

data are presented as number (percentage). All analyses were conducted using Stata/SE version 14.1 (StataCorp, College Station, TX) and R version 3.2.2.

## RESULTS

### Derivation Cohort

We included 28,758 hospitalizations with mechanical ventilation in the ICU, occurring among 25,944 unique patients (Table 1). The patients' mean age (SD) was 65.4 (15.6) years. Two-thirds of patients were admitted through the Emergency Department. The mean hospital length of stay (SD) was 14.2 (23.3) days. Figure 1 displays the duration of mechanical ventilation through day 14; the median duration of ventilation was 37 hours (IQR = 15-110).

### Oxygenation Ratios

A total of 3,505,707 hourly SpO<sub>2</sub>/FiO<sub>2</sub> ratio values were available, with a median value of 250 (IQR = 218-326); 173,576 hourly PaO<sub>2</sub>/FiO<sub>2</sub> ratio values were available, with a median value of 214 (IQR = 134-307). SpO<sub>2</sub>/FiO<sub>2</sub> ratio values were much more frequently available than PaO<sub>2</sub>/FiO<sub>2</sub> values across all ranges (Supplemental Table 2<sup>a</sup>). During ventilation, the number of recorded PaO<sub>2</sub>/FiO<sub>2</sub> ratios was substantially lower than the number of SpO<sub>2</sub>/FiO<sub>2</sub> ratios across all quintiles of recorded values (see Supplemental Table 3<sup>a</sup>). The SpO<sub>2</sub>/FiO<sub>2</sub> and PaO<sub>2</sub>/FiO<sub>2</sub> ratios were moderately to strongly correlated when SpO<sub>2</sub>/FiO<sub>2</sub> and PaO<sub>2</sub>/FiO<sub>2</sub> ratios were available in the same hour (0.47) or when restricted to PaO<sub>2</sub>/FiO<sub>2</sub> ratios at or below 400 and SpO<sub>2</sub>/FiO<sub>2</sub> ratios derived from saturations less than or equal to 96% (0.68). Visual inspection of concurrent SpO<sub>2</sub>/FiO<sub>2</sub> and PaO<sub>2</sub>/FiO<sub>2</sub> ratios, performed to complement the correlation analysis, revealed periods of relative concordance and discordance between individual SpO<sub>2</sub>/FiO<sub>2</sub> and extrapolated PaO<sub>2</sub>/FiO<sub>2</sub> ratios. Supplemental Figure 1<sup>a</sup> shows a random sample of 6 ventilation episodes for illustrative purposes.

### SpO<sub>2</sub>/FiO<sub>2</sub> Ratio Time at Risk

Hospital mortality increased as the proportion of time with an SpO<sub>2</sub>/FiO<sub>2</sub> ratio below 150 (SF-TAR) increased over the first 24 hours of mechanical ventilation (Figure 2 and Supplemental Table 4<sup>a</sup>). In the first 24 hours of ventilation, patients with an SF-TAR of 0% (n = 10,703) had a hospital mortality rate of 16.4%. Among patients with a 24-hour SF-TAR of 91% to 100% (n = 1405), the mortality rate was 70.2%.

### SF-TAR and PaO<sub>2</sub>/FiO<sub>2</sub> Ratio Comparisons

A total of 86.1% of patients had at least 1 PaO<sub>2</sub>/FiO<sub>2</sub> ratio during the first 24 hours of ventilation (Supplemental Table 2<sup>a</sup>). Discrimination for hospital mortality in the adjusted logistic regression model was modestly higher with the SF-TAR (AUROC = 0.81, 95% CI = 0.81-0.82) than with the worst PaO<sub>2</sub>/FiO<sub>2</sub> ratio (AUROC = 0.78, 95% CI = 0.78-0.79, p < 0.001). Results were similar when SF-TAR was compared with the single worst SpO<sub>2</sub>/FiO<sub>2</sub> ratio in the first 24 hours (AUROC = 0.79; 95% CI = 0.79-0.80, p < 0.01). Even when SF-TAR data were limited to either the first 6 or 12 hours of

Variable	Value
Age, y, mean (SD)	65.4 (15.6)
Male sex, no. (%)	16,248 (56.5)
Hospitalized through ED, no. (%)	19,168 (66.7)
First hospital ward or location, no. (%)	
Intensive care unit	13,662 (47.5)
Operating room	7042 (24.5)
Hospital ward	6620 (23.0)
Stepdown unit	1345 (4.7)
Other	89 (0.3)
Hospital length of stay, d, mean (SD)	14.2 (23.3)
Full code status at time of admission, no. (%)	27,362 (95.2)
Predicted eSAPS3 hospital mortality, % (SD)	30.3 (19.1)
Observed hospital mortality, no. %	7112 (24.7)

ED = Emergency Department; eSAPS3 = electronic Simplified Acute Physiology Score 3; SD = standard deviation.

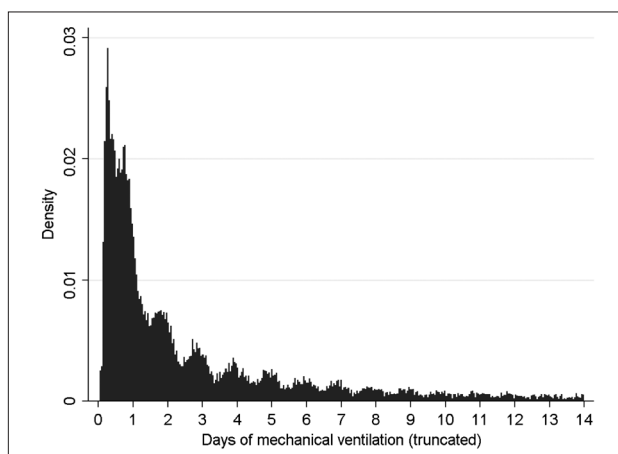


Figure 1. Histogram of duration of mechanical ventilation in hours in derivation cohort, truncated at 14 days (representing 92.6% of overall sample). The x-axis represents elapsed days. The y-axis represents frequency of patients with that duration of ventilation

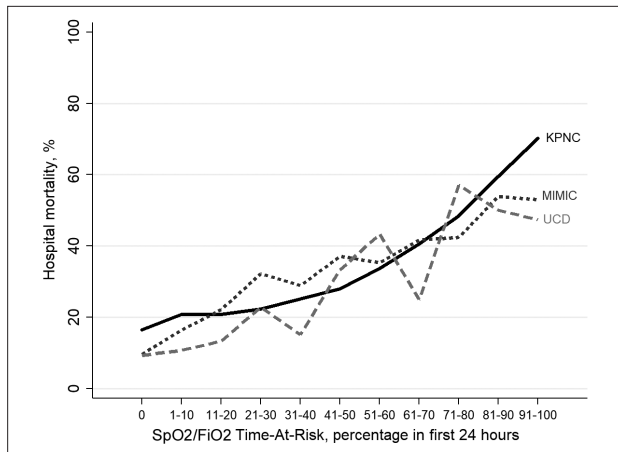


Figure 2. Hospital mortality in all 3 patient cohorts across increasing levels of peripheral blood oxygen saturation/fraction of inspired oxygen (SpO<sub>2</sub>/FiO<sub>2</sub>) ratio time-at-risk categories on day 1 of ventilation.

KPNC = Kaiser Permanente Northern California; MIMIC = Medical Information Mart for Intensive Care; UCD = University of California, Davis.

mechanical ventilation, the AUCs for these models were both 0.80 (95% CI = 0.79–0.80 and 0.80–0.81, respectively). Each 10% increase in SF-TAR during the first 24 hours of ventilation was associated with a 24% increase in the odds of hospital mortality (adjusted odds ratio = 1.24, 95% CI = 1.23–1.26,  $p < 0.001$ ).

### Validation Data

The MIMIC cohort included 13,755 hospitalizations with mechanical ventilation. The patients' mean age (SD) was 63.1 (16.0) years, and the median duration of ventilation was 22 hours (IQR = 9–75; Supplemental Table 1<sup>a</sup>). Correlation between SpO<sub>2</sub>/FiO<sub>2</sub> and PaO<sub>2</sub>/FiO<sub>2</sub> ratios was moderate at 0.49 when both values were available concurrently. The hospital mortality rate was 9.7% among patients with SF-TAR of 0% and was 53.0% among those with SF-TAR of 91% to 100% (Figure 2 and Supplemental Table 4<sup>a</sup>). Each 10% increase in SF-TAR was associated with an adjusted odds ratio of 1.26 for hospital mortality (95% CI = 1.23–1.30,  $p < 0.001$ ).

The UCD cohort included 1088 hospital encounters involving mechanical ventilation where SpO<sub>2</sub>/FiO<sub>2</sub> and PaO<sub>2</sub>/FiO<sub>2</sub> ratios were available concurrently. The mean age (SD) was 54.9 (17.0) years; the median duration of mechanical ventilation was 35 hours (IQR = 12 to 126 hours; see Supplemental Table 1<sup>a</sup>). Correlation between SpO<sub>2</sub>/FiO<sub>2</sub> and PaO<sub>2</sub>/FiO<sub>2</sub> values was 0.50 for all values and 0.56 when comparisons were restricted to SpO<sub>2</sub>/FiO<sub>2</sub> values with saturation less than or equal to 96%. The hospital mortality rate was 9.3% in patients with an SF-TAR of 0% and was 47.4% with an SF-TAR of 91% to 100% (Figure 2 and Supplemental Tables 4 and 5<sup>a</sup>). Each 10% increase in SF-TAR was associated with an adjusted odds ratio for hospital mortality of 1.21 (95% CI = 1.12–1.31,  $p < 0.001$ ) when a SOFA score lacking the respiratory subscore was included in the model, and 1.16 (95% CI = 1.08–1.28,  $p < 0.001$ ) using the full SOFA score.

### DISCUSSION

In this study, we examined the value of using SpO<sub>2</sub>/FiO<sub>2</sub> ratios to predict mortality among a mixed population of mechanically ventilated patients. Although individual SpO<sub>2</sub>/FiO<sub>2</sub> ratios are ubiquitously available and frequently assessed, they were not consistently correlated with PaO<sub>2</sub>/FiO<sub>2</sub> ratios, which were substantially less available or even unavailable in a sizable proportion of ventilated patients. We thus developed a longitudinal measure of oxygenation (SF-TAR) that is based on the percentage of time that patients exhibited severe hypoxemia (SpO<sub>2</sub>/FiO<sub>2</sub> ratio < 150), and we tested its utility for identifying patients at increased risk of death. In 3 independent datasets, we found that the SF-TAR during the first 24 hours of ventilation was significantly associated with hospital mortality and that the SF-TAR could discriminate between survivors and nonsurvivors at least as well as the current ABG-based gold standard for quantifying severity and prognostication in AHRF.

This study has several implications for diagnosis and prognostication in patients with AHRF, including those with and without ARDS. Recent studies have shown that clinician recognition of ARDS remains poor, with several barriers that hamper both diagnosis and classification of severity.<sup>6,31,32</sup> Lack of standardized timing and frequency of ABG sampling may be a contributory factor.<sup>33,34</sup> Additionally, initiatives to reduce unnecessary testing in the ICU may further decrease the availability of ABG-derived PaO<sub>2</sub>/FiO<sub>2</sub> values.<sup>35–38</sup> In contrast to ABGs, the SpO<sub>2</sub> values are ubiquitously available, can be frequently or continuously measured, and are free of risk. Thus, our data suggest that use of SpO<sub>2</sub>/FiO<sub>2</sub> ratios, either as single worst values or when used in a longitudinal SF-TAR approach, should play a central role in improving the recognition of disease severity and prognostication of mortality in mechanically ventilated patients, with and without ARDS, particularly when SpO<sub>2</sub> is less than or equal to 96%, when estimates of hypoxemia by SpO<sub>2</sub>/FiO<sub>2</sub> are more accurate.<sup>39</sup>

We developed the SF-TAR to represent a metric that characterizes both the magnitude and duration of acute hypoxemia. Several studies have demonstrated improved prognostic performance with repeated measurement of PaO<sub>2</sub>/FiO<sub>2</sub> ratios after changing to standardized ventilator settings within the first 48 hours of ARDS, or after using standardized ventilator settings with reassessment at 24 hours.<sup>14–17,40</sup> Although limited to patients with ARDS, these studies support incorporating the response to initial interventions over time as a means of improving prognostication in patients with AHRF. Furthermore, there is increasing recognition that single timepoint evaluations of hypoxemia severity contribute to misclassification of patients because patients dynamically improve and worsen even during a single day.

Our finding that SF-TAR in the first 6 hours of ventilation, independent of ventilator settings or indication for ventilation, has nearly the discriminatory power of the 24-hour value is particularly important, highlighting its potential to improve the early recognition of disease subtypes for clinical trial enrollment and to identify severely ill patients meriting protocolized care pathways. Further extension of time-based clinical phenotyping

metrics like the SF-TAR may also facilitate improved characterization of the molecular basis of common AHRF subtypes, as demonstrated by the recent recognition of ARDS endotypes with potential differential response to therapies.<sup>41-43</sup> The SF-TAR may offer additional advantages in clinical applications in that its performance does not depend on repeated collection of ABG samples or application of standardized ventilator settings that may be difficult and costly to implement outside a clinical study.

We demonstrated that SpO<sub>2</sub>-based measures have prognostic value in a mixed population of patients. Ventilated patients without ARDS face substantial short- and long-term morbidity and mortality, and recent data suggest that mortality in patients with non-ARDS AHRF may be similar to those with ARDS when severity of illness at ICU admission is similar.<sup>34,44,45</sup> Given mounting evidence that lung protective ventilation may also benefit patients without ARDS,<sup>11,46,47</sup> quantifying the severity and duration of hypoxemia using the SF-TAR may help to identify additional predictors of adverse outcomes in this understudied population. Although we did not explicitly identify patients with ARDS, our findings are broadly consistent with prior work demonstrating the value of SpO<sub>2</sub>/FiO<sub>2</sub> ratios for classification and prognostication in ARDS.<sup>18-22</sup>

Use of frequently available values like the SF-TAR may offer future utility for characterizing the course of impending or progressive respiratory failure. This may be particularly relevant for patients at high risk of ARDS and those with early acute lung injury. Future work should evaluate patients with respiratory failure who are treated with noninvasive mechanical ventilation or high-flow nasal cannula.<sup>48-51</sup> Our finding that even relatively short SF-TAR intervals performed similarly to the worst PaO<sub>2</sub>/FiO<sub>2</sub> ratio in 24 hours may facilitate development of automated surveillance tools to improve the efficiency of clinical trial screening, the timeliness of enrollment, and the accuracy of AHRF classification for studies.<sup>52</sup> Temporal metrics like the SF-TAR may also enable new technology-leveraged approaches to the management of patients with AHRF. For example, EMR-based early warning systems could use SF-TAR-based risk as a clinical decision support trigger that may be more resistant to false alarms from periodic low SpO<sub>2</sub>/FiO<sub>2</sub> ratios resulting from low pulse oximetry signal quality or charting errors. In addition, most current warning score systems fail to include or simply dichotomize oxygen saturation values.<sup>53</sup> The SF-TAR-based triggers could be incorporated into automated surveillance systems designed to detect evolving hypoxemic respiratory failure at early time points when gradual escalation in the intensity of respiratory support may mask overt hypoxemia. Although we evaluated SF-TAR only during mechanical ventilation, future work should include longitudinal hypoxemia metrics in patients before invasive mechanical ventilation, as well as in those who never need it.

This study has several strengths. We developed the SF-TAR in a large, contemporary, community-based multicenter cohort of more than 28,000 ventilated patients, and we validated the association between SF-TAR and mortality in 2 academic medical center-based cohorts totaling more than 14,000 additional

patients, suggesting the generalizability of our findings. Our use of real-world EMR data, with the potential for data quality errors, further reinforces the generalizability of the SF-TAR. Finally, all 3 patient samples incorporated medical and surgical patients, with and without ARDS, suggesting broad clinical utility.

Our study also has several limitations. First, the correlation between SpO<sub>2</sub>/FiO<sub>2</sub> and PaO<sub>2</sub>/FiO<sub>2</sub> ratio values was lower here than in previous studies, likely reflecting patient heterogeneity, unsynchronized measurement of SpO<sub>2</sub>/FiO<sub>2</sub> and PaO<sub>2</sub>/FiO<sub>2</sub> values, and potential EMR data quality issues.<sup>18</sup> This finding suggests that single-time-point SpO<sub>2</sub>/FiO<sub>2</sub> ratios derived from routine clinical data entry may have limitations for clinical phenotyping or clinical decision support triggers, particularly when SpO<sub>2</sub> values are close to 100%. Second, although the SF-TAR exhibited significantly higher discrimination than the worst single PaO<sub>2</sub>/FiO<sub>2</sub> or SpO<sub>2</sub>/FiO<sub>2</sub> values, the incremental increase in performance was modest. If the primary use of non-invasive hypoxemia metrics were only to drive early recognition of risk, isolated SpO<sub>2</sub>/FiO<sub>2</sub> ratio values might still represent the simplest and most rapid approach to risk stratification. Further research focused specifically on the first hours after intubation may help to clarify whether the SF-TAR offers advantages over isolated SpO<sub>2</sub>/FiO<sub>2</sub> ratios. Third, we evaluated only a single SpO<sub>2</sub>/FiO<sub>2</sub> ratio threshold to quantify the SF-TAR, and it is possible that a different threshold value might improve SF-TAR performance.

The fourth limitation of this study is that we evaluated the performance of the SF-TAR using data only from the first 24 hours of mechanical ventilation, and it is possible that an SF-TAR derived from later time bins such as day 2 of mechanical ventilation might have improved discrimination for mortality.<sup>16,54,55</sup> Fifth, we did not assess for ARDS in our patients given the high likelihood of diagnostic inaccuracy associated with the clinical underrecognition of ARDS and thus its diagnostic coding in the EMR.<sup>6</sup> Whether SF-TAR is equally predictive with and without ARDS, as well as for individual ARDS risk factors, remains unclear, and future research using prospectively identified cohorts may clarify this question. Sixth, the SF-TAR was not designed to replace the PaO<sub>2</sub>/FiO<sub>2</sub> ratio or other diagnostic criteria for ARDS. Because of this and our inability to confidently identify true-positive and true-negative ARDS cases in our EMR-derived datasets, we did not test the diagnostic accuracy of the SF-TAR for ARDS.

## CONCLUSION

We found that extended periods of severe hypoxemia (SpO<sub>2</sub>/FiO<sub>2</sub> ratio < 150) were significantly associated with mortality in a nearly linear fashion in 3 large independent cohorts. The SF-TAR, even in the first 6 hours of ventilation, had discrimination for mortality comparable with the single worst PaO<sub>2</sub>/FiO<sub>2</sub> ratio in 24 hours. These data reinforce the clinical utility of SpO<sub>2</sub>/FiO<sub>2</sub> ratios in patients with AHRF and highlight the potential value of severity of illness metrics that incorporate assessment of organ dysfunction over time. Our findings also suggest that the SF-TAR may be a useful metric for diagnosis and prognostication when one is using electronic health record-derived data in mechanically ventilated patients. ♦

\* Supplemental Material is available at: [www.thepermanentjournal.org/files/2020/19.113Suppl.pdf](http://www.thepermanentjournal.org/files/2020/19.113Suppl.pdf)

### Disclosure Statement

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### Authors' Contributions

Jason Y Adams, MD, MS; Angela J Rogers, MD, MPH; and Vincent X Liu, MD, MSc, conceived and designed the study. Jason Y Adams, MD, MS; Alejandro Schuler, MS, PhD; Sandra L Taylor, PhD; Albert W Riedl, MS; and Vincent X Liu, MD, MSc, coordinated and performed data collection and statistical analyses. All authors participated in analysis and interpretation of study data. Jason Y Adams, MD, MS; Angela J Rogers, MD, MPH; and Vincent X Liu, MD, MSc, wrote the first draft of the manuscript, and all authors participated in revision of the manuscript for important intellectual content. Jason Y Adams, MD, MS; and Vincent X Liu, MD, MSc, obtained funding for the study, and Vincent X Liu, MD, MSc, provided overall study supervision. Jason Y Adams, MD, MS; Angela J Rogers, MD, MPH; and Vincent X Liu, MD, MSc, had full access to the data used in the study and take full responsibility for the integrity of the data and the accuracy of the data analysis. Vincent X Liu, MD, MSc, was responsible for the final decision to submit the manuscript.

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# Aspirin Use, Compliance, and Knowledge of Anticancer Effect in the Community

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## ABSTRACT

**Introduction:** Millions of adults worldwide use low-dose aspirin for secondary prevention of heart disease. Results of randomized trials indicate that regular use of low-dose aspirin may reduce the risk of colorectal cancer by more than 20%, leading to speculation of its chemoprevention role for high-risk groups. Little is known, however, about the use of aspirin in our community.

**Objective:** To determine aspirin use and therapy compliance (never or rarely missing a dose) and to assess whether patients in our community are aware of its anticancer effect.

**Methods:** Observational study. Prospective data were collected during a 1-year period from patients in our general surgical clinic regarding aspirin use, comorbidities, adverse effects, and awareness of anticancer effect. Statistical analysis was performed.

**Results:** Among aspirin users ( $n = 137$ ), the mean age was 65.8 years. Most (76.6%) received an 81-mg daily dose of aspirin. Compliance was 25.6% and was significantly associated with diabetes mellitus ( $p = 0.0028$ ). Only 9.5% were aware of the medication's anticancer effect. Among nonusers ( $n = 383$ ), the mean age was 53.3 years, a significant difference vs that of aspirin users ( $p < 0.001$ ). Only 4.7% of nonusers knew of the anticancer effect. Nonusers were more likely to be women ( $p = 0.0005$ ), younger than age 40 years ( $p < 0.0001$ ), and have comorbidities or polypharmacy ( $p = 0.002$ ). No significant difference was found between groups in anticoagulants use, nonsteroidal anti-inflammatory drug use, and smoking.

**Conclusion:** Knowledge of aspirin's anticancer effect is low. More research is required to understand why aspirin compliance is also low.

## INTRODUCTION

Aspirin is used worldwide at low doses for secondary prevention of heart disease. There has been recent speculation regarding an additional role for aspirin: Chemoprevention of colorectal, breast, and other types of epithelial cancer.<sup>1</sup> The cyclooxygenase (COX) enzyme system, and its 2 isoenzymes, COX-1 and COX-2, play a key role in prostaglandin synthesis in both health and disease.<sup>2,3</sup> Excessive prostaglandin generation is thought to permit the progression of precursor epithelial lesions into cancers.<sup>4</sup> Abnormal expression of COX-2 is considered to be a key event in cancer promotion. It is an inducible isoenzyme, expressed after stimulation by growth factors and tumor promoters,<sup>5-7</sup> in turn generating uncontrolled prostaglandin release with all its negative sequelae.<sup>8-10</sup>

Aspirin, a nonsteroidal anti-inflammatory drug (NSAID), inhibits the COX enzyme system at a low dose.<sup>1</sup> Findings of randomized controlled trials have recently indicated that regular administration of

aspirin for 5 years can reduce the risk of colorectal cancer up to 27%.<sup>11-13</sup> Because millions of adults already use aspirin worldwide for the primary and secondary prevention of cardiovascular disease, considerable data already exist regarding its tolerability and side effect profile.<sup>1,14</sup> Currently, there are patients who self-administer aspirin to reduce the risk of ischemic heart disease, perhaps partly because information regarding the anticancer effect of the drug has begun to emerge in the community. In these groups, aspirin might be a good candidate for chemoprevention. In healthy individuals, younger age groups, and patients not receiving any other medications, regular aspirin use would probably lead to an unacceptable increased risk of gastrointestinal tract bleeding and hemorrhagic stroke.

It is important to know how patients presently use aspirin in the community. Vital data include how many patients self-administer aspirin, how many take aspirin on a physician's advice, and an

understanding of the nature of compliance with aspirin therapy in the community. Although randomized controlled trials give valuable information regarding efficacy, they are not representative of how medications are realistically used by patients in the community.

Surprisingly, little information exists in the literature concerning aspirin use in the community and is mainly limited to retrospective studies focused on the use of aspirin in cardiovascular disease.<sup>15</sup> The aim of our study was to prospectively investigate aspirin use, compliance, and awareness of its anticancer effect in our community.

## METHODS

Prospective data were collected using questionnaires and chart reviews during a 1-year period from every patient attending our community general surgical clinic regarding aspirin use, comorbidities, adverse effects of aspirin, and awareness of the effect of aspirin against colorectal cancer. All patients were referred from local primary care practices in Carleton County, New Brunswick, Canada. Compliance was defined as full if the patient stated on the questionnaire s/he never or rarely missed a dose of aspirin. Noncompliance was registered for all other entries apart from this. We did not specifically ask why patients were taking aspirin in our study and did not inquire regarding income or class stratification.

Patients were asked on questionnaires if they were aware of the anticancer effect of aspirin and, if so, to list their sources of

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information. Concomitant use of other medications was recorded on a separate questionnaire given to all patients as part of hospital policy and was used to derive statistics for the number and the types of concurrent medications. Exclusion criteria included age younger than 18 years or older than 100 years. Patients were divided into 2 groups: Aspirin users and nonusers. All patients gave informed consent for the study.

Statistical analyses were performed with the unpaired *t*-test and the Fisher exact test using statistical software (SPSS version 16). The level of significance was set at 0.05.

RESULTS

Five hundred twenty patients were enrolled prospectively in the study. Allergy to aspirin or sensitivity was not disclosed by any patient. All patients were white. Table 1 shows the patients' characteristics by study group.

Aspirin Users

A total of 76.6% of patients were taking a daily aspirin dose of 81 mg; 5.8% of patients were taking a dose more than 300 mg; in 17.6%, the exact dose of aspirin being taken could not be determined. In fact, 32.9% of patients were not even aware of what dose of aspirin they were taking, although in some of these patients, the information was able to be determined from the medical record. Sixty-two percent of patients were taking aspirin on their physician's advice, and the rest were self-administering aspirin without a physician's recommendation.

Compliance with aspirin therapy was low, with 25.6% of patients stating they never or rarely missed a dose of aspirin. Another 39% admitted to missing doses weekly to monthly, and 3% never took aspirin despite it being prescribed. Less than 6% (5.8%) of patients taking aspirin reported adverse effects, including minor bruising, bleeding, or gastrointestinal upset. No serious complications were described.

Patients with diabetes mellitus were significantly more likely to be fully compliant with aspirin therapy compared with those without diabetes (*p* = 0.0028, Table 2). Age and sex were not significant factors in compliance.

Table 1. Characteristics of aspirin users vs nonusers			
Characteristic	Aspirin users (N = 137)	Nonusers (N = 383)	p value (unpaired <i>t</i> -test)
Men:women ratio	1.11:1	1:1.84	NA
Mean age (range), y	65.8 (23-100)	53.3 (18-90)	< 0.001
Awareness of anticancer effect, %	9.5	4.7	0.06
Aspirin users in past/ceased treatment, %	NA	1	NA

NA = not applicable.

Nonusers

Patients not using aspirin were significantly more likely to be women, younger than age 40 years, have ischemic heart disease, have diabetes, and/or use more than 5 concurrent medications (Table 3). No significant difference was found between the groups in anticoagulant use, additional NSAID use, or current smoking/history of smoking (Table 3).

Knowledge of Anticancer Effect

Knowledge of aspirin's anticancer effect was low in both groups, especially nonusers (Table 1). There might be some modest degree of evidence for knowledge of anticancer effect in the aspirin users group because the *p* value was near 0.05; however, this finding cannot be taken as significant. The main sources of information regarding the anticancer effect were media or the Internet.

DISCUSSION

Noncompliance occurs when patients do not follow recommended treatment plans. Underuse occurs when medications are used or prescribed less than would be expected.<sup>15</sup> Compliance in our study was self-reported. Retrospective reporting can be inaccurate because patients may overestimate the degree of compliance with treatment.<sup>16-18</sup> We relied on self-reporting because other ways of measuring compliance (eg, pill counting, measurement of serum levels) were not applicable to the design of our study and were logistically difficult to implement. Patient reporting, however, has been shown to be more accurate than clinician reporting.<sup>19,20</sup> Physicians may exaggerate compliance or find it difficult to estimate, particularly with long-term treatment regimens.

In our study, 62% of the aspirin users were taking the medication under

Table 2. Compliance with therapy in aspirin users group	
Factor	p value <sup>a</sup>
Age	0.22
Sex	0.24
Diabetes mellitus	0.0028
Ischemic heart disease	0.06
Use of > 5 medications	0.07

<sup>a</sup> Fisher exact test.

Table 3. Significant differences of nonusers of aspirin versus aspirin users	
Characteristic	p value <sup>a</sup>
Female sex	< 0.0005
Age < 40 y	< 0.0001
Ischemic heart disease	0.002
Diabetes	< 0.0005
Use of > 5 medications	< 0.0005
Smoker/ex-smoker	0.19
Anticoagulant use	0.51
Additional NSAID use	0.20

<sup>a</sup> Fisher exact test; nonusers compared with aspirin users.

NSAID = nonsteroidal anti-inflammatory drug.

physician advice, probably for prevention of cardiovascular disease. The rest were self-administering aspirin. We did not explore reasons for aspirin use in this specific group, but with knowledge of the anticancer effect at only 9.5% in this group, it is possible that patients self-administered aspirin for cardiovascular reasons or perhaps for analgesia. We note that we did not specifically ask why patients were taking aspirin in our study, and this is perhaps a limitation of our work, because it may have given an insight into compliance.

Compliance was significantly associated with the presence of diabetes mellitus. Age and sex were not significantly associated with compliance. In our study, aspirin nonusers were significantly associated with age and presence of diabetes and cardiac

disease, but in aspirin users, *better compliance* was associated with diabetes. It is possible that the aspirin users represent a group with substantial disease that is either more health conscious or has better relationships with primary health care practitioners. These factors have been demonstrated to improve adherence to medical advice.<sup>21</sup> This group of patients may have had more specialist involvement in their care. Patients managed by cardiologists have significantly better compliance, including with aspirin therapy.<sup>22</sup>

A recent systematic review examined factors influencing noncompliance with antihypertensive agents.<sup>23</sup> The regimens for antihypertensive medications are similar to aspirin in various ways, including that they are taken daily at a low dose for long periods (years). Three key factors were found to be consistently related to noncompliance: Medication cost, adverse effects, and the nature of the physician-patient relationship.<sup>23</sup> Some other factors determined to be potentially relevant were racial/ethnic minority status, marital status, depression, a history of cardiovascular disease, and multiple dosing regimens.

In our rural community, we believe that cost plays a major role in compliance and underuse of aspirin. Although aspirin is fairly inexpensive and is available over the counter, cost is probably still an issue for many of our patients who are from very low-income families. Additionally, the lack of an obvious benefit while taking a medication long term may lead to underuse and poor compliance. Although we did not specifically look at income and social class and their impact on the use of aspirin in our study, this needs more analysis in our sample and will be the focus of ongoing work. Some evidence suggests that if patients know they will need to take medication regularly for years, compliance suffers, particularly if regimens are complex.<sup>24-26</sup>

Reviewing the aspirin users group, there was variability in the dosing regimens prescribed, ranging from 81 mg once daily to nearly 6% taking more than 300 mg. This range indicates there may be issues with understanding what constitutes an effective aspirin regimen for primary and secondary prevention. This issue needs urgent exploration because higher doses of aspirin are associated with greater risks of complications of bleeding and peptic ulceration.<sup>14</sup>

Adverse effects can reduce compliance with most medications, but this effect is not as strong as others, including the physician-patient relationship.<sup>26</sup> Low-dose aspirin is relatively well tolerated, reflected by the low incidence of adverse effects in our study (5.8%). Access to primary care and the physician-patient relationship could be key factors explaining noncompliance in our study. In patients using prescribed medications for psychiatric illness, 74% who form weak or poor alliances with their physician at 6 months fail to adhere to medication use during the following year and a half.<sup>27</sup>

Understanding and memory of consultations can affect satisfaction with the encounter, which in turn affects compliance.<sup>28</sup> Organizational factors, such as waiting time, comfort of seating, noncohesive staff, and inconvenient appointment times, are also relevant.<sup>29,30</sup> Although physicians seldom attribute a patient's noncompliance to their own communication style, there is evidence to demonstrate otherwise. The type of language used, quality of information given, and nature of the instructions to take the medication, all affect compliance.<sup>26,31</sup> Nonadherence to a prescribed treatment may reflect an effort by the patient to restore control lost to the illness, its treatment, and an unsatisfactory physician-patient relationship.<sup>26</sup> Teaching patients to gain control over their health issues can result in improved adherence.<sup>32</sup>

How patients perceive illness can affect compliance with using medication. In the context of a prevention strategy, a healthy patient may not see the benefit of taking medications daily because there is no immediate gain. In chronic disease with pervasive symptoms, another addition to a regimen that does little to improve ongoing quality of life may seem unnecessary. This coupled with unsatisfactory consultations can reduce compliance.

### Underuse of Aspirin

Nonuse was significantly associated with women younger than age 40 years, the presence of ischemic heart disease or diabetes, and polypharmacy. Underuse of cardiac and other medications has previously been shown to be associated with older age, female sex, diabetes, and symptomatic cardiac disease or intervention.<sup>33-37</sup> Other risk factors in these studies

included ethnicity, being overweight, poor education, polypharmacy, and receiving dual antiplatelet therapy. Unfortunately, these groups are also representative of individuals who would derive the most benefit from primary or secondary prevention.

Women are less likely than men to be adherent in their long-term use of medications and less likely to receive the medication treatment and monitoring recommended by clinical guidelines.<sup>36</sup> It has been indicated that an individual's sex influences adherence. Women and men differ in their health beliefs and health behaviors and also may have different attitudes toward medications, with nonadherence appearing to be a more consistent phenomenon in women.<sup>38</sup> On a population basis, women and men can differ in educational level, employment, income, and disease patterns.<sup>39</sup> There is some evidence that women are more likely to obtain a prescription but then not fill it.<sup>40</sup>

Previous studies have also found that adverse effects of medications can be a reason for nonadherence in women.<sup>39,41</sup> Although women and men seem to report similar numbers of adverse effects, women use adverse effects as the reason for noncompliance almost twice as often as men.<sup>42</sup> This might correlate to underuse of medications for prevention of disease, particularly if there is no immediate perceived benefit. Other studies have found that women have a higher risk for development of adverse effects with medication.<sup>43</sup> It is possible they are more sensitive to drugs compared with men because of pharmacokinetic differences, wrong doses, or unsuitable medications more often than men.

The reasons for underuse of aspirin in our study population are likely to be multifactorial but are likely to include the same issues as with compliance. These reasons include problems in the nature of the physician-patient relationship, poor access to specialty care, poverty, lack of adequate health information, and lack of clear communication strategies for primary and secondary prevention in the physician's office. In our community, these issues are common, and all have been shown to correlate with underuse in the aforementioned studies.

Interestingly, we found that polypharmacy was associated with nonuse

of aspirin. It has previously been shown that when patients take just 1 medication, nonadherence is around 15%; when 2 or 3 drugs are prescribed, nonadherence rates can increase to 25%, and with 5 or more medications, rates of nonadherence simply owing to drug error alone can be as high as 35%.<sup>26,44</sup> It is not clear how this translates to underuse or nonuse from the patient's point of view. It may be possible that in the context of polypharmacy and chronic disease, the less likely a patient will be to use another medication, even if recommended by his/her family physician, particularly in the absence of immediate benefit.<sup>45,46</sup> This hypothesis requires further testing in a prospective enrolled study.

### Knowledge of Anticancer Effect

There was an interesting hint in our study findings that patients using aspirin might be more aware of the anticancer effect of aspirin compared with nonusers. We would like to reaffirm that this was not a significant finding, as is true of the other instances in our study in which the value of *p* was near 0.05 and can therefore not be deemed significant, according to Wood et al.<sup>47</sup>

The anticancer effect of aspirin is well documented in the medical literature and has recently surfaced in the general media.<sup>48</sup> It appears, however, this information has not yet translated into awareness at the physician-patient interface. Previous studies found that although patients may seek health information from the Internet and various other sources, the quality of the physician-patient relationship is more valuable in terms of access to health knowledge.<sup>49</sup> The various means of disseminating information in the modern era represent a potential opportunity for increasing patient education about the anticancer effect of aspirin.

### CONCLUSION

For a strategy of chemoprevention of colorectal cancer with aspirin to be successful, the drug must be taken at the physician-recommended dose without fail, regularly, and long term. The risks of taking the medication must be lower than the perceived benefit.

Results of recent studies have suggested that the risk of major bleeding events with aspirin may be higher than previously

considered and may equally balance or approach any cardiovascular benefit.<sup>50,51</sup> Chemoprophylaxis seems to make sense in patients already prescribed aspirin for prevention of cardiac disease because a potential risk reduction of colorectal cancer of up to 27% might outweigh the percentage risks of adverse effects of aspirin. This decision would need a balanced discussion of harms vs benefits with the patient.

Underuse and nonadherence to medications have substantial cost and health implications for society. We hope our results, taken in the context that they represent only our local community, will help inform clinicians of groups that are most vulnerable for noncompliance and underuse of aspirin and allow them to develop and target effective prevention strategies. In the future, we would like to examine knowledge of aspirin's anticancer effect in patients in general, and in a wider physician population. ♦

### Disclosure Statement

*The author(s) have no conflicts of interest to disclose.*

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### Author Contributions

*Gurpreet Singh Ranger, MD, conceived the study idea, designed the study and questionnaire, saw the patients, and drafted the final manuscript. Cindy McKinley-Brown, RN, statistically analyzed the data, and provided critical insight into the paper. Emma Rogerson helped review and submit the final manuscript. Krystal Schimp-Manuel distributed and organized the collection of the questionnaires. All authors have given final approval to the manuscript.*

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## Companions

Wine and cheese are ageless companions, like aspirin and aches, or June and moon, or good people and noble ventures.

— MFK Fisher, 1908-1992, American food writer

# Identifying Patients with Rare Disease Using Electronic Health Record Data: The Kaiser Permanente Southern California Membranous Nephropathy Cohort

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## ABSTRACT

**Introduction:** Developing a reliable means to identify and study real-world populations of patients with membranous nephropathy (MN) using electronic health records (EHRs) would help advance glomerular disease research. Identifying MN cases using EHRs is limited by the need for manual reviews of biopsy reports.

**Objective:** To evaluate the accuracy of identifying patients with biopsy-proven MN using the EHR in a large, diverse population of an integrated health system.

**Methods:** A retrospective cohort study was performed between June 28, 1999, and June 25, 2015, among patients with kidney biopsy results (N = 4723), which were manually reviewed and designated as MN or non-MN. The sensitivity, specificity, and positive predictive value (PPV) of International Classification of Diseases, Ninth Revision (ICD-9) diagnosis codes were determined using 2 approaches: 1) clinical (MN-specific codes 581.1, 582.1, or 583.1) and 2) agnostic/data-derived (codes selected from supervised learning at the highest predictive performance).

**Results:** One year after biopsy, the sensitivity and specificity of an MN diagnosis were 86% and 76%, respectively, but the PPV was 26%. The data-driven approach detected that using only 2 codes (581.1 or 583.1) improved specificity to 94% and PPV to 58%, with a small decrease in sensitivity to 83%. When any code was reported at least 3 times, specificity was 98%; PPV, 78%; and sensitivity, 64%.

**Discussion:** Our findings suggest that ICD-9 diagnosis codes might be a convenient tool to identify patients with MN using EHR and/or administrative claims information. Codes selected from supervised learning achieved better overall performance, suggesting the potential of developing data-driven methods.

a real-world environment would provide insights into the natural history of disease and would help determine treatment. We postulate that developing a reliable means to identify and study real-world populations of patients with MN using existing administrative and clinical information would represent a major advancement in glomerular disease research.<sup>6-8</sup> Accordingly, we sought to develop an approach to readily and reliably identify patients with biopsy-proven MN in a large integrated health system using International Classification of Diseases, Ninth Revision (ICD-9) diagnosis codes.

## METHODS

A retrospective cohort study was performed in Kaiser Permanente Southern California (KPSC), an integrated health system inclusive of more than 4.5 million members, 14 medical centers, and more than 200 satellite clinics. The study population was derived from 4723 patients who underwent a native kidney biopsy procedure between June 28, 1999, and June 25, 2015, and had at least 1 year of continuous follow-up.<sup>9</sup> A manual chart review of biopsy reports for all patients was performed to identify the different cases of glomerular disease including MN.<sup>9</sup> Secondary MN was excluded with the exception of MN associated with systemic lupus erythematosus, which was included in the study cohort. On the basis of the chart reviews, patients were categorized as having biopsy-proven MN or non-MN. This retrospective data-only study was approved by the KPSC institutional review board (#5815) and exempted from the need to obtain informed consent.

We developed 2 algorithms to determine whether an EHR approach using ICD-9 codes would reliably capture and predict biopsy-proven MN. The first

## INTRODUCTION

Membranous nephropathy (MN) is among the most common glomerular diseases in adults and is associated with substantial morbidity, mortality, and health care expenditure.<sup>1,2</sup> It is challenging to study large-scale populations of patients with MN because tools (eg, laboratory tests or diagnosis codes) to quickly identify cases of MN from electronic health record (EHR) or administrative/

claims datasets are lacking. Indeed, the diagnosis of MN requires a kidney biopsy, which is the gold-standard diagnostic test for MN. However, manual review of large volumes of kidney biopsy reports is impeded by resource limitations and/or the unavailability of biopsy reports in structured research datasets. As a result, knowledge of MN epidemiology largely derives from single-center case series or resource-intensive cohort studies, with uncertain generalizability of findings to the overall population.<sup>3-5</sup>

The increasing prevalence of health systems capturing information through the EHR provides more opportunities to study rare disease populations such as glomerular disease and may help improve management strategies. Building an effective means to recognize and follow these populations within the backdrop of

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approach was the *clinically intuitive approach* (clinical approach), in which we used all ICD-9 codes that suggested a diagnosis of MN. These codes were 581.1 (nephrotic syndrome with lesion of membranous glomerulonephritis), 582.1 (chronic glomerulonephritis with lesion of membranous glomerulonephritis), and 583.1 (nephritis and nephropathy, not specified as acute or chronic, with lesion of membranous glomerulonephritis). MN was considered as “diagnosed” and predicted if at least 1 selected code appeared in the patient’s EHR within the 1 year after kidney biopsy.

The second approach was the *data-driven/agnostic approach* (data-driven approach). In this method, we evaluated all ICD-9 codes for each patient who had biopsy-proven MN. We then determined which of the ICD-9 codes had the strongest associations with MN collected from supervised learning results using R software (version 3.4.3).<sup>10</sup> The learning was realized using multiple logistic modeling in a randomly resampled subset with half the size of the cohort, and a total of 1000 resampling sets were accomplished. Thus,

for each time of sampling, half of the patients were randomly selected for training, and the other half were used for validation. All ICD-9 codes appearing in the EHR during the year after kidney biopsy were included in the modeling and tested for association with MN. Demographic and clinical variables (age, sex, race, birth year, biopsy year, and hospital) were included in the models as covariates to adjust for potential confounding effects.

We calculated the sensitivity, specificity, and positive predictive value (PPV) of the 2 approaches. Sensitivity analyses were performed, whereby we required at least 2 or at least 3 ICD-9 code appearances for case identification. Finally, to examine coding practices, we determined the cumulative incidence of ICD-9 codes for MN more than 12 months and compared those with biopsy-proven MN diagnoses vs those with alternate diagnoses.

## RESULTS

The study cohort comprised 416 patients who had biopsy-proven MN. Using the clinical approach, the sensitivity of at

least 1 code for MN (581.1, 582.1, 583.1) in the first 12 months after kidney biopsy was 86% (78% if  $\geq 2$  codes and 70% if  $\geq 3$  codes). Specificity was 76% (83% and 87% for  $\geq 2$  and  $\geq 3$  codes, respectively), and PPV was 26% (31% and 35%, respectively; Table 1).

In the data-driven approach, a total of 6280 unique codes were found in the 1-year follow-up, and 127 unique codes remained for learning after excluding noninformative codes defined as prevalence less than 5%. We built 1000 different sets of subjects by randomly sampled half size of each biopsy-proven group, and a multiple logistic model was used to test associations in each resampled set. After collecting test results from all the resampled sets, we found that codes 581.1 and 583.1 were always at the top 10 strongest associations with biopsy-proven MN, with odds ratios of 2.62 (95% confidence interval = 1.77–3.86) and 3.77 (95% confidence interval = 2.54–5.6), respectively. The other code selected using the clinically intuitive approach (582.1) was found with a very low prevalence, at 1.3%, and a nonsignificant odds ratio

**Table 1. Clinical-based approach to identification of membranous nephropathy (MN); codes 581.1, 582.1, 583.1<sup>a</sup>**

Codes reported $\geq 1$ time				Codes reported $\geq 2$ times				Codes reported $\geq 3$ times			
Biopsy-proven MN				Biopsy-proven MN				Biopsy-proven MN			
Diagnosed MN	Yes	No	Total	Diagnosed MN	Yes	No	Total	Diagnosed MN	Yes	No	Total
Code reported $\geq 1$ time											
Yes	357	1023	1380	Yes	324	732	1056	Yes	293	554	847
No	59	3284	3343	No	92	3575	3667	No	123	3753	3876
Total	416	4307	4723	Total	416	4307	4723	Total	416	4307	4723
Sensitivity (95% CI)	0.86 (0.82–0.89)			Sensitivity (95% CI)	0.78 (0.74–0.82)			Sensitivity (95% CI)	0.70 (0.66–0.75)		
Specificity (95% CI)	0.76 (0.75–0.78)			Specificity (95% CI)	0.83 (0.82–0.84)			Specificity (95% CI)	0.87 (0.86–0.88)		
PPV (95% CI)	0.26 (0.24–0.28)			PPV (95% CI)	0.31 (0.28–0.33)			PPV (95% CI)	0.35 (0.31–0.38)		

<sup>a</sup> Code 581.1 is nephrotic syndrome with lesion of membranous glomerulonephritis; code 582.1 is chronic glomerulonephritis with lesion of membranous glomerulonephritis; and code 583.1 is nephritis and nephropathy, not specified as acute or chronic, with lesion of membranous glomerulonephritis. CI = confidence interval; PPV = positive predictive value.

**Table 2. Data-driven approach to identification of membranous nephropathy (MN); codes 581.1, 583.1<sup>a</sup>**

Codes reported $\geq 1$ time				Codes reported $\geq 2$ times				Codes reported $\geq 3$ times			
Biopsy-proven MN				Biopsy-proven MN				Biopsy-proven MN			
Diagnosed MN	Yes	No	Total	Diagnosed MN	Yes	No	Total	Diagnosed MN	Yes	No	Total
Yes	344	252	596	Yes	306	128	434	Yes	268	74	342
No	72	4055	4127	No	110	4179	4289	No	148	4233	4381
Total	416	4307	4723	Total	416	4307	4723	Total	416	4307	4723
Sensitivity (95% CI)	0.83 (0.79–0.86)			Sensitivity (95% CI)	0.74 (0.69–0.78)			Sensitivity (95% CI)	0.64 (0.60–0.69)		
Specificity (95% CI)	0.94 (0.93–0.95)			Specificity (95% CI)	0.97 (0.97–0.98)			Specificity (95% CI)	0.98 (0.98–0.99)		
PPV (95% CI)	0.58 (0.54–0.62)			PPV (95% CI)	0.71 (0.66–0.75)			PPV (95% CI)	0.78 (0.74–0.83)		

<sup>a</sup> See footnote to Table 1 for explanation of diagnosis codes. CI = confidence interval; PPV = positive predictive value.

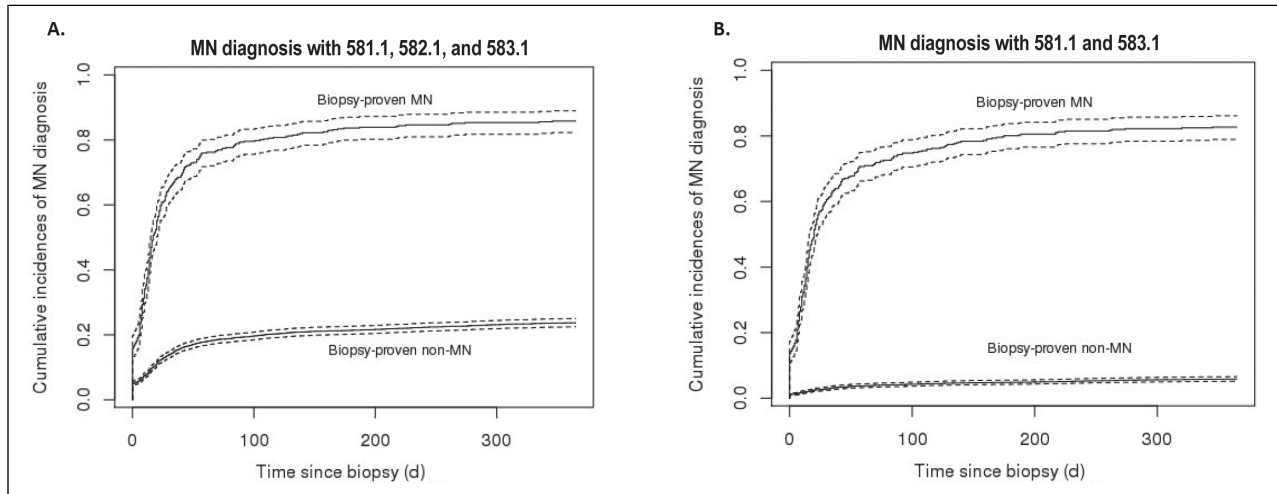


Figure 1. Cumulative incidences of coding for membranous nephropathy (MN) in the 365 days after kidney biopsy, comparing patients with biopsy-proven MN with those with biopsy-proven diagnoses other than MN, using either a clinically intuitive approach (A, on left) or a data-driven/agnostic approach (B, on right). Cumulative incidence curves with the clinical approach demonstrated that 64%, 81%, and 86% of patients with biopsy-proven MN received an International Classification of Diseases, Ninth Revision diagnosis code suggestive of MN by 30, 120, and 365 days. Cumulative incidences using data-driven/agnostic approach were marginally lower at 60%, 80%, and 83% of patients, respectively.

of 0.95 (95% confidence interval = 0.82–1.13). The third prevalent code found in the learning results was 583.81 but with low prevalence at 48.7%. Thus, we determined codes 581.1 and 583.1 as the 2 codes of interest for our data-driven approach, which happened to be 2 of the 3 ICD-9 codes suggesting MN used for the clinical approach. Using either of these 2 codes (ie, excluding code 582.1) appearing in the 12 months after biopsy led to substantial improvements in specificity (94%, 97%, and 98%, respectively, if  $\geq 1$ ,  $\geq 2$ , or  $\geq 3$  ICD-9 codes were used) and PPV (58%, 71%, and 78%, respectively, if  $\geq 1$ ,  $\geq 2$ , or  $\geq 3$  ICD-9 codes were used; Table 2).

Using the clinical approach, cumulative incidence curves demonstrated that among patients with biopsy-proven MN, 64%, 81%, and 86% received an ICD-9 code suggestive of MN by 30, 120, and 365 days, respectively, after kidney biopsy (Figure 1). Using the data-driven approach, cumulative incidences were marginally lower at 60%, 80%, and 83% of patients by 30, 120, and 365 days, respectively.

We performed further exploratory analyses of coding practices in non-MN cases. These results revealed that those with biopsy-proven focal segmental glomerulosclerosis accounted most for patients likely to receive an ICD-9 code suggesting MN (53% of false-positive cases).

## DISCUSSION

We evaluated the utility of diagnosis codes for identifying MN in a large integrated health system using an EHR-based approach. Our findings suggest that ICD-9 diagnosis codes might be a convenient tool to identify patients with MN using EHR and/or administrative claims information. Although the ICD-9-based clinical approach was reasonably sensitive and specific for MN (both  $> 80\%$ ), the relative rarity of MN cases even in this biopsied cohort resulted in a very poor predictive ability (PPV was only 26%, increasing to 35% if we required  $\geq 3$  code appearances). Were we to expand the cohort to all patients in this health system (in whom the incidence of MN approximates 10–20 per million population),<sup>9</sup> rather than restricting to those who had undergone a kidney biopsy, we would expect an even lower PPV. In contrast, using a data-driven approach, we could increase the PPV to 78%, albeit with a loss of sensitivity. Accordingly, each of the studied approaches has merit, depending on the goals of a research study: If estimating disease incidence, for example, an approach with high sensitivity (such that you are capturing most patients) should be selected. However, if studying disease natural history or treatment outcomes in patients with MN,<sup>11</sup> an approach with

high PPV (such that you can be confident that you are studying cases of true MN) should be selected.

Our study has several limitations. First, we restricted our study population to people who had undergone a kidney biopsy: Accordingly, our outcome measures (sensitivity, specificity, and PPV) are applicable only to biopsied patients. Second, our cohort was composed of a racially/ethnically diverse cohort of patients with private insurance residing in Southern California.<sup>9</sup> Therefore, the applicability of our findings to other patient populations with potentially different disease distributions, and to other health systems with potentially different coding practices, cannot be determined. The clinical practice environment at KPSC has standardized and population-based practices for many chronic conditions, including chronic kidney disease, and has achieved high levels of success.<sup>12–14</sup> However, there are no internal diagnostic or treatment guidelines for glomerular diseases.

A third limitation is that we restricted our analyses to ICD-9 codes that were in use at the time of and up to 1 year after the date of the studied kidney biopsy procedures. Thus, we cannot speak for the sensitivity, specificity, or PPV of more contemporary ICD-10 codes. However, a major application of our

diagnostic algorithms (once validated in other populations) would be to study long-term patient outcomes (eg, disease natural history, treatment practices, and renal outcomes) among patients with MN. Therefore, identifying patients who underwent biopsy before October 2015 (when ICD-10 codes were implemented) using ICD-9 codes and then capturing outcomes using a combination of ICD-9 and ICD-10 codes would be most appropriate.<sup>11</sup>

Finally, the highest PPV we could achieve was 78%. Although it may be beyond the scope of this study (and potentially limiting clinical utility), additional measures to enhance PPV may include the addition of demographics, health care utilization data (eg, nephrology visits), medication data (eg, immunosuppressive therapies), laboratory data (eg, urine protein or phospholipase A<sub>2</sub> receptor antibody levels<sup>15</sup>), and/or free text data extracted from kidney biopsy reports.

## CONCLUSION

We found that ICD-9 diagnosis codes suggestive of MN received in the year after a kidney biopsy could be used to identify cases of MN with reasonable sensitivity but with lower PPV. A data-driven approach (whereby we were agnostic to the meaning of the ICD-9 diagnosis codes and instead selected those codes that were most strongly associated with a true diagnosis of MN) performed better than a clinical approach (where we focused only on those ICD-9 codes that suggested MN). Use of more than 1 code appearing in the patient record further improved PPV.

Our results suggest that ICD-9 diagnosis codes, if applied carefully or with support from machine learning, might be a convenient and reliable tool to identify large-scale populations of patients with MN using EHR or administrative/claims data. We welcome further studies aiming to validate and expand our approaches in other patient populations and to extend them to other glomerular diseases. Ultimately, applying these approaches to facilitate large-scale

epidemiologic studies will inform understanding of the characteristics, experiences, and outcomes of real-world patients with MN. ♦

## Disclosure Statement

*The author(s) have no conflicts of interest to disclose.*

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## Authors' Contributions

*John J Sim, MD, participated in the study concept and design; participated in data acquisition, analysis, and interpretation; contributed to drafting of the manuscript; and cosupervised the study. He had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Yu-Hsiang Shu, PhD, participated in the study concept and design; participated in data acquisition, analysis, and interpretation; and contributed to drafting of the manuscript. Amy Z Sun, MD, and Michelle M O'Shaughnessy, MD, participated in the study concept and design and contributed to drafting of the manuscript. Teresa N Harrison, SM, and Aviv Hever, MD, participated in data acquisition, analysis, and interpretation and helped critically revise the manuscript. Steven J Jacobsen, MD, PhD, helped critically revise the manuscript for important intellectual content; lent administrative, technical, or material support; and cosupervised the study.*

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**Just Before Sunrise**

Bolsa Chica Ecological Reserve, Huntington Beach, CA

photograph

**Jorge A Ramirez, MD**

Meaning "little bag" in Spanish, the "Bolsa Chica" is home to a variety of wildlife including shovelnose guitarfish, grey smooth-hound shark, California halibut, and more than 200 species of birds, with habitats such as open water, dunes, salt marsh, freshwater marsh, and mudflats. The footbridge is located at the start of a trail along the wetlands. Dr Ramirez took this photograph at the reserve during the summer of 2019.

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# Challenging the Surgical Axiom: Albumin Level Does Not Reliably Predict Development of Wound Complications in Patients Undergoing Body Contouring

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## ABSTRACT

**Introduction:** Hypoalbuminemia has traditionally been associated with a poor nutritional status and subsequent high incidence of postoperative wound complications in surgical patients. Recent evidence, however, suggests that traditional nutritional markers are inadequate in predicting postoperative morbidity.

**Objective:** To test the hypothesis that preoperative albumin levels are not associated with adverse outcomes in patients undergoing body contouring.

**Methods:** All patients undergoing body contouring from 2015 to 2017 were identified using the American College of Surgeons National Surgical Quality Improvement Program database. Demographics, comorbidities, and wound classification were extracted from the database. The independent predictors of developing wound complications were identified. Logistic regressions were used to identify the impact of albumin on outcomes.

**Results:** During the study period, 4496 patients were identified. Wound complications developed in 202 patients (4.5%). Increasing body mass index, history of diabetes mellitus, American Society of Anesthesiologists classification, history of prior open wound, and tobacco use were independently associated with the development of postoperative complications. Albumin levels were not associated with the development of wound complications. Similarly, albumin levels were not associated with the need for a repeated operation, with readmission, or with the total hospital length of stay.

**Conclusion:** Albumin values were not associated with wound complications or need for reoperation in patients undergoing body contouring. Further research is warranted.

## INTRODUCTION

Body contouring has become increasingly common since 2010, especially with the development of bariatric surgery leading to massive weight loss. Body-contouring procedures are often extensive, performed in an elective setting, and challenge the body in wound healing, which is critical for procedures.<sup>1</sup> Factors such as autoimmune disease, tobacco use, and nutritional status play a major role in wound healing and, therefore, play an important role in the postoperative course of patients undergoing body contouring. For this reason, many authors suggest a preoperative evaluation of patients' nutritional status.<sup>2</sup>

Albumin has been traditionally used as a marker of nutritional status by both nutritional specialists and surgeons to guide decision making regarding the optimal time for surgery. The traditional dogma dictates that preoperative hypoalbuminemia correlates with poor wound healing and higher incidence of

wound complications after major surgery. However, this dogma has been challenged by several studies whose results show that the correlation between albumin levels and nutritional status is not as strong as once believed.<sup>3</sup> In fact, serum albumin levels may be affected only in individuals who are experiencing "extreme" starvation (defined as a body mass index [BMI] < 12 kg/m<sup>2</sup> or more than 6 weeks' starvation).<sup>4</sup> We hypothesized that preoperative albumin levels would not be associated with a higher incidence of wound complications in patients undergoing elective body contouring.

## METHODS

### Patients

All patients undergoing body contouring from 2015 to 2017 were identified using the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database.<sup>5</sup> Table 1 lists the Current Procedural Terminology codes used for this study. Only patients with a preoperative albumin level within 30 days of the operation were included. Patients who did not have a clean wound classification at the end of the surgery were also excluded from further analysis to ensure the homogeneity of the study population.

The study population was then divided into 2 major groups depending on the development of wound complications. Wound complications were defined as wound dehiscence or superficial and deep surgical site infection. The definition of a surgical site infection was derived from the Centers for Disease Control and Prevention.<sup>6</sup>

The following variables were extracted from the database: Age, sex, race, tobacco use, BMI, and various comorbidities including diabetes, chronic obstructive pulmonary disease, hypertension, and recent body weight loss (defined as loss of > 10% of weight within the previous 30 days).

### Outcome Measures

The primary outcome was the development of wound complications. These complications included wound dehiscence and

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superficial and deep surgical site infection. Secondary outcomes included need for reoperation within 30 days, need for readmission within 30 days, and total hospital length of stay.

### Statistical Analysis

The 2 groups based on the development of wound complications were compared for their baseline characteristics. The Fisher exact test or  $\chi^2$  test was used to compare categorical variables

as appropriate. Continuous variables were examined for normality of distribution using the Shapiro-Wilk test. Normally distributed variables were compared between the 2 groups using the Student *t*-test, and nonnormally distributed variables were compared using the Mann-Whitney (U) test.

To identify the independent predictors of development of wound complications, we used a forward stepwise logistic regression. The dependent variable was the development of complications, and the independent variables included all those that differed at a  $p < 0.2$  in the previously performed univariate analysis. Independent predictors with adjusted odds ratios (AORs) and 95% confidence intervals (CIs) and adjusted *p* values were derived from the regression.

Next, the mean preoperative albumin level was calculated for each group on the basis of their outcome (yes vs no). The mean values were compared with their counterparts using the Mann-Whitney test or Student *t*-test as appropriate. The *p* values were reported.

To evaluate the impact of albumin on the development of wound complications, we used a binary logistic regression. The dependent variables inserted in the model were those that differed from the bivariate analysis at a  $p < 0.2$ . The preoperative albumin was inserted as a continuous variable. AORs with 95% CIs along with adjusted *p* values were derived from the regression. A similar process was replicated for the rest of the outcomes.

**Table 1. Current Procedural Terminology (CPT) codes used**

CPT code	Description
15830	Panniculectomy
15847	Abdominoplasty
15832	Excision, excessive skin; thigh
15833	Excision, excessive skin; leg
15834	Excision, excessive skin; hip
15835	Excision, excessive skin; buttock
15836	Excision, excessive skin; arm
15837	Excision, excessive skin; forearm
15838	Excision, excessive skin; submental fat pad
15839	Excision, excessive skin; other area
19300	Mastectomy for gynecomastia
19316	Mastopexy
19318	Reduction mammoplasty

**Table 2. Demographics and clinical characteristics<sup>a</sup>**

Characteristics	Overall (N = 4496)	No wound complications (n = 4294)	Wound complications (n = 202)	p value
Male sex	299 (6.7)	285 (6.6)	14 (6.9)	0.87
Age, y, mean (SD)	53 ± 8	53 ± 9	51 ± 11	0.91
Hispanic race	448 (10.0)	435 (10.1)	13 (6.4)	0.15
Alcohol use	2 (1.0)	1 (0.02)	1 (0.5)	0.32
Tobacco use	365 (8.1)	337 (7.8)	28 (13.9)	0.02
Albumin level, g/dL, mean (SD)	4.1 (0.3)	4.1 (0.4)	4.0 (0.5)	0.70
Total OR time, min, mean (SD)	175 (87.0)	172 (85.0)	181 (91.0)	0.71
BMI, kg/m <sup>2</sup> , mean (SD)	27.8 (3.6)	26.9 (2.1)	33.7 (4.9)	0.02
<b>Comorbidities</b>				
Body weight loss > 10%	12 (0.3)	11 (0.3)	1 (0.5)	0.52
Chronic disease requiring use of corticosteroids	135 (3.0)	125 (2.9)	10 (5.0)	0.10
COPD	60 (1.3)	54 (1.3)	6 (3.0)	0.05
Diabetes mellitus	493 (10.9)	463 (10.8)	30 (14.8)	0.01
Hypertension	1432 (31.9)	1349 (31.4)	83 (41.1)	0.04
Open wound	45 (1.0)	35 (0.3)	10 (5.0)	< 0.01
Renal disease requiring dialysis	16 (0.4)	13 (0.3)	3 (1.5)	0.03
<b>ASA classification<sup>b</sup></b>				
1	563 (12.5)	554 (12.9)	9 (4.5)	< 0.01
2	2721 (60.5)	2622 (61.1)	99 (49.0)	
3	1171 (26.0)	1086 (25.3)	85 (42.1)	
4	38 (0.8)	29 (0.7)	9 (4.5)	

<sup>a</sup> Data are presented as number (%) unless indicated otherwise. Some percentages do not total to 100 because of rounding.

<sup>b</sup> ASA classification was missing for 3 patients in the no-wound complications group.

ASA = American Society of Anesthesiologists; BMI = body mass index; COPD = chronic obstructive pulmonary disease; OR = operating room; SD = standard deviation.

## RESULTS

During the study period, 4496 patients were identified and met the criteria to be included in the study. Of those, 202 patients (4.5%) experienced a wound complication, whereas 4294 patients (95.5%) did not. Most patients were female (93.3%, Table 2). The most common comorbidity was hypertension (31.9%), followed by diabetes mellitus (10.9%) and chronic disease requiring use of corticosteroids (3.0%, Table 2).

A stepwise forward logistic regression was performed to identify the independent predictors of developing wound complications in the study population (Table 3). The most important predictor was BMI (AOR = 1.54 [95% CI = 1.23-9.51], adjusted  $p < 0.01$ ). Other independent predictors of wound complication development were a history of diabetes mellitus (Table 3). The C statistic for the model was 0.82 (95% CI = 0.71-0.86,  $p = 0.04$ ).

There was no significant difference in the mean albumin levels regarding wound complications between the group with wound complications and the group without (Table 4). Preoperative albumin levels had no impact on wound complications after the 2 groups were adjusted for differences (Table 5). Similarly, preoperative albumin levels had no impact on the secondary outcomes when the differences were adjusted for (Table 5).

## DISCUSSION

Our study found no association with albumin levels and several complications in patients undergoing body contouring. There was no significant difference in serum albumin levels in patients who had wound complications or a reoperation within 30 days and those who did not have either complication. The results were similar after performing a multivariate analysis as well. Although there was no difference in the development of wound complications, we did not account for the development of seromas. A low albumin rate, which could reflect a poor nutritional status, might result in a higher incidence of seromas in patients undergoing body contouring. When we analyzed all wound complications combined, there was no significant difference in serum albumin levels between those who had a complication and those who did not. Once again, these findings were similar after performing a multivariate analysis.

There are limited studies examining the influence of albumin levels on postoperative complications of body contouring. Fischer et al<sup>7</sup> analyzed the outcomes of 1797 patients through the same national database (ACS NSQIP) and found that there was a significant difference in albumin levels between patients with and without wound complications. This difference was also evident for major morbidity as well. The findings of our study are discordant with those of Fischer et al.<sup>7</sup> Our study did not find a significant difference among the serum albumin levels between patients with and without wound complications. Our study also examined the readmission and reoperation rates within 30 days, whereas these were not considered in the study by Fischer et al.<sup>7</sup>

There are, however, several studies looking at the complications after body contouring and various risk factors for the complications. Michaels et al<sup>8</sup> list some of the most common complications after body-contouring procedures. In their analysis of 700 patients, their overall complication rate was 42%. This

**Table 3. Independent predictors of wound complications**

Step	Variable	R <sup>2</sup>	AOR (95% CI)	Adjusted p value
1	Body mass index	0.234	1.54 (1.23-9.51)	< 0.01
2	Diabetes mellitus	0.341	3.45 (1.12-9.55)	0.03
3	ASA classification	0.372	1.45 (1.23-5.61)	0.02
2	Open wound	0.401	1.27 (1.02-7.29)	0.04
3	Tobacco use	0.419	1.72 (1.04-11.31)	0.04

AOR = adjusted odds ratio; ASA = American Society of Anesthesiologists; CI = confidence interval.

**Table 4. Outcomes**

Outcome	Mean albumin (SD), g/dL	p value
Wound complications		
Yes (n = 202)	4.0 (0.5)	0.70
No (n = 4294)	4.1 (0.1)	
Reoperation within 30 d		
Yes (n = 121)	4.0 (0.7)	0.17
No (n = 4375)	4.1 (0.4)	
Readmission within 30 d		
Yes (n = 137)	3.9 (0.5)	0.57
No (n = 4375)	4.0 (0.4)	

SD = standard deviation.

**Table 5. Impact of albumin level on outcomes**

Outcome	AOR (95% CI)	Adjusted p value
Wound complications	1.05 (0.23, 4.31)	0.78
Reoperation within 30 d	0.99 (0.75, 2.83)	0.95
Readmission within 30 d	0.75 (0.41, 1.93)	0.34
Total length of stay	0.11 (-0.09, 0.32)	0.27

AOR = adjusted odds ratio; CI = confidence interval.

rate was similar to that reported in a study by Momeni et al.<sup>9</sup> In a retrospective chart review spanning almost 10 years, the authors reported a minor complication rate of 28.8% and a major complication rate of 11.5%.<sup>9</sup> The overall complication rate was about 40%. This study examined risk factors for complications such as a history of smoking or previous surgeries. They did not look at preoperative nutritional status as a risk factor. Another study was more focused on the development of a seroma after body-contouring surgeries.<sup>10</sup> After body-contouring procedures, seromas developed in about 14% of the patients examined in the study. After a multivariate analysis, the risk factor found to be significant for the development of seromas was the weight of skin excised. Once again, the preoperative nutritional status was not examined.<sup>10</sup>

To our knowledge, our study is one of the few published studies to question the validity of using serum albumin levels as a predictor of complications after body contouring. The study is derived from a robust database comprising data from a multitude of hospitals (ACS NSQIP). This poses a strength compared with other studies derived from a single institution.

There are also limitations to this study. This is a retrospective study, which presents various biases for that reason. In addition, we are not able to determine the context of the body contouring performed for the patients. That is, we are not able to gather from the NSQIP database whether these procedures were performed after weight loss that was a result of bariatric surgery. This is important because of the high prevalence of nutritional deficiencies among patients with a history of bariatric surgery.<sup>11</sup> A subgroup analysis of patients with a history of bariatric surgery would have strengthened this study even more.

We challenge the dogma that preoperative albumin levels should be used as a predictor for postoperative wound complications after body contouring. This notion arose from the proposed link between albumin levels and nutritional status. Therefore, many saw patients with lower albumin levels as malnourished. This belief is being challenged throughout many disciplines as more studies are showing that lower albumin levels may be present for various reasons, not only for malnourishment.<sup>12</sup> These findings warrant further study of albumin levels as preoperative risk factors for postoperative wound complications.

## CONCLUSION

We found conflicting evidence regarding the use of serum albumin values as a reliable predictor for development of wound complications in patients undergoing body contouring. As such, new, more reliable predictors must be identified in an effort to counsel these patients in the preoperative setting regarding the risk of wound complications. ❖

## Disclosure Statement

*The author(s) have no conflicts of interest to disclose.*

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## Practical Medical Men

The practical medical men are the juries who settle all the theories of the hour,  
as they meet emergencies day after day.

— Sarah Orne Jewett, 1849-1909, American novelist, short story writer, and poet

# Immunotherapy Outcomes in Advanced Melanoma in Relation to Age

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## Editor's note

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## ABSTRACT

**Introduction:** Older age is a melanoma risk factor. Elderly individuals are likelier to have immunosenescence, which could help melanoma cells escape immune surveillance. Hence, it is believed that elderly people cannot mount a potent immune response to checkpoint inhibitors to eliminate melanoma.

**Objectives:** To investigate age-related differences in the time to progression, overall survival, and immunotherapy-related adverse events among patients with metastatic melanoma who received checkpoint inhibitors.

**Methods:** We retrospectively identified patients at our institution between January 2012 and December 2016 with stage IV melanoma who received at least 1 dose of ipilimumab, pembrolizumab, nivolumab, or combined ipilimumab and nivolumab. Demographic, pathologic, and clinical characteristics were obtained. Immune-related response criteria were used to define responses.

**Results:** Twenty-nine patients were younger than age 65 years and 31 were age 65 years or older. Time to progression was comparable between the age groups (hazard ratio = 0.79, 95% confidence interval = 0.37-1.70,  $p = 0.46$ ). Overall survival was not significantly different after immunotherapy between groups (hazard ratio = 0.75, 95% confidence interval = 0.31-1.82,  $p = 0.491$ ). Overall, immunotherapy-related adverse events were comparable between groups, with 62% in younger patients (18/29) and 45% in older patients (14/31  $p = 0.19$ ). Of 60 patients, 30 responded to immunotherapy. Nonresponders were more likely than responders to have *BRAF*-mutated melanomas (16 [53.3%] vs 8 [27.6%];  $p = 0.04$ ) and less likely to have immunotherapy-related adverse events (12 [40%] vs 20 [66.7%];  $p = 0.04$ ).

**Conclusion:** Aging does not seem to affect response to checkpoint inhibitors. Elderly patients with metastatic melanoma should be treated similarly to younger patients.

## INTRODUCTION

The incidence of cutaneous melanoma is increasing faster than any other potentially preventable cancer in the US.<sup>1</sup> An estimated 96,480 new cases of cutaneous melanoma were diagnosed in the US in 2019.<sup>2</sup> High-dose interleukin-2 has been the agent of choice to treat metastatic melanoma since 1985.<sup>3</sup> With high-dose interleukin-2, long-term survivals are observed in 5% to 10% of patients. However, because of the severe toxicity profile, its use is restricted to a minority of patients who are physically fit enough to withstand such therapy.<sup>3</sup>

The advent of immunotherapy with checkpoint inhibitors has revolutionized the management of metastatic melanoma. It is known now that the cytotoxic T-lymphocyte antigen-4 (CTLA-4) imposes

a negative feedback on T cells, leading to inactivation of their cytotoxic function. Targeting CTLA-4 with ipilimumab helps restore T-cell activity against melanoma.<sup>4</sup> The programmed death-1 protein (PD-1) is an immune checkpoint receptor expressed by activated T cells. The PD-1 binds to its ligands PDL1 and PDL2, on melanoma cells, which deactivate the T cell, allowing melanoma cells to escape immune surveillance. The CTLA-4 inhibitor, ipilimumab, and the PD-1 inhibitors, pembrolizumab and nivolumab, are approved by the US Food and Drug Administration to treat metastatic melanoma.<sup>5</sup>

Checkpoint inhibitors help activate T cells but also can give rise to immunotherapy-related adverse events (irAEs) such as immune-mediated colitis, rash, autoimmune pneumonitis, pruritus, nausea,

anemia, arthralgia, vomiting, constipation, immune-mediated hepatitis, immune-mediated nephritis and renal dysfunction, autoimmune endocrine deficiencies (hypothyroidism, hypophysitis, and adrenal insufficiency), autoimmune encephalitis, and fatigue.<sup>6</sup>

Age is an important prognostic factor in cutaneous melanoma. Melanoma has an aggressive biology, and, with advancing age, carries a worse prognosis.<sup>7-9</sup> Differences in the natural history of melanoma between younger and older patients are believed to be partially the result of immunosenescence that helps melanoma cells escape an effective immune surveillance.<sup>8</sup> All immune cells originate from the hematopoietic stem cells in the bone marrow, and as we age, there is a 2-fold to 4-fold decline in the proliferative capacity of these stem cells compared with younger people.<sup>10</sup> Although, production of pro-B cells decreases markedly with aging, T-cell precursors seem to be less affected.<sup>11</sup> Aging results in decreased Toll-like receptor function. Toll-like receptors have been found to induce the protective adaptive immune responses in antitumor immunity,<sup>12</sup> reduced cytokine production,<sup>13</sup> and decreased production of nitric oxide and reactive oxygen species by macrophages.<sup>14</sup> Likewise, the ability of NK (natural killer) cells to produce interferon- $\gamma$  becomes modestly impaired in older individuals, thus impairing the ability to destroy melanoma cells.<sup>15</sup> Moreover, aging results in a decline in the number and function of T cells and dendritic cells (the most potent antigen-presenting cells).<sup>10</sup> It also reduces

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the costimulatory molecule CD28, which impairs the ability of T cells to proliferate and secrete interleukin-2.<sup>16</sup>

Our basic understanding of immunosenescence has broadened, giving rise to the myth among some physicians that checkpoint inhibitors may not be as effective in treating the elderly patients with metastatic melanoma as it is in treating the younger ones. This study was conducted to investigate age-related differences in outcomes among patients with metastatic melanoma who received immunotherapy with checkpoint inhibitors.

## METHODS

### Patients

All patients with metastatic melanoma (M1a, b, or c), regardless of pathologic type (cutaneous, mucosal, and ocular), who received immunotherapy with checkpoint inhibitors at our institute between January 2012 and December 2016, were included in this retrospective study. Evaluable patients received at least 1 dose of ipilimumab, pembrolizumab, nivolumab, or combined ipilimumab and nivolumab.

Baseline characteristics included age, sex, melanoma pathologic type, *BRAF* mutation status, prior melanoma-directed therapies, Eastern Cooperative Oncology Group (ECOG) performance status, baseline serum lactate dehydrogenase levels, and presence of brain metastases. The Charlson Comorbidity Index, which predicts the 1-year mortality for a patient who may have a range of comorbid conditions, such as heart disease, AIDS, or cancer (a total of 22 conditions), was calculated. Each condition was assigned a score of 1, 2, 3 or 6, depending on the risk of dying associated with each one the score was calculated and reported for every patient. IrAEs including fever, fatigue, diarrhea and biopsy-confirmed colitis, hypothyroidism, adrenal insufficiency, rash, itching, vitiligo, central nervous system adverse events, and other adverse events believed to be caused by immune therapy, were noted. The date of death and/or the date of melanoma recurrences were recorded.

### End Points and Assessment

The primary objective of this study was to evaluate the baseline demographic,

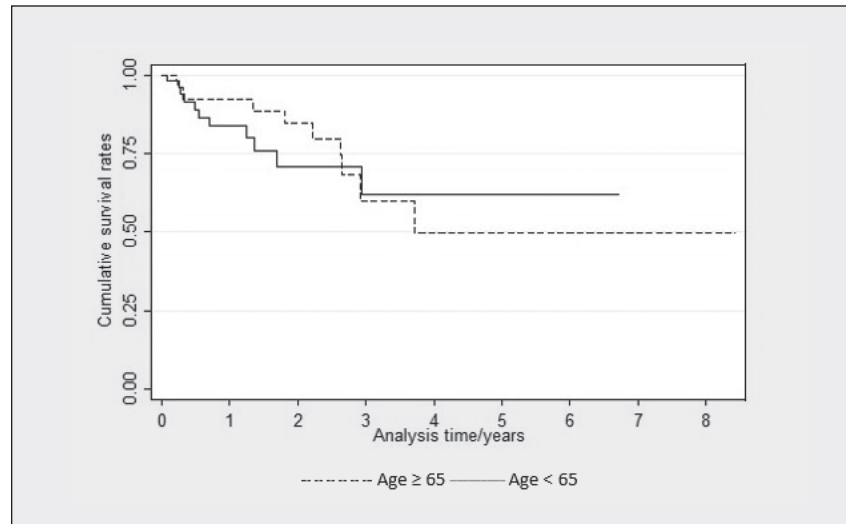


Figure 1. Kaplan-Meier survival plot for overall survival among patients with stage IV melanoma<sup>a</sup>

<sup>a</sup> Adjusted for sex, melanoma type, and brain metastasis ( $p = 0.491$ ) in patients younger than age 65 years or age 65 years and older.

clinical, and pathologic characteristics between responders and nonresponders to immune checkpoint inhibitors among patients with metastatic melanoma, then to investigate the age-related differences (< 65 years vs  $\geq 65$  years) in the time to progression, overall survival, and irAEs. Responses to checkpoint inhibitors were defined as complete response, partial response, or stable disease observed on positron emission tomography or total-body computed tomography scans obtained 6 months after the initiation of immunotherapy. Any evidence of radiologic progression (an increase in tumor burden of at least 25% compared with baseline) at 6 months was considered progressive disease. Because of lack of documentation, irAEs were not graded but were recorded as all irAEs of any severity.

The study protocol was approved by the institutional review board at the University of Arkansas for Medical Sciences, Little Rock, AR.

### Statistical Analysis

We used bivariate analyses to describe the distribution of response to immunotherapy by demographics and pathologic characteristics. Study participants enrolled in the study at the time of immunotherapy initiation. Participation in the study ended because of disease progress, termination of immunotherapy, death, or the end of our

study (February 1, 2017). The Cox proportional hazards regression model was used to assess the response to immunotherapy and the overall survival by age group. Because our eligible participants were all non-Hispanic whites and had stage IV melanoma, we did not need to adjust for race and disease stage to control confounding in our Cox proportional hazards models. All analyses were conducted using Stata 14.0 software (StataCorp, College Station, TX).

## RESULTS

### Responders versus Nonresponders

Of 96 patients with metastatic melanoma diagnosed at the University of Arkansas for Medical Sciences, 36 patients were excluded from the study because they received treatment elsewhere. Thus, 60 patients were available for this retrospective review. As shown in Table 1, 36 (60%) of 60 patients were men. Cutaneous melanoma was the predominant type. Forty percent of patients ( $n = 24$ ) harbored the *BRAF* mutation. Prior treatment before starting immunotherapy was documented in 22 (36.6%) of 60 patients. Adverse events to immunotherapy were found in 32 (53.3%) of 60 patients.

Patients who did not respond to immunotherapy were more likely to have a *BRAF* mutation, a higher Charlson index, and a lower irAE profile. No difference

between responders and nonresponders was noted regarding the type of immunotherapy used (Table 1). Overall irAEs were present in 20 (66.7%) of responders compared with 12 (40%) of nonresponders ( $p = 0.03$ ). Endocrinopathies, hepatitis,

pneumonitis, dermatitis, and central nervous system adverse effects were similar in both responders and nonresponders. Thirty percent of patients ( $n = 10$ ) who responded to immunotherapy had colitis compared with 7% ( $n = 2$ ) in nonresponders

( $p = 0.03$ ). Similarly, rheumatologic adverse effects were more common in responders ( $p = 0.007$ ). There was no statistical difference between responders and nonresponders regarding the presence or absence of brain metastasis ( $p = 0.78$ ).

**Table 1. Demographic and pathologic characteristics among patients with stage IV melanoma, by response to immunotherapy<sup>a</sup>**

Characteristic	Responders (n = 30)	Nonresponders (n = 30)	p value
Age at initiation of immunotherapy, y median, (IQR)	66.9 (54.3-73.3)	62.7 (54.3-69.1)	0.48
Sex			0.6
Men	19 (63.3)	17 (56.7)	
Women	11 (36.7)	13 (43.3)	
Melanoma type			0.06
Cutaneous	28 (93.3)	26 (86.7)	
Mucosal	0 (0.0)	4 (13.3)	
Ocular	2 (6.7)	0 (0.0)	
BRAF mutation			0.04
No	21 (70.0)	14 (46.7)	
Yes	8 (26.7)	16 (53.3)	
Missing	1 (3.3)	0 (0.0)	
Previous treatment			0.59
None	18 (60.0)	20 (66.7)	
Yes	12 (40.0)	10 (33.3)	
Charlson Comorbidity Index, median, (IQR)	6 (6,8)	9 (6,10)	0.003
ECOG score, median, (IQR)	0 (0,1)	0 (0,1)	0.51
Brain metastasis			0.78
No	21 (70.0)	20 (66.7)	
Yes	9 (30.0)	10 (33.3)	
Elevated baseline serum LDH level			0.28
No	27 (90.0)	24 (80.0)	
Yes	3 (10.0)	6 (20.0)	

<sup>a</sup> Data are presented as number (percentage) unless indicated otherwise.

ECOG = Eastern Cooperative Oncology Group; IQR = interquartile range; LDH = lactate dehydrogenase.

**Table 2. Cox regression for overall survival among patients with stage IV melanoma**

Age group, y	Survival status after immunotherapy initiation		Hazard ratio (95% confidence interval)		Median survival, y
	Alive, no. (%)	Dead, no. (%)	Crude	Adjusted <sup>a</sup>	
< 65	18(46.2)	11 (52.4)	1.0	1.0	4.14
≥ 65	21 (53.8)	10 (47.6)	0.81 (0.34-1.92)	0.75 (0.31-1.82)	5.00

<sup>a</sup> Adjusted for sex, melanoma type, and brain metastasis.

**Table 3. Cox regression for disease progression in patient with stage IV melanoma**

Age group, y	Disease progression		Hazard ratio (95% confidence interval)		Median time to progression, y
	No, no. (%)	Yes, no. (%)	Crude	Adjusted <sup>a</sup>	
< 65	13 (43.3)	16 (53.3)	1.0	1.0	0.33
≥ 65	17 (56.7)	14 (46.7)	0.78 (0.38-1.61)	0.79 (0.37-1.70)	0.99

<sup>a</sup> Adjusted for sex and melanoma type.

### Time to Progression and Overall Survival by Age Group

Twenty-nine patients were younger than age 65 years and 31 were age 65 years and older. After adjustment for sex, melanoma type, and presence of brain metastasis, there was no significant difference in survival after immunotherapy between the 2 age groups (hazard ratio [HR] = 0.75, 95% confidence interval [CI] = 0.31-1.82,  $p = 0.491$ ; Table 2 and Figure 1). Similarly, the time to progression was compared between groups, and after adjustment for sex and melanoma type, the time to progression was found to be comparable with no statistically significant difference (HR = 0.79, 95% CI = 0.37-1.70,  $p = 0.46$ ; Table 3).

### Age-Related Differences in Immunotherapy-Related Adverse Events

Overall irAEs in the 2 age groups were comparable, with 62% in the younger patients (18/29) and 45% in the older patients (14/31;  $p = 0.19$ ). The irAEs, including endocrinopathies, colitis, hepatitis, pneumonitis, dermatitis, and central nervous system adverse effects, were similar in both age groups. Interestingly, rheumatologic adverse effects were more common in younger patients ( $p = 0.035$ ; Table 4).

## DISCUSSION

Aging is accompanied by functional decline in both innate and adaptive immunity.<sup>17</sup> We found no significant differences, when adjusted for sex, type of melanoma, and presence of brain metastasis, in the time to progression and the overall survival between the younger than age 65 and age 65 years and older groups who received checkpoint inhibitors for treatment of metastatic melanoma. Our results were similar to those of other studies.<sup>18</sup> In one study, 855 patients with unresectable stage III or stage IV melanoma received ipilimumab after failure to respond or intolerance to at least 1 prior systemic treatment. There were no statistically significant

Table 4. Immune-related adverse events (AEs; number of patients)					
Adverse event	Age < 65 years (n = 29)		Age ≥ 65 years (n = 31)		p value
	AEs	No AEs	AEs	No AEs	
Overall adverse events	18	11	14	17	0.190
Endocrinopathies	8	21	4	27	0.155
Colitis	8	21	4	27	0.833
Hepatitis	1	28	1	30	0.962
Pneumonitis	3	26	0	31	0.066
Dermatitis	4	25	6	25	0.563
Rheumatologic disease	6	23	1	30	<b>0.035<sup>a</sup></b>
CNS adverse effects	1	28	1	30	0.962

<sup>a</sup> Boldface indicates significant.  
CNS = central nervous system.

differences in the median progression-free survival and overall survival between the older (> 70 years) and the younger (≤ age 70 years) group.<sup>19</sup> In the US Expanded Access Program, the 1-year survival rate in patients with metastatic melanoma treated with ipilimumab was not different among age 65 years and younger compared with age 65 years and older, which was 38% and 37%, respectively.<sup>20</sup> Another study of 95 patients, treated with immunotherapy for metastatic melanoma, showed that the survival and response rates, to checkpoint inhibitors, in patients older than age 80 years were very similar to those for younger patients.<sup>21</sup>

Immunotoxicity is an indirect marker of the efficacy of immunotherapy. Our results revealed that responders, regardless of age, had a higher rate of irAEs (66.7%) than did nonresponders (40%;  $p = 0.04$ ). Immune-mediated colitis, in particular, was higher in responders compared with nonresponders (approximately 30% [ $n = 10$ ] vs 7% [ $n = 2$ ],  $p = 0.03$ ). One prior study showed significantly improved response rates in patients in whom immune-mediated enterocolitis developed because of ipilimumab.<sup>22</sup> Other studies showed a strong correlation between the treatment response rate and irAEs,<sup>23–25</sup> but these studies pertain to patients who received anti-CTLA-4; the data are conflicting regarding anti-PD-1 immunotherapy. The results of recently concluded multicenter randomized controlled trials, including CheckMate 037<sup>26</sup> and KEYNOTE-006,<sup>27</sup> showed significantly improved progression-free survival and decreased rates of adverse effects in patients receiving anti-PD-1 immunotherapy compared with

those receiving anti-CTLA-4. Our study findings lend support to the correlation between response rate and irAEs irrespective of the type of immunotherapy administered.

There is also a strong correlation between the development of vitiligo and the tumor response in patients receiving immunotherapy.<sup>28–30</sup> In our study, vitiligo developed in only 2 patients (3.3%) and both had complete response to immunotherapy. A systematic review was conducted of 137 studies comprising 139 treatment arms (11 general immune stimulation, 84 vaccine trials, 28 antibody-based trials, and 16 adoptive T-cell transfer studies) and including a total of 5737 patients.<sup>30</sup> The overall cumulative incidence of vitiligo was 3.4% (95% CI = 2.5%–4.5%). Vitiligo development was significantly associated with better progression-free survival (HR = 0.51; 95% CI = 0.32–0.82;  $p < 0.005$ ) and overall survival (HR = 0.25; 95% CI = 0.10–0.61;  $p < 0.003$ ), indicating that these patients have 2 to 4 times less risk of disease progression and death, respectively, compared with patients without vitiligo development.<sup>30</sup>

In our study, 7 (11.7%) of the patients treated with checkpoint inhibitors had immune-related rheumatologic adverse effects. Interestingly, this was particularly common in younger patients ( $p = 0.03$ ). Another study showed that 1.3% of the total patients treated with nivolumab and ipilimumab experienced rheumatologic adverse events.<sup>31</sup>

A *BRAF* mutation has been associated with earlier age of onset, more aggressive clinical course, and decreased survival in patients who did not receive *BRAF*

inhibitor therapy.<sup>32</sup> Our study showed increased rates of the *BRAF* mutation in patients who failed to respond compared with the ones who responded to the immunotherapy (53% vs 27%,  $p = 0.04$ ). However, *BRAF* inhibitors have improved survival in these patients with gene mutations.<sup>33</sup> Sequential treatment with *BRAF* inhibitors and checkpoint inhibitors has emerged as a new strategy in the treatment of *BRAF*-mutated melanoma, but data remain conflicting regarding the preferred sequence.<sup>34–36</sup> Nonetheless our study touches on the interaction between the *BRAF* mutation and the response to immunotherapy, and the data regarding this interaction per se are still lacking. A *BRAF* mutation contributes to immune escape. Boni et al<sup>37</sup> showed that *BRAF* inhibition increases the expression of melanocyte differentiation antigens, which is associated with increased antigen-specific T-cell recognition; MEK inhibition, on the other hand, impairs T-lymphocyte function. It is not fully understood whether patients with a *BRAF* mutation should be treated with *BRAF* inhibitors first or immunotherapy first. Clinical trials are being conducted to clarify the appropriate sequence. In a retrospective study, progression-free survival and response rates were found to be similar irrespective of the timing of *BRAF* inhibitor therapy (before or after immunotherapy).<sup>35</sup> In another study, a longer overall survival was found if ipilimumab was given before a *BRAF* inhibitor compared with a *BRAF* inhibitor followed by ipilimumab, or with either agent alone.<sup>38</sup> The results of that study support the use of immunotherapy as first line in patients with *BRAF* mutations.<sup>38</sup>

Other studies have shown that immunotherapy in elderly patients may respond better in melanoma because of fewer regulatory T cells relative to CD8+ T cells in tumor deposits.<sup>39</sup> Another study by Li et al<sup>40</sup> showed that immune checkpoint inhibitors significantly prolonged the survival in both younger and older groups with melanoma. Anti-PD-1 agents were more efficient in older compared with younger patients with melanoma.

Although our study discussed all the checkpoint inhibitors as 1 group, further research will be necessary to identify differences, if any, between these agents. In

addition, because our study is a retrospective study with a small sample size, it is likely to have practitioner bias because of the lack of randomization. It is a single-institution study in the Southern US. Further randomized multicenter studies with larger sample sizes will be useful to better evaluate the differences between these 2 age groups in terms of response to treatment, survival, and adverse effect profile.

## CONCLUSION

Aging does not seem to affect the response to checkpoint inhibitors. Time to progression, overall survival, and immune-mediated adverse events were similar in younger and older patients with metastatic melanoma receiving checkpoint inhibitors. Autoimmunity owing to checkpoint inhibitors, especially immune-mediated colitis and vitiligo, are markers of better response. Elderly patients with metastatic melanoma should be treated similarly to younger patients, even with combination therapy such as ipilimumab and nivolumab. Future studies should investigate better biomarkers, such as PDL1, to predict response to checkpoint inhibitors. ❖

## Disclosure Statement

The author(s) have no conflicts of interest to disclose.

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## Authors' Contributions

Dinesh Atwal, MD; Fade Mahmoud, MD; Krishna Joshi, MD; and Rahul Ravilla, MD, did protocol writing, data collection, and data analysis. Issam Makhoul, MD; Laura Hutchins, MD; Naveen Yarlagadda, MD; Sunil Kakadia, MD; and Yadav Pandey, MD, helped with the literature review, discussion, and writing the manuscript.

All authors vouch for the accuracy and completeness of the data and analyses, and all have given final approval to the manuscript.

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### Lack of Discrimination

The hypercorticism of body injury and disease may be designed to protect the body from its own police force, leaving intact the “seasoned, experienced” troops but reducing the number of naïve trainees whose commitment to destroy might lack discrimination between self and non-self.

— Charles G Craddock, MD, 1921-1996, American physician, researcher, and professor of medicine

# Awareness of Heterotopic Ossification in Total Joint Arthroplasty: A Primer

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## ABSTRACT

Heterotopic ossification (HO) is the presence of normal bone in soft tissue where bone should not exist. After direct musculoskeletal trauma of the surrounding soft tissue, HO is hypothesized to develop from a dysfunction of normal lamellar bone formation and remodeling that appears in nonskeletal areas of the body. Acquired HO related to total joint arthroplasty (TJA) of the hip and knee forms outside the joint capsule and can be a challenging condition when it impairs the essential healing process after elective surgery. Although HO is rare after elective TJA and thus clinically immaterial, when clinically relevant HO develops, patients may experience the following: 1) limited ambulation, 2) restricted range of motion, and 3) severe pain and discomfort that may lead to loss of function. Ultimately, patients with clinically relevant HO after elective TJA may require additional treatment, including medication, radiation therapy, manipulation under anesthesia, surgical excision of the HO, and possibly revision TJA. Awareness of HO and an understanding of the associated risk factors along with the various management options will enable health care practitioners and their patients to optimize their surgical outcomes.

## INTRODUCTION

The goal of this article is to describe heterotopic ossification (HO) after total joint arthroplasty (TJA), its risk factors, and management, to increase awareness of this condition so that physicians can optimize their surgical outcomes. See the Sidebar: Advance Organizer Quiz to Retrieve, Use and Organize the Materials Presented in this Article.

HO is the presence of bone in soft tissue where bone does not normally exist. This condition develops from dysfunction of normal lamellar bone formation and remodeling (inhibition),

which presents in areas of soft tissue (nonskeletal) in the body.<sup>1</sup> All bone, including HO, has its own vascular supply of blood vessels. Because of the associated vascularity, HO bone can grow at 3 times the normal rate, causing destruction and pain in the joints.<sup>2</sup> Mature HO shows cancellous bone growth (eg, trabecular or spongy, light, porous bone) enclosing numerous large spaces, as well as mature lamellar bone, blood vessels, and bone marrow with minimal production of normal blood cells.<sup>3</sup>

## TYPES OF HETEROTOPIC OSSIFICATION

The 4 types of HO are presented in Table 1. Of the 4 types described, acquired HO is most frequently observed and is the focus of this article. The 3 less common forms are 1) neurogenic HO, which can develop in patients with paraplegia after spinal cord injury; 2) genetic HO, such as myositis ossificans progressiva, a rare hereditary form of HO, which generally has a poor prognosis (most patients with this condition die early owing to related complications of restrictive lung disease and pneumonia); and 3) idiopathic HO, the causes of which remain unknown and ambiguous.

In direct musculoskeletal trauma, acquired HO may develop in patients with injuries related to fractures (eg, acetabular, dislocations), blast injuries, and burns.<sup>4</sup> Similarly, soft-tissue trauma related to elective TJA might also lead to the acquired type of HO.<sup>5</sup> HO after TJA of the hip and knee can be challenging because extra-articular heterotopic ossifications formed outside the joint capsule may impair the essential healing process necessary for a successful surgical outcome. Local trauma to soft tissue produced by TJA is hypothesized to disrupt the normal balance of bone formation and inhibition, possibly by inducing inflammatory dynamics needed to stimulate the production of HO: 1) osteogenic precursor cells, 2) inducing agents, and 3) a permissive soft-tissue environment.<sup>6</sup> When normal lamellar bone develops pathologically in muscle, tendons, and other areas of soft tissue, this progression of HO may limit patients' ambulation, reduce their range of motion, and, because of severe pain and discomfort, cause loss of function. Patients in whom clinically relevant HO develops may be subjected to additional treatment, including additional medication, radiation therapy, manipulation of the affected knee joint under anesthesia (MUA), surgical excision of the HO, and possibly revision TJA.<sup>3</sup>

**Table 1. Types of heterotopic ossification<sup>1</sup>**

Type	Examples
Acquired/traumatic	acetabular fracture
	shoulder fracture/dislocation of elbow, knee, or soft-tissue trauma related to lower limb TJA
	blast and burn injuries
Neurogenic	central nervous system injury
	traumatic brain injury
	spinal cord injury
Genetic	fibrodysplasia ossificans progressive
	progressive osseous heteroplasia
	Albright hereditary osteodystrophy
Idiopathic	no recognized precipitating condition

1. Speed J. Heterotopic ossification [Internet]. Medscape Updated 2019 Apr 10 [cited 2020 Jan 3]. Available from: <http://emedicine.medscape.com/article/327648-overview>  
TJA = total joint arthroplasty.

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**Keywords:** clinically relevant heterotopic ossification, heterotopic ossification, joint stiffness, pathological bone growth, TJA, total joint arthroplasty

Advance Organizer Quiz to Retrieve, Use, and Organize the Materials Presented in this Article

Please answer true or false to the following items:

- 1. Heterotopic ossification (HO) is the presence of abnormal bone in soft tissue where bone does not normally exist.  
False; it is normal bone.
- 2. Women are at greater risk than men of getting HO after elective total joint arthroplasty (TJA).  
False, men are at higher risk.
- 3. Clinical signs of HO usually appear within a month of elective TJA.  
True
- 4. Optimally, prophylactic measures against HO after elective TJA should be administered within 24 to 48 hours after surgery.  
True
- 5. Management of clinically relevant HO is well established by orthopedic experts.  
False

INCIDENCE OF HETEROTOPIC OSSIFICATION AND RISK FACTORS

The incidence of acquired HO in TJA varies greatly from one patient population to another. The incidence of HO after total hip arthroplasty (THA) varies widely from 0.6% to 90% (when evaluated in high-risk populations),<sup>7</sup> although the consensus is that the incidence of HO is approximately 53% in THA (of which one-third of cases are clinically meaningful).<sup>8</sup> Although HO is thought to be underreported, the overall incidence of HO after total knee arthroplasty (TKA) is about 15%.<sup>9</sup>

Risk factors for postoperative HO include excess weight, age older than 65 years, the presence of excessive osteophytes noted preoperatively, previous HO, and posttraumatic arthritis.<sup>10,11</sup> Often, however, the HO that forms after TJA is clinically immaterial, causing it to be ignored and go unreported.<sup>12</sup>

CLINICAL PRESENTATION

The signs and symptoms of HO after elective TJA usually appear within 3 to 8 weeks postoperatively,<sup>13,14</sup> and most often HO presents as an incidental finding on plain radiographs. In patients with HO after THA, HO typically forms in the connective tissue between the muscle planes around the femoral neck and adjacent to the greater trochanter.<sup>8</sup> After TKA, HO can form anterior to the distal femoral shaft in the quadriceps expansion.<sup>15</sup> The most common complaint related to the development of HO is stiffness, and when a large amount is present, the stiffness may progress to ankylosis (abnormal stiffening causing immobility) in the affected joint.<sup>12</sup> Many patients who demonstrate early or low-grade HO on plain films are asymptomatic, and pain is rarely a problem. On physical examination, reported pain, stiffness, loss of joint mobility, decreased ambulation, and resulting

loss of function are the principal complications of HO.<sup>10</sup> Fever, swelling, erythema, and occasional joint tenderness seen in early HO can be difficult to distinguish from other conditions (see next section on assessment).<sup>14</sup>

ASSESSMENT OF CLINICALLY RELEVANT HETEROTOPIC OSSIFICATION

Although clinically relevant HO occurs infrequently after TJA, appropriate laboratory and imaging data (see Sidebar: Assessment of Heterotopic Ossification) should be obtained to confirm the diagnosis and distinguish HO from other diagnostic possibilities. The differential diagnosis of HO includes cellulitis, osteomyelitis, thrombophlebitis, deep vein thrombosis, septic arthritis, tumor, hematoma, and fracture.<sup>16</sup>

Conventional radiography followed by 3-phase bone scanning can be considered to confirm the diagnosis of HO, establish the extent and metabolic activity of HO, determine if medical treatment is warranted, and choose the appropriate time for surgical resection if needed.<sup>17</sup> Serial quantitative bone scans to assess for presence and/or progression of acquired HO can serve as an aid to time the surgical intervention.<sup>14</sup> Although rarely performed in the clinical setting, serum alkaline phosphatase levels can be used to detect early HO.<sup>14</sup> Alkaline phosphatase levels generally become abnormal and increase 2 weeks after most injuries and are not specific to HO. In the typical case of HO, however, the alkaline phosphatase levels reach approximately 3.5 times their normal levels as early as 10 weeks after the inciting trauma, before returning to normal at about 18 weeks.<sup>14</sup> Measurement of 24-hour urinary prostaglandin E<sub>2</sub> excretions, also rarely assessed in the clinical setting, can help in detecting early HO.<sup>7</sup> A sudden increase in prostaglandin E<sub>2</sub> excretion points to the need for bone scanning.<sup>18</sup>

PREVENTION OF HETEROTOPIC OSSIFICATION FOR AT-RISK PATIENTS

Currently there are no universal treatment strategies or guidelines for the prevention and management of patients with HO. However, for individuals identified as high risk for development of acquired HO, the following are possible treatment options and/or prophylactic measures:

- 1. serial quantitative bone scanning to assess status of HO and determine whether medical and/or surgical treatment is warranted
- 2. nonsteroidal anti-inflammatory agents, preferably indomethacin, to prevent and/or slow the progression of HO
- 3. radiation therapy to prevent or inhibit the progression of HO
- 4. manipulation under anesthesia to loosen stiff joints after TKA procedures in select patients

Researchers suggest that prophylactic measures against HO be administered within 24 to 48 hours after TJA for optimal deterrence of HO.<sup>10</sup>

MANAGEMENT OF HETEROTOPIC OSSIFICATION

Once clinically relevant HO is demonstrated, radiation therapy with or without MUA in TKA recipients, and/or with surgical resection of the HO (often used in conjunction with radiation

Assessment of Heterotopic Ossification

- measurement of serum alkaline phosphatase levels (for early heterotopic ossification)
- measurement of 24-hour urinary prostaglandin E<sub>2</sub> excretion (for early heterotopic ossification)
- conventional radiography
- three-phase bone scanning

therapy), can be considered to restore and preserve joint mobility and function. Surgical resection of HO is generally reserved for mature HO (recurrence and progression of HO can occur after “excision of” HO). In patients who underwent THA, MUA is not performed because of the risk of hip instability. In cases where these measures fail to produce optimal patient outcomes, revision TJA may be indicated.<sup>7</sup>

## CONCLUSION

Despite the lack of consensus on standardized treatment guidelines for acquired HO established by the orthopedic community, various treatment options can be employed to possibly manage this condition. Health care professionals should be cognizant of and alert to the signs and symptoms of patients at risk of acquired HO, to ensure treatment optimization. ❖

## Disclosure Statement

*The author(s) have no conflicts of interest to disclose.*

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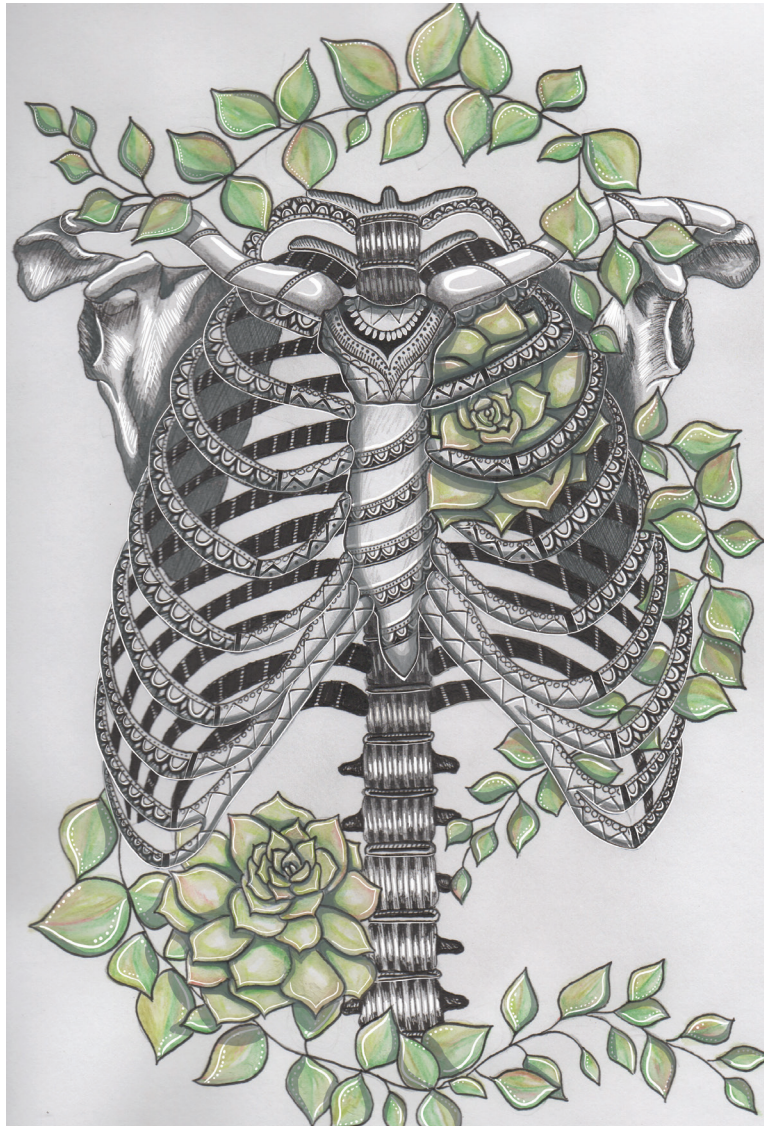
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## Ossifying Matter

Sometimes the ossifying matter flows out of the bones, and forms bony excrescences; and frequently in very old men it fixes on the arteries, and makes them grow bony; and when this happens to a degree, the arteries lose their power to propel the blood, until the extreme parts mortify.

— William Cheselden, 1688-1752, English surgeon and teacher of anatomy and surgery



**Counterbalanced**  
ink and paper

**Emery Boudreau**

From Ms Boudreau: "I drew this piece in an effort to find some sort of balance during medical school. So much of our time as students is put towards studying, preparing for cases the following day, or trying to get some sleep in after a 24-hour call shift. It is easy to lose sight of the passions we have outside of medicine—the things that help ground us in this difficult part of our training. I think making time for those things is equally as important as the material we study in aiding us to become good doctors."

In recent research, it has become clear that addressing the need to counterbalance stress and sleepless nights early on in a physician's career will help reduce or even prevent episodes of burnout. For me, it is art that allows me to escape the demands of medical school and focus on the lines and details on the page in front of me. Another thing is time spent outdoors, which I represented with leaves winding through the anatomy I've been studying."

Ms Boudreau is a third-year medical student at the University of Utah School of Medicine in Salt Lake City.

# Fostering Partnerships with the Safety Net: An Evaluation of Kaiser Permanente's Community Ambassador Program in the Mid-Atlantic States

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## ABSTRACT

**Introduction:** Kaiser Permanente (KP) Mid-Atlantic States has partnered with communities in its service area since 2011 to provide health services to underserved individuals. As part of KP's Community Benefit investment, the Community Ambassador Program places KP advanced-practice clinicians in safety-net clinics to share best practices and to improve access and quality of care.

**Objective:** To report program outcomes and disseminate lessons learned.

**Methods:** Using data from participating clinics, we retrospectively evaluated the program and estimated Community Ambassadors' contributions to clinic capacity, patient access, evidence-based care, and clinical quality measures. Furthermore, we conducted 29 semistructured phone interviews with stakeholders. Questions focused on program benefits, challenges, learning, and sustainability.

**Results:** From 2013 to 2017, Community Ambassadors filled up to 32.8 full-time equivalent positions and conducted 294,436 patient encounters in 19 clinics. In certain years and for subsets of clinics, Community Ambassadors performed above average on 2 high-priority quality measures: Cervical cancer screening for women aged 21 to 64 years and diabetes (blood glucose) control. Interviews with 15 Community Ambassadors, 15 health centers leaders, and 7 KP Mid-Atlantic States staff members revealed that Community Ambassadors improved patient access, clinic capacity, and care quality. Ambassadors also exported KP best practices and supported KP's community relations. Challenges included patient acuity, clinic resources, staff turnover, and long-term sustainability.

**Conclusion:** The Community Ambassador Program achieved its goals and had clear benefits, offering a model for large health care systems wanting to collaborate with community-based clinics. Careful planning is needed to ensure that positive results are sustained.

## INTRODUCTION

*America's Health Care Safety Net: Intact but Endangered*, the title of a 2000 report by the Institute of Medicine (now the National Academy of Medicine),<sup>1</sup> captures the fragility of the health care infrastructure that serves the nation's low-income people. The safety net is made up of a collection of hospitals, Federally Qualified Health Centers (FQHCs), free clinics, and other organizations that deliver health services regardless of the patient's ability

to pay.<sup>1</sup> The threats to the system highlighted in the Institute of Medicine report persist, but new challenges have also arisen to stress the safety net further. Along with financial struggles, competitive pressures, and demands for performance, health care organizations in the safety net feel increased strain from regulatory changes<sup>2</sup> and shifting insurance markets after the implementation of the Patient Protection and Affordable Care Act.<sup>2-4</sup> At the same time, the safety-net clientele has grown more diverse and is often challenged by multiple comorbidities and conditions of social need.<sup>2</sup>

To survive and even thrive in a fast-changing environment, safety-net providers are going beyond traditional support through grant funding<sup>5</sup> by joining forces with health organizations and other local allies to grow capacity, increase patient access, and improve care quality in their communities.<sup>6</sup> Across the country, partnerships have led to the development of direct specialty referrals and resource-sharing systems between community-based clinics and local hospitals.<sup>6</sup> Academic health centers and research networks have joined with FQHCs to support adoption and sustainment of evidence-based practices in mental health<sup>7</sup> and cancer<sup>8</sup> care. Other collaborative efforts have focused on providing financial assistance with coinsurance and copays for low-income people newly eligible for health insurance coverage under the Patient Protection and Affordable Care Act.<sup>3,9,10</sup> Despite the emergence of creative partnerships to strengthen the safety net, little is known about their effectiveness and potential to sustainably improve health care delivery to vulnerable populations.

To start filling this knowledge gap, we present the results of the evaluation of a multiyear effort to support the safety net through a partnership between an integrated delivery system and community-based clinics in Kaiser Permanente's (KP's) Mid-Atlantic States (KPMAS) Region. Since 2011, the KPMAS Community Benefit Program has implemented the Community Ambassador

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Editor's note: Please also see: *Let's Care for Those in Need—Today: Collaborating to Solve the Uninsured Crisis in America*, by Lee Jacobs, MD (page 106); and *Addressing the Health Needs of the Uninsured: One Community's Solution*, by Lynne M Hutchison, DNP, FNP-BC and Raymond L Cox, MD, MBA (page 102)

Program (CAP), which places KP advanced-practice clinicians in community-based health centers to boost capacity and to improve patient access. Trained by KP and salaried by the KP Health Plan, the Community Ambassadors spread KP best practices to community settings, to improve population health beyond KP membership and in such critical areas as preventive medicine, chronic illness management, pediatrics, and women's health.<sup>10</sup> We are not aware of other programs that take a similar workforce-based approach to supporting the health care safety net.

An assessment of the CAP's first year (2011–2012) suggested that the program had a positive effect on care delivery and some key evidence-based quality measures; opportunities for improvement also were acknowledged.<sup>11</sup> With an encouraging start and some early challenges, the CAP must be evaluated further to determine its overall impact and potential value as a model for health systems wanting to support community health. In this article we describe the CAP and our evaluation methods, report program outcomes, and discuss implications for partnerships with the safety net.

## METHODS

### Program Description and Setting

Following an earlier pilot, KPMAS established the CAP in 2011. Through a collaboration of the KPMAS Community Benefit Program and KP's Labor Management Partnership, the CAP placed KP nurse practitioners, midwives, and physician assistants to work as Community Ambassadors in FQHCs and other community-based health centers, such as free clinics, faith-based

organizations, and hospital-based programs. The initiative reflected KP's stated mission to support the communities it serves beyond its membership.<sup>12</sup> The approach to community health by KP includes using its health system assets to meet community needs identified through Community Health Needs Assessments. The CAP is an example of addressing an important access gap in the safety net by placing KP advanced-practice clinicians in community clinics subsequent to KP internal workforce restructuring.

While practicing in the safety net, the Community Ambassadors remained KP Health Plan employees (although for most of the program they did not identify as KP practitioners to patients) and retained their salaries, benefits, and seniority. Knowing the CAP would eventually end because of attrition, KPMAS wanted lessons learned from the program to serve as a blueprint for similar initiatives that could be expanded to other areas to improve capacity and expand coverage in the safety net.

At the start of the program there were up to 40 Community Ambassadors working at 18 safety-net clinics in Washington, DC; Northern Virginia; and suburban Maryland. As of this writing, the CAP continued to operate in a reduced form as Community Ambassadors lost to attrition (primarily retirement) were not replaced, causing some clinics to drop out. In 2017, there were 15 Community Ambassadors staffing the program at 9 partner clinics: 5 in Maryland and 4 in Virginia. Table 1 summarizes characteristics of those clinics.

The CAP's goals are unchanged: Expanding clinic capacity and patient access to care for the underserved within KPMAS service

**Table 1. Clinics active in the Community Ambassador Program (CAP) in 2017**

Clinic	Clinic type	Clinic location	CAP-supported services	Community Ambassadors
<b>Maryland</b>				
Clinic A	FQHC	Montgomery and Prince George's Counties, MD	Centering Pregnancy Program Colposcopy services Ultrasonography level 1	2 women's health nurse practitioners
Clinic B	Other clinic type <sup>a</sup>	Montgomery County, MD	Implementation of behavioral health integration <sup>b</sup> Implementation of ALL/PHASE <sup>c</sup>	1 part-time physician assistant; 1 full-time women's health nurse practitioner (retired in 2017)
Clinic C	Other clinic type <sup>a</sup>	Montgomery County, MD	Support for the only clinician in one of the clinic's locations	1 adult medicine nurse practitioner
Clinic D	FQHC	Prince George's County, MD		1 adult medicine nurse practitioner; 1 women's health nurse practitioner
Clinic E	FQHC	Baltimore, MD	Support for 2 clinic locations	1 women's health nurse practitioner
<b>Virginia</b>				
Clinic F	FQHC	Prince William County and Fairfax	Centering Pregnancy Program Prenatal ultrasonography	2 part-time women's health nurse practitioners
Clinic G	Free clinic	Prince William County	Adult care services	1 physician assistant retiring at end of first quarter 2018; 1 part-time adult medicine nurse practitioner
Clinic H	FQHC	Alexandria and Fairfax	Implementation of behavioral health integration <sup>b</sup>	1 women's health part-time nurse practitioner; 1 adult medicine part-time nurse practitioner
Clinic I	Other clinic type <sup>a</sup>	Arlington County	Pediatric services	2 part-time pediatric nurse practitioners

<sup>a</sup> Includes 501c3 nonprofit health care organizations, hospital-based clinics, clinics serving special populations, and partially free clinics.

<sup>b</sup> Kaiser Permanente's initiative to integrate primary care and behavioral health services.

<sup>c</sup> Kaiser Permanente's ALL/PHASE (Preventing Heart Attacks and Strokes Every day) protocol uses low-cost and generic medications and clinical interventions to reduce the incidence of heart attacks.

FQHC = Federally Qualified Health Center.

**Table 2. Community Ambassador full-time equivalent (FTE) and total encounters, 2013-2017**

Measure	2013	2014	2015	2016	2017
Community Ambassador Program FTE	32.8	27.7	23.2	20.7	15.3
Total Community Ambassador encounters	67,867	46,701	67,163	55,970	56,735
Encounters per FTE	2057	1610	2920	2799	3782

area and improving quality of care through sharing best practices with community-based health care professionals. On the basis of the 2012 study findings,<sup>11</sup> the Community Ambassadors made early progress toward most program goals by enabling higher patient volumes, expanded services, and better quality of care in their assigned clinics. Specifically, clinic-level performance improved on 2 quality indicators: Adult asthma therapy and adult weight screening. At the Community Ambassador level, performance was at or close to 90% on adult weight screening and adult tobacco-use assessment. Gains on other quality measures were lower, however. Capacity did not grow as expected, and there were challenges with integrating the KP advanced-practice clinicians into their new settings. Low clinic resources made it difficult to address language barriers with patients, and inadequate systems affected some reporting of program data.<sup>11</sup>

In this evaluation, we expand on those preliminary findings by taking a more extensive look at the CAP.

### Evaluation Design

Using mixed methods, we conducted a retrospective evaluation of the 18 clinics taking part in the CAP from 2013 to 2017. Our assessment combined an extensive review of program documents; regular meetings (facilitated and documented by the evaluation team) with KPMAS program leads, executives, and evaluators; analysis of quantitative data submitted by clinics and Community Ambassadors during their CAP participation; and interviews with Community Ambassadors, health center leadership, KPMAS program staff, and Community Health leaders.

Data from each source were analyzed concurrently.<sup>13</sup> Background documents were synthesized to create clinic profiles. The KPMAS program staff and Community Health leaders provided historical context and helped refine interview guides and validate emerging findings. *Although quantitative analyses spanned several years, we focused our qualitative data collection on the clinics participating in the CAP in 2017.* A detailed description of quantitative and qualitative data collection and analyses follows.

### Data and Analytic Strategy

#### Quantitative Data Collection and Analysis

Throughout the program, KPMAS collected 2 sets of Community Ambassador data: 1) service utilization data (including the number of patient encounters and unduplicated patients served) and 2) performance data in 19 measures from the National Committee for Quality Assurance Healthcare Effectiveness Data and Information Set (HEDIS)<sup>14</sup> and the Health Resources and Services Administration Uniform Data System<sup>15</sup> clinical quality measures.

Working with our KPMAS partners, we obtained and analyzed utilization and clinical quality data from 12 clinics for the years 2013 to 2017.<sup>a</sup> Clinical quality data were included in analyses

if they met the following criteria: 1) were discussed by program stakeholders as related to clinical priority areas during interviews, 2) included measurements for multiple timepoints between 2013 and 2017, 3) had a sample size of at least 50 patients per clinic or Community Ambassador per year, and 4) were reported annually. The resulting clinical quality dataset allowed 2 sets of analyses: 1) Community Ambassador performance on 9 measures was compared with overall clinic performance for 2013 to 2015 (Community Ambassadors were included in overall clinic data), and 2) Community Ambassador performance on 10 measures was compared with statewide FQHC averages for Virginia; Maryland; and Washington, DC.

#### Qualitative Data Collection and Analysis

We conducted 29 semistructured telephone interviews with KPMAS stakeholders and with Community Ambassadors and health center leadership at 9 active CAP clinics. Interview guides focused on core domains of interest: Benefits and challenges of program participation, program goals and the health centers' relationship with KP, and prospects for the CAP's sustainability. Subsets of questions were tailored to specific stakeholder groups (eg, Community Ambassadors, health center leaders). The 1- to 2-hour interviews were recorded with permission and professionally transcribed. Analysis was assisted by Atlas.ti software (version 7.5.2, Berlin, Germany).<sup>16</sup> Two team members who were experienced in qualitative methods coded transcripts using a code list developed a priori.<sup>17</sup> Preliminary themes identified through content analysis were reviewed, and their interpretation iteratively refined, by the evaluation team.<sup>18</sup> Quotes were edited for clarity and length while preserving participants' voice and intent.

## RESULTS

### Clinic Data

Between 2013 and 2017, Community Ambassadors conducted 294,436 in-person patient encounters in 18 clinics and provided both preventive and acute care. The number of full-time equivalent (FTE) positions filled by Community Ambassadors began at 32.8 in 2013 and decreased to 15.3 in 2017 because of attrition. Using encounters per FTE as a productivity measure, Community Ambassadors had an average of 3782 encounters per FTE in 2017—their most productive year. Encounters and productivity data are summarized in Table 2.

In 2017, Community Ambassadors in 9 clinics conducted 23% of all patient encounters in their assigned departments (Figure 1). The proportion of patient encounters by Community Ambassadors was even higher in some clinics. For example, the 2 Community Ambassadors at Clinic G conducted more than 7000 encounters, or 40% of the total in their departments. (Program staff confirmed that 2017 data were consistent with the percentage of patients seen by Community Ambassadors throughout the program.)

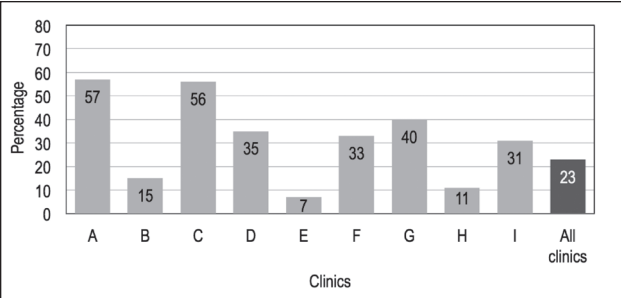


Figure 1. Community Ambassador encounters as percentage of total encounters (N = 1,234,550) in assigned clinic departments, 2017.<sup>a</sup>

<sup>a</sup> Total encounters include both in-person and phone encounters.

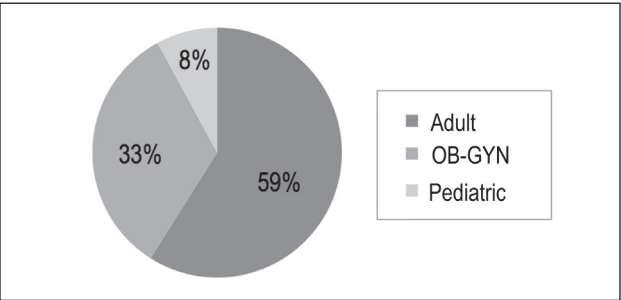


Figure 2. Percentage of Community Ambassador encounters by type, 2013-2107<sup>a</sup> (N = 335,157).

<sup>a</sup> Data were not available by patient type for 2016; includes data for 2013-2015 and 2017. Total encounters include both in-person and phone encounters.

Community Ambassadors primarily saw adult patients, with approximately one-third of encounters serving obstetrics/gynecology patients and less than 10% of encounters serving pediatric patients (Figure 2).

Data on selected clinical quality measures suggest that the Community Ambassadors’ performance was consistent with the average quality of care provided by their health centers and FQHCs across the Region. In 2 areas—cervical cancer screening and diabetes (blood glucose) control—Community Ambassadors provided enhanced quality of care to their patients.

From 2013 to 2015, Community Ambassadors demonstrated higher performance relative to their clinics on cervical cancer screening rates for women aged 21 to 64 years (Table 3). The Community Ambassadors’ average screening rate was 68% compared with a 61% average screening rate for participating clinics. In 2016, Community Ambassadors placed at FQHCs achieved an average cervical cancer screening rate of 63%, compared with average statewide screening rates of 45% to 59%.<sup>19</sup> Some Community Ambassadors’ performance was up to 40% higher than that of their clinics (data not shown).

Compared with statewide averages for FQHCs in Virginia; Maryland; and Washington, DC, in 2016, Community Ambassadors working in FQHC demonstrated higher performance in diabetes control (Table 4). Their patients had a 21% rate of uncontrolled diabetes (as measured by hemoglobin A<sub>1c</sub> values greater than 9.0%), whereas statewide FQHC averages ranged from 27% to 38%.<sup>19</sup> (Because of changes in reporting requirements, diabetes control data were available only for 2016.) Community Ambassadors at some clinics had rates of uncontrolled diabetes for their patients as low as 9%.

Interviews

We interviewed Community Ambassadors (N = 15), health center leaders (N = 15), and KP program leads, executives, evaluators, and Community Health leadership (N = 7). Coded interviews were analyzed to identify themes relative to 4 predetermined evaluation domains: 1) accomplishment of program

Table 3. Community Ambassador and participating clinic performance on select quality measures, 2013-2015				
Metric	Community Ambassador		Clinic	
	No. of patients	Average performance (%)	No. of patients	Average performance (%)
Patients (aged ≥ 18 y) screened for tobacco use 1 or more times within 24 mo	24,270	72	109,303	76
Patients (aged ≥ 18 y) identified as tobacco users who received cessation counseling intervention	7177	82	70,324	77
Patients (aged ≥ 18 y) with diagnosis of coronary artery disease prescribed lipid-lowering therapy	284	73	1730	67
Patients (aged 50-75 y) who received appropriate screening for colorectal cancer	7845	30	50,855	28
Patients with diabetes who received hemoglobin A <sub>1c</sub> assessment	4367	55	12,685	74
Patients with controlled hypertension	6897	65	20,783	68
Women (aged 21-64 y) who received cervical cancer screening	27,259	68	100,545	61
Women (aged 40-69 y) who received mammography screening	12,001	44	49,656	36
Pregnant women receiving prenatal care in first trimester	7255	54	4639	50

goals, 2) program benefits, 3) program challenges, and 4) program sustainability and prospects.

### Accomplishment of Program Goals

**Increased Access to Care for Underserved Populations:** Stakeholders reported that Community Ambassadors have increased the access to preventive and acute care for patients who have no other health care resources. They emphasized how the program had benefited many underserved groups, including uninsured or underinsured individuals, immigrants and refugees, incarcerated women, and religious and ethnic minorities. Increased access occurred at existing clinic sites and, in some cases, by opening new sites. Both Community Ambassadors and health center leaders identified increased access as one of the CAP's most important contributions. This was underscored by health center leaders who anticipated that the loss of their Community Ambassadors would lead to reduced clinic operating hours and fewer visits and patients seen.

*[T]he bottom line is if these practitioners would not have been here, those patients would very likely not be getting access to care. I think it's truly as simple as that.* —Health center leader, free clinic

**Increased Health Care Centers' Capacity:** The Community Ambassadors have increased the health centers' capacity in various ways. Many interviewees discussed Community Ambassadors' impact on women's health, including improved delivery of gynecologic care in general and of specialized services such as long-term reversible birth control.

*We have a GYN nurse practitioner; she brought to the clinic a new approach and comprehensive care for the female GYN patient . . . We saw the number of mammograms and [Papanicolaou tests] increase significantly as a result.* —Health center leader, other clinic type

Other outcomes were increased capacity for preventive services (eg, screening) and chronic care management (eg, diabetes education and management, HIV education and treatment), and easier access to medications through on-site dispensing.

*Kaiser [Permanente Community Ambassadors] being there has helped [the clinics] have services that they didn't have before. I was helpful in creating a diabetes education program there . . . I responded to a proposal to get mental health services at the clinic, so now we have behavioral health there on a regular basis.* —Community Ambassador, free clinic

Moreover, Community Ambassadors helped clinics build stronger systems and processes. They improved scheduling and workflows, promoted productive use of the electronic medical record, and generated revenues that boosted the clinics' bottom line and enabled infrastructure development.

**Improved Quality of Care at Clinics:** Community Ambassadors have helped health centers improve their quality of care by providing more comprehensive care options. They have also enabled spreading the workload across a greater number of practitioners (thus carving more time with complex patients) and mentored and modeled best practices to other staff. Both Community Ambassadors and health center leaders perceived quality of care improvements as being directly tied to the skills and expertise of KP advanced-practice clinicians.

**Table 4. Community Ambassador performance on select quality measures compared with clinic averages and state averages, 2016**

Metric	Community Ambassadors at all clinics		Community Ambassadors at FQHCs <sup>a</sup>		Clinic performance, % (FQHCs only)	Statewide averages, % <sup>a</sup>		
	No.	Average performance (%)	No.	Average performance (%)		VA	MD	DC
Patients (aged ≥ 18 y) screened for tobacco use 1 or more times within 24 mo	29,252	81	22,079	80				
Patients (aged ≥ 18 y) identified as tobacco users who received cessation counseling intervention	15,479	88	14,267	90	96	82	91	89
Patients (aged ≥ 18 y) with diagnosis of CAD prescribed lipid-lowering therapy	1464	88	136	79	88	78	84	89
Patients (aged 50-75 y) who received appropriate screening for colorectal cancer	8044	39	5242	39	41	36	40	40
Patients with uncontrolled diabetes (HbA <sub>1c</sub> > 9.0%)	4599	16	2542	21	30	33	27	38
Patients screened for depression with a standardized tool	16,084	52	6526	84	84			
Patients screened for depression with documented follow-up plan	1475	93	1040	96		60	76	49
Women (aged 21-64 y) who received cervical cancer screening	16,601	60	14,074	63	54	45	49	59
Pregnant women receiving prenatal care in first trimester	1558	54	1558	54	57	60	74	65
Children who received appropriate vaccines by second birthday	1144	37			31	38	41	53

<sup>a</sup> Blank cells mean the data were not available.

CAD = coronary artery disease; DC = Washington, DC; FQHC = Federally Qualified Health Center; HbA<sub>1c</sub> = hemoglobin A<sub>1c</sub>; MD = Maryland; VA = Virginia.

*I think the [Community Ambassadors] give very high-quality care ... They came from an organization [KP] with such clear guidelines and clear protocols for the highest quality care, and then they've brought that to the center. I think it has impacted our culture ... They're both wonderful role models for young nurse practitioners. —Health center leader, free clinic*

Community Ambassadors have exported KP health care by implementing practices, procedures, and protocols that were either not in place or not performed to KP standards. Examples include KP medication guidelines for patients at high risk of cardiovascular disease and clinical guidelines for prenatal care, cervical cancer screenings, and intake screening for depression and anxiety. Time management skills, patient empanelment, infection control practices, and after-visit summaries in multiple languages were often introduced or improved by the Community Ambassadors.

*At Kaiser [Permanente], as a patient you are asked to schedule your appointments with your primary care provider. That kind of philosophy about seeing your primary care provider for your visits is definitely supported by the [KP] nurse practitioners here, and that's good because I want us to move in that direction. —Health center leader, free clinic*

#### Benefits of Community Ambassador Program

Beyond achievement of program goals, there were additional program benefits for health centers, patients, Community Ambassadors, and KPMAS.

*Benefits for Health Centers and Patients:* Community Ambassadors and health center leaders reported that the Community Ambassadors formed trusting, ongoing, and stable relationships with patients. Community Ambassadors are trained to build supportive rapport with their patients. Often, they have worked at the health centers longer than other clinical staff and are most reliably present on-site. More effective care and better health outcomes may be important results of the continuity of care the Community Ambassadors have enabled.

Health center leaders noted the advantage of relying on Community Ambassadors whom KP had vetted and trained, and whose salaries were not paid by the clinics. These savings in salaries have allowed some clinics to see more uninsured or underinsured patients, and others to invest in infrastructure and equipment.

*With the revenue savings from [2 Community Ambassadors], we were able to purchase inexpensive ultrasound machines and colposcopes for each center. We were able to extend our services to include LEEP [loop electrosurgical excision procedure<sup>20</sup>] services and purchase that equipment. That equipment probably would have been unaffordable to us and our practice if we didn't have the Community Ambassadors. —Health center leader, free clinic*

*Benefits for KPMAS:* Further benefits of the CAP include enabling KPMAS to fulfill its mission of improving health in the communities it serves beyond its members while helping burnish the health system's reputation in the Region.

*I think it should be promoted that we work for Kaiser Permanente, and [KP is] paying me to be here at this clinic to provide care for you. —Community Ambassador, free clinic*

The KPMAS stakeholders stressed that the program has reinforced relationships with the safety net, aiding the kind of reciprocal learning and understanding that can support further KP engagement with community-based clinics.

*Benefits for Community Ambassadors:* Many Community Ambassadors voiced strong satisfaction with the care they provided and the opportunity for professional development afforded to them by the CAP. They talked about their pride in serving vulnerable patients, the improvements they made in the health centers, and the growth they experienced in their jobs while working in challenging environments.

*I'm very proud of the fact that I'm providing care to people who really need health care. I'm keeping them out of the hospital, keeping them out of the Emergency Rooms. I'm keeping them healthier.*

—Community Ambassador, free clinic

#### Challenges for Community Ambassador Program

Interviewees were clear that the CAP's benefits far outweighed problems. When asked about challenges they encountered, many talked about caring for patients with complex medical and social needs, and doing so in clinics with limited resources and a shortage of qualified staff. Lack of affordable, reliable access to specialty care was the most often cited challenge by both Community Ambassadors and health center leaders. A few interviewees said the dual management structure for Community Ambassadors (as KP employees working elsewhere) and quarterly data reporting to KP were cumbersome aspects of the CAP.

#### Program Sustainability and Prospects

Community Ambassadors and health center leaders said that many of the CAP's practices, programs, and standards of care had become embedded in routine operations and were likely to be sustained.

*The prenatal program at this clinic is profitable, so I think they would sustain the program as it is ... It may not grow any larger ... If we both left, there would only be 1 person to do sonograms, but I'm sure that they would find a way. —Community Ambassador, free clinic*

However, they also worried about persistent funding problems and being unable to replace the Community Ambassadors if they left.

*[W]ithout this program, I would have a very difficult time running the clinic that I'm running and [ensuring] the quality that we provide to the patients and the number of patients that we see. It would be humanly impossible. —Health center leader, other clinic type*

Part of the CAP's value to participating health centers is a funding structure unlike that of traditional grants. Health center leaders cited the high skill level, training and retention of KP advanced-practice clinicians, more active involvement by KP, and lower administrative burden as clear advantages of the CAP over other forms of financing.

*What we got with the ambassadors and this type of grant [were] seasoned, experienced professionals. Other grants might give us money that we then have to look for those staff, [but] we have had difficulty finding that level of experience and expertise that fits our salary structure. So, I think that experienced staff is something that's very different about this grant. —Health center leader, FQHC*

Given the CAP's perceived benefits, it is no surprise that Community Ambassadors and health center leaders overwhelmingly hoped the program would last and perhaps grow, continuing to expand patient access and promote KP in the community.

*I would say that to be true to their mission of feeling that the community is not just the Kaiser [Permanente] patients but the community that they live in is important and that having the Ambassador program is really fulfilling that mission. I wouldn't shortchange that, because I think that's really woven into the essence of [KP], and it's something to be proud of.*—Community Ambassador, other clinic type

However, many acknowledged that the CAP staffing has been shrinking, and because KPMAS no longer employs nurse practitioners (most of the Community Ambassadors) in primary care, there is no clear pipeline for staffing the program.

## DISCUSSION

This study provides new insights into the characteristics and contribution of a KP effort to bolster the health care safety net through a partnership with community-based health centers. The main innovation of the KPMAS CAP is its workforce-based approach, which employs KP advanced-practice clinicians to work in safety-net clinics and directly boosts health care services through adding staff with advanced clinical expertise.

The CAP showed encouraging outcomes shortly after its launch in 2011.<sup>11</sup> The current evaluation of the CAP's mature phase—from 2013 to 2017—confirms preliminary findings. Access to several years' worth of data and key stakeholders with vast program knowledge have enabled us to gain an in-depth understanding of the CAP, to describe its trajectory, and to consider its future. These are clear strengths of this study.

The CAP model amounts to a large commitment of financial and human resources, suggesting that programs should consider sustainability options early on to preserve and maximize benefits from their investments. Well-designed data reporting systems can support measuring the impact of the intervention accurately and feasibly for community-based clinics. A “refresh and rebuild” of the CAP to bring it into the future should ensure leadership buy-in, alignment with organizational priorities, and clear long-term goals along with strategies to achieve them. Just as important, program stakeholders should work with participating clinics to ensure that any new solutions fit clinic needs. Because KPMAS is committed to continuing to support its safety-net partners, it is exploring future directions by assessing how clinic priorities align with KPMAS Community Health goals and strategies.

Our study encountered some limitations. First, because this was a community-based evaluation rather than a research study, we relied on quantitative data that were sometimes of uneven quality across program years and participating clinics. Potential bias in self-reported information by clinic staff and Community Ambassadors, inadequate local data collection systems, and KP-mandated changes in reporting schedule and definitions could have affected the accuracy and reliability of measures. We believe that regular review and validation of quantitative results by KPMAS stakeholders helped to avoid errors in our estimates.

Second, this study encompassed 5 years of the CAP; however, our interview sample was drawn only from clinics engaged in the CAP in 2017. It is possible that failing to interview stakeholders from health centers no longer in the program biased our qualitative findings, but the context and long-range perspective offered by KPMAS staff partly addressed this limitation.

Finally, we evaluated a program supported by an integrated health care system, and our findings may not be generalizable to partnerships in the safety net involving other types of large health care organizations.

## CONCLUSION

As a partnership between KPMAS and safety-net clinics, the CAP achieved its goals to improve access to care for underserved populations, increase the clinics' capacity, enhance quality of care, and export KP health care. The program has also strengthened relationships between KP and participating safety-net organizations. However, there are concerns that a dwindling work force could not sustain the CAP in its current form, with potential negative effects for patient access to care. As KPMAS assesses its next steps, the CAP's experience contains valuable lessons for health care organizations interested in working together with safety-net providers to sustainably improve community health. ♦

\* Some data were missing for clinics that closed or dropped out of the program. Consistent data were not available for all measures because of changes in data reporting requirements and methods between years. For the years 2013 to 2015, data were collected on the performance of Community Ambassadors' clinics or clinic departments (eg, Pediatrics, Adult Medicine). For 2016 to 2017, only data on Community Ambassador performance were collected. Several measures selected for reporting by Kaiser Permanente Mid-Atlantic States were changed in 2016.

## Disclosure Statement

The author(s) have no conflicts of interest to disclose.

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## A Thousand Fibers

We cannot live only for ourselves.

A thousand fibers connect us with our fellow men.

—Herman Melville, 1819-1891, American novelist, short story writer,  
and poet of the American Renaissance period

## SPECIAL REPORT

# Adverse Childhood Experiences (ACEs) and Community Physicians: What We've Learned

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<https://doi.org/10.7812/TPP/19.099>**ABSTRACT**

**Introduction:** The prevalence of childhood trauma, as measured by the Adverse Childhood Experiences (ACE) Study questionnaire, has been studied in a wide variety of community settings. However, little is known about physicians' familiarity with and use of the ACE questionnaire or the prevalence of childhood trauma in the physician community.

**Objective:** To survey a convenience sample of community-based physicians and resident physicians to assess for familiarity with and use of the ACE questionnaire in clinical practice and to measure the prevalence of their own ACEs.

**Methods:** An electronic survey was created and disseminated that included demographic questions, questions about physician awareness and use of the ACE questionnaire in clinical practice, and the 10-point ACE questionnaire.

**Results:** Most physicians surveyed (81%) reported they had never heard of the ACE questionnaire. Even fewer (3%) reported using the questionnaire in clinical practice. Most physicians (55.5%) reported no personal history of ACEs. Physicians reporting a history of childhood trauma reported a wide range of ACE scores (1-9). Compared with men, women reported a statistically higher number of ACEs ( $p < 0.001$ ).

**Conclusion:** In this sample of community physicians, familiarity with and clinical use of the ACE questionnaire was low. Most physicians surveyed reported no personal history of childhood trauma. Of physicians reporting a history of childhood trauma, women were disproportionately affected. Physicians in this study reported a lower prevalence of ACEs than the population they serve. Physicians must become better educated and actively address the effects of ACEs on their patients and on themselves.

**INTRODUCTION**

The relationship between childhood trauma and behavioral and medical problems in adulthood was the subject of a large, cross-sectional study by Kaiser Permanente and the Centers for Disease Control and Prevention, known as the Adverse Childhood Experiences (ACE) Study.<sup>1</sup> Researchers in this study interviewed more than 17,000 adults in California between 1995 and 1997. Study participants were asked if they had during childhood ever experienced abuse (emotional, physical, or sexual), neglect (physical or emotional), or any of a number of specific household challenges (substance abuse, a family member with mental illness, parental domestic violence, parental separation or divorce, or the incarceration of a family member). Each participant was assigned an ACE score (eg, 0-10) depending on the number of trauma types s/he reported experiencing. In

the study, 26% of respondents reported 1 ACE, 16% reported 2 ACEs, 9.5% reported 3 ACEs, and 12.5% reported experiencing 4 or more ACEs. Only 36% of respondents reported no history of ACEs.

Subsequent studies have shown that exposure to childhood trauma is a dose-dependent risk factor for a wide range of learning,<sup>2</sup> behavioral, and health problems in childhood<sup>3,4</sup> and adulthood.<sup>5,6</sup> Patients with a history of ACEs are more likely to engage in unhealthy behaviors such as overeating, physical inactivity, and smoking. These patients have been shown to disproportionately experience alcoholism, substance abuse,<sup>7</sup> and depression.<sup>8</sup> Individuals with a history of childhood trauma are also more likely to have sleep disturbances,<sup>9</sup> obesity, diabetes, ischemic heart disease,<sup>10</sup> chronic obstructive airway disease,<sup>11</sup> and cancer as an adult.<sup>12</sup> As a result, these patients are also at increased risk of early mortality.<sup>13</sup>

Little is known, however, about physicians' awareness and use of the ACEs questionnaire or the prevalence of childhood trauma in the physician community. In this study, we surveyed a convenience sample of community-based primary care physicians, specialists, and resident physicians to measure their awareness and use of the ACEs questionnaire in clinical practice. We also sought to determine the prevalence of ACEs among resident and attending physicians providing care for patients in the community, in Muskegon County, MI.

**Health of Muskegon County**

The ACE Study questionnaire (hereafter called the ACE questionnaire) has been used to study a wide variety of both urban and rural populations.<sup>14</sup> Muskegon County, MI, is a good example of this research. Located along the shores of Lake Michigan,<sup>15</sup> the county has a population of approximately 173,000 residents and a mix of both urban and rural living. The largest industries in the county are manufacturing, health care, and retail services, and its largest employer is Mercy Health.<sup>16</sup> In 2017, the median household income for the county was \$46,077, and the poverty rate was 18.5%. The racial makeup of the county is estimated to be 76.5% white, 13.5% African American, and 5.5% Hispanic.

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Keywords: ACEs Muskegon, ACE Study, adverse childhood experiences, childhood trauma, physician adverse childhood experiences, physician well-being, trauma-informed care

When it comes to longevity and health, Muskegon County regularly ranks in the bottom quartile of counties in Michigan. The *Michigan 2019 County Health Rankings Report*<sup>17</sup> ranked Muskegon County 63rd for longevity, 75th for health outcomes, and 78th for healthy behaviors, out of 83 counties in the state. This same report, however, ranked Muskegon County 9th in the state for clinical care resources (access to care and quality of care). In addition, an estimated 93.5% of the population of the county has health care coverage.<sup>15</sup>

### Study Questions

#### Demographic Questions:

1. Are you an attending physician or a resident? (Attending/Resident)
2. What is your specialty? (Anesthesia, Emergency Medicine, Family Medicine, General Surgery, Internal Medicine, Internal Medicine Subspecialty, Obstetrics and Gynecology, Other, Pediatrics, Psychiatry, Radiology/Pathology, Surgery Subspecialty, Urology)
3. Are you a man or a woman? (Man/Woman)
4. What is your age? (18-29, 30-39, 40-49, 50-59, 60-69, 70-79, 80+ y)
5. What is your race/ethnicity? (African Descent/black, white, Hispanic/Latino, Native American/Aboriginal, other)
6. Do you live in Muskegon County, Michigan? (Y/N)

#### ACE Awareness Questions:

7. Have you previously ever heard of the ACE questionnaire? (Y/N)
8. Have you ever asked the ACE survey questions to a patient in your practice? (Y/N)

#### ACE Survey Questions:

9. Did a parent or other adult in the household often or very often: Swear at you, insult you, put you down, or humiliate you? Or act in a way that made you afraid that you might be physically hurt? (Y/N)
10. Did a parent or other adult in the household often or very often: Push, grab, slap, or throw something at you? Or ever hit you so hard that you had marks or were injured? (Y/N)
11. Did an adult or person at least 5 years older than you ever: Touch or fondle you or have you touched their body in a sexual way? Or attempt or actually have oral, anal, or vaginal intercourse with you? (Y/N)
12. Did you often or very often feel that: No one in your family loved you or thought you were important or special? Or your family didn't look out for each other, feel close to each other, or support each other? (Y/N)
13. Did you often or very often feel that: You didn't have enough to eat, had to wear dirty clothes, and had no one to protect you? Or your parents were too drunk or high to take care of you or take you to the doctor if you needed it? (Y/N)
14. Were your parents ever separated or divorced? (Y/N)
15. Was your mother or stepmother: Often or very often pushed, grabbed, slapped, or had something thrown at her? Or sometimes, often, or very often kicked, bitten, hit with a fist, or hit with something hard? Or ever repeatedly hit over at least a few minutes or threatened with a gun or knife? (Y/N)
16. Did you live with anyone who was a problem drinker or alcoholic or who used street drugs? (Y/N)
17. Was a household member depressed or mentally ill, or did a household member attempt suicide? (Y/N)
18. Did a household member go to prison? (Y/N)

ACE = Adverse Childhood Experiences; N = no; Y = yes.

### HealthWest ACEs Assessment in Muskegon County

In an effort to understand the disconnect between the health of the county and the clinical care provided, the Resilience Muskegon team was created. This team is led by HealthWest, a community mental health agency in Muskegon, MI, and includes community members and partners from local health and human services agencies, education, and health care. The purpose of this team is to study the many factors driving unhealthy behaviors in the county and to help educate the community about trauma-informed care (TIC). Although a number of definitions for TIC exist, all are centered around creating a sense of control and empowerment for patients who have experienced trauma by addressing their physical, psychological, and emotional safety needs.<sup>18,19</sup>

The team worked together, as part of a public education campaign, to administer the ACE questionnaire to 2252 Muskegon County adults (1.3% of the county's adult population) between November 2015 and September 2016.<sup>20</sup> Muskegon County ACEs were found to be higher than previously published statewide<sup>21</sup> and national data.<sup>22</sup> The most commonly reported ACE was a history of parental separation, reported by approximately 45% of respondents. In this survey group, 18.7% of respondents reported 1 ACE, 13.5% reported 2 ACEs, 10.3% reported 3 ACEs, and 31.4% reported experiencing 4 or more ACEs. Only 26% of respondents reported no history of ACEs. Women reported more than double the rate of childhood sexual abuse compared with men.<sup>20</sup>

### Educating, Implementing, and Coordinating Trauma-Informed Care

The Resilience Muskegon team has engaged in numerous activities to help educate the Muskegon community about ACEs and TIC. Efforts started in the public schools with the development of programs to educate administrators, teachers, paraprofessionals, coaches, and students about ACEs, trauma, mental health, and resilience. Thousands of community educators have been trained. Data from the HealthWest ACE survey were used to write a \$4 million System of Care grant to enhance services for youth with mental health needs and to help the community become more family focused and culturally responsive. This effort, branded MYalliance System of Care,<sup>23</sup> includes youth, family, mental health, child welfare, juvenile justice, educational, faith-based community, and other community-based organizations. MYalliance System of Care is working in the areas of youth and family engagement, development of a countywide mobile crisis unit, intensive care coordination, and interconnected school-based services.

Multiple local agencies and initiatives have since integrated trauma-informed approaches into their work. The Great Start Collaborative, a coalition of parents, educators, health professionals, business leaders, and community leaders, has incorporated ACEs and resilience training into their programs. Access Health, a Muskegon nonprofit organization that works to create programs and partnerships around community health, began piloting a tool to measure resilience factors in its clients. Muskegon County, through the MYalliance System of Care initiative, is working to implement Handle With Care,<sup>24</sup> a

partnership between law enforcement, schools, and mental health agencies. Handle With Care makes it possible for law enforcement to notify schools when students experience a traumatic event. As a result, students have the opportunity to receive psychological first aid and TIC in a safe environment and in the familiarity of their own school. Since inception of the MYalliance System of Care's trauma-informed approach in schools, the community has gone from having only 4 community-based mental health clinicians, from HealthWest and Hackley Community Care (a Federally Qualified Health Center in the county), in its schools to 22 (Lauren Meldrum, personal communication, 2019 Sep 9).<sup>a</sup>

Over the years, a great deal of time and effort has been invested in educating the Muskegon County community about the effects of ACEs on human and population health. The extent to which this information has become part of the knowledge base and clinical practice of the physicians and resident physicians who provide care for this community, however, has previously not been studied.<sup>25</sup>

### ACEs and Physicians

Rates of screening for ACEs by Muskegon County physicians have previously not been studied. Also, to date, little is known about the prevalence of ACEs in the physician community. These deficits in knowledge are important for the community at large and for physicians. Studies have shown that medical students, residents, primary care physicians, medical specialists, and surgical specialists, during the course of their educational and professional careers, are at increased risk of a number of health and behavioral problems, including poor self-care, burn-out,<sup>26,27</sup> and suicide.<sup>28,29</sup>

Given the unusually high prevalence of ACEs and reported lower life expectancy of residents of Muskegon County, compared with the rest of Michigan, we hypothesized that physicians providing care for patients in this community were very likely unaware of the ACEs questionnaire and were underusing it in their clinical practice. We also hypothesized, given the educational rigors and social support necessary to become a physician, that the prevalence of ACEs in the physician community would be lower than that of the community in general.

## METHODS

### Participants and Setting

The sample came from Mercy Health, a Medicare 5-star-rated hospital and health care system<sup>30</sup> that provides an estimated 85% of all health care services to the residents of Muskegon County. Mercy Health employs a large group of both primary care and specialty care providers, and a number of independent specialists are affiliated with the institution as well. The physician network also provides training for residents in 5 different residency programs, including emergency medicine, family medicine, internal medicine, obstetrics and gynecology, and osteopathic manipulative medicine.

Among the Mercy Health medical staff and residents, 70% of physicians identify as men and 30% identify as women. Although official data on the racial makeup and diversity of the medical staff and residents are lacking, the estimated racial composition of the study group is 91% white, 2% African

American, and 7% other racial groups (F Remington Sprague, MD, personal communication, 2019 Feb).<sup>b</sup> All Mercy Health physician assistants, nurse practitioners, and other nonphysician providers were excluded from this study.

### Study Design and Administration

An anonymous electronic survey was created using online survey software (Qualtrics, Qualtrics, Provo, UT, and Seattle, WA) that included the 10-point ACEs questionnaire, along with 6 basic demographic questions and 2 questions about familiarity with and use of the ACEs questionnaire (see Sidebar: Study Questions). An institutional review board application was made, and a waiver was granted from the University of Michigan.

Before administration of the survey, study questions were presented to the Mercy Health Medical Executive Committee for discussion and review. After the necessary approval was obtained, the Mercy Health Office of Medical Affairs electronically mailed the survey to the 402 active members of the medical staff and residents in training. After the initial invitation to complete the survey, 2 additional reminders were sent to the study group at 2-week intervals. Self-reported familiarity with and clinical use of the ACE questionnaire was ascertained. Similarly, physician responses to each individual ACE question and cumulative ACE scores were abstracted. A yes response to any question on the ACE questionnaire scored 1 point, with a maximum possible ACE score of 10.

### Data Analysis

For statistical analysis, members of the medical staff were divided into 13 different specialty categories (see Sidebar: Study Questions, question 2). The  $\chi^2$  test was used to assess for statistical differences in ACEs between resident physicians and attending physicians, male and female physicians, white and nonwhite physicians, and among the different physician specialties. Data and statistical analyses were performed by a statistician in the Department of Urology at the University of Michigan, Ann Arbor. All analyses were performed using statistical analysis software (SAS version 9.4, SAS Institute, Cary, NC).

## RESULTS

The survey was sent to the 65 residents in training and to 337 active medical staff at Mercy Health, and 226 physicians responded, for an overall response rate of 56.2%. Nine surveys did not indicate whether the respondent was a resident physician or member of the medical staff. Of the 217 remaining returned surveys, 48 (73.8% of 65) were from residents and 169 from medical staff members (50.1% of 337). Respondents' demographics and specialties are presented in Tables 1 and 2, respectively.

### Knowledge and Use of ACEs Questionnaire

Forty-four physicians (19.5%) reported knowledge of the ACE questionnaire, whereas 182 (80.5%) physicians reported having no prior knowledge of the questionnaire. Eight physicians (3.5%) reported having used the ACE questionnaire in their clinical practice, whereas 218 (96.5%) physicians reported they had not. Ten surveys were returned with no response.

**Table 1. Physician demographics (N = 226)**

Demographic characteristic	Physicians, no. (%)
Age, y	
18-29	25 (11)
30-39	68 (30)
40-49	51 (23)
50-59	39 (17)
60-69	40 (18)
≥ 70	3 (1)
Sex <sup>a</sup>	
Women	92 (41)
Men	133 (59)
Race/ethnicity	
White	205 (91)
African American	4 (2)
Hispanic	2 (1)
Native American	1 (0.4)
Other	14 (6.2)

<sup>a</sup> One result is missing for sex.

**Table 2. Average number of adverse childhood experiences (ACEs) by physician specialty**

Physician specialty	Physicians, no. (%)	Average no. of ACEs reported
Family medicine	53 (23.5)	1.0
Internal medicine	42 (18.6)	0.8
Other	25 (11.1)	0.8
Emergency medicine	24 (10.6)	1.0
Obstetrics and gynecology	21 (9.3)	1.3
Anesthesia	17 (7.5)	0.8
Surgical subspecialty <sup>a</sup>	16 (7.1)	0.9
Pediatrics	7 (3.1)	2.7
General surgery	5 (2.2)	1.0
Internal medicine subspecialty <sup>b</sup>	5 (2.2)	1.2
Radiology/pathology	5 (2.2)	0.2
Urology	5 (2.2)	1.8
Psychiatry	1 (0.4)	4.0

<sup>a</sup> Surgical subspecialty: Cardiothoracic surgery, dentistry, neurosurgery, ophthalmology, oral maxillofacial surgery, otolaryngology, podiatry, or vascular surgery.

<sup>b</sup> Internal medicine subspecialty: Cardiology, dermatology, gastrointestinal medicine, geriatrics, hospital medicine, nephrology, osteopathic and manipulative medicine, pain management, physical medicine and rehabilitation, pulmonary medicine, or rheumatology.

### Physicians' ACEs

The average ACE score of all physician specialties was 1.0 (Table 2). Among physicians reporting a history of childhood trauma, the most commonly reported ACE was parental separation (20.5%). Reported least commonly were parental domestic violence (2.7%), physical neglect (1.8%), and having a family member who was incarcerated (2.3%). Given the length of each individual ACEs question, survey results are presented by category of childhood trauma (Table 3).

With respect to cumulative ACEs, 55.5% of physicians in this study reported none. Twenty percent of physicians reported an exposure to 1 ACE, 10% to 2 ACEs, 6.4% to 3 ACEs, and 8% to 4 or more ACEs. Two physicians (0.9%) reported exposure to 9 ACEs (Figure 1).

Physicians who identified themselves as women reported more cumulative ACEs than did men ( $p < 0.001$ ). Women in this study were statistically more likely than their male counterparts to have experienced physical abuse (17% vs 8%,  $p = 0.0339$ ) and sexual abuse (19% vs 5%,  $p = 0.0006$ ). There were no significant differences in number of ACEs reported between resident and attending physicians, white and nonwhite physicians, primary care physicians and specialists, or between specialties.

## DISCUSSION

### Lack of ACE Awareness by Physicians

Most physicians responding to our survey reported they had not previously heard of the ACE questionnaire. Only a tiny percentage of respondents reported having previously administered the survey in their clinical practice.

A wide range of type and cumulative exposure to trauma was reported by physicians with a personal history of ACEs. However, compared with data from the HealthWest survey, physicians in our study reported a dramatically lower prevalence of both individual and cumulative ACEs than the patients they serve. Physicians who identified as women reported significantly greater exposure to physical abuse, sexual abuse, and cumulative ACEs than their male counterparts.

The American Academy of Pediatrics has published a policy statement encouraging its members to take an active role in assessing and educating the greater public about the long-term sequelae of ACEs.<sup>31</sup> Findings from the present study, however, are consistent with data from other studies, demonstrating that both residents<sup>32</sup> and attending physicians<sup>33</sup> are often unaware of the existence and availability of the ACE questionnaire.

### Physicians' Interest in Learning More about ACEs

An unexpected outcome of the planning, preparation, and analysis of the study was the engagement and questions we received about the effects of childhood trauma and ACEs. For example, after our initial study proposal to the Mercy Health Medical Executive Committee, several physician leaders on the committee approached us and disclosed that this was the first time they had been introduced to the concepts of ACEs and TIC. Presentations of the findings of this study, both to the Mercy Health Medical Executive Committee and the Mercy Health Department of Surgery, have further served to facilitate discussion around this topic. Whether these discussions and new information about the prevalence and possible effects of ACEs in our patients and physician community will result in higher rates of ACEs screening remains to be seen.

### Lack of Routine ACEs Screening

A review of the literature caused us to be concerned that routine screening for ACEs is not taking place, to any large degree, in community-based practices,<sup>34</sup> and data obtained from this study add to those concerns. Many of the common barriers to

**Table 3. Physician responses by category of childhood trauma<sup>a</sup>**

Study question	Category of trauma assessed	Physicians, no. (%)
9	Emotional abuse	27 (12.3)
10	Physical abuse	25 (11.4)
11	Sexual abuse	23 (10.5)
12	Emotional neglect	23 (10.5)
13	Physical neglect	4 (1.8)
14	Parental separation or divorce	45 (20.5)
15	Parental domestic violence	6 (2.7)
16	Household substance abuse	27 (12.3)
17	Household mental illness	44 (20.0)
18	Incarcerated family member	5 (2.3)

<sup>a</sup> Of 402 surveys sent to physicians, 220 were returned with questions 9-18 fully completed.

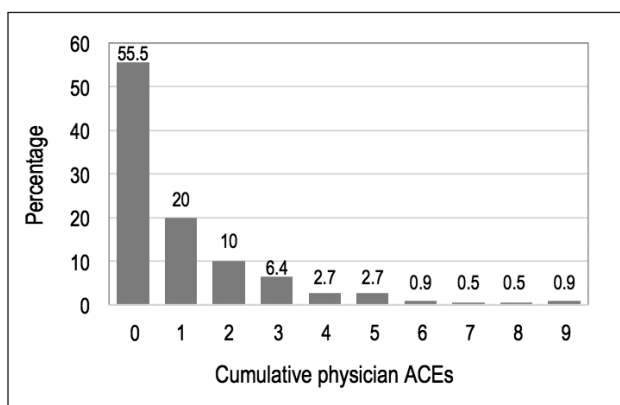


Figure 1. Physicians with adverse childhood experiences (ACEs), cumulative percentage.<sup>a</sup>

<sup>a</sup> Percentages do not total to 100% because of rounding.

implementing screening for ACEs in physician offices have already been identified and solutions put forward.<sup>35</sup> In addition, the American Academy of Pediatrics has published resources to help practices overcome these barriers and successfully implement office-based screening for ACEs.<sup>36</sup> At the 2019 Michigan State Medical Society House of Delegates Annual Meeting, Resolution 29-18 calling for “routine screening of ACEs in pediatric appointments” was approved.<sup>37</sup> It remains to be seen whether pediatricians and other physicians in our community will change their practice in response to the state medical society’s House of Delegates Resolution or the results of this study.

### Effects of ACEs on Physicians

Research on the prevalence of physicians’ personal ACEs is only beginning to be performed. Most physicians in our study did not report any adverse experiences from their childhoods. Physicians who reported ACEs reported a wide range of type and cumulative exposure, including 2 physicians in this study who reported ACE scores of 9. Previous research has shown that women experience childhood trauma more often than men, and data from our study support those findings. Our study is unique in that most respondents were men.

Research on the effects of ACEs on physician health and well-being is also still in its infancy. However, a study from a Colorado treatment facility found that 78% of its clients with an ACE score of 4 or higher had a substance abuse problem, a mental health problem, or both.<sup>38</sup> Reports like this serve as an important reminder that, as humans, physicians have the propensity to experience the same kinds of neurobiologic responses to childhood trauma as their patients do.<sup>39</sup>

### Implications for Hospital Leadership, Patients, and Physicians

The results of this study have important implications for health care and hospital administrators, patients, and physicians. Health care leaders and hospital administrators can benefit from a better understanding of the potential cost-saving benefits of screening for ACEs. For example, Felitti<sup>40</sup> reported that patients at his institution who completed a trauma-related survey at home, and follow-up questions in the office, went on to experience a 35% reduction in outpatient visits and an 11% reduction in visits to the Emergency Department.

For the first time in history, reports indicate that most physicians in the US are employed, rather than being in private practice.<sup>41</sup> As a result, health care and hospital administrators have an unprecedented opportunity to help educate physicians about the evidence-based effects of childhood trauma and the importance of screening for it. They are also in a unique position of being able to help foster the relationships and create the infrastructure needed to implement the TIC model in the community.

Patients who are educated about the relationship between childhood trauma and human health might be more willing to bring any personal history of trauma to their practitioner’s attention. In addition, patients with a history of ACEs may find information and programs that help with resiliency training to be useful.

Physicians stand to benefit from these findings, because a greater understanding of the biological and behavioral basis of disease might translate into improved clinical outcomes. This improved understanding might provide an opportunity for physicians to take better care of not only their patients but also themselves. In our experience, partnering with trauma-centered agencies and organizations has been energizing. It has given new meaning and a greater sense of purpose to our practice. A better understanding of this link could also provide clues, and possibly new treatment options, for physicians with a history of exposure to childhood trauma who display signs of disruptive professional behavior, burnout, depression, or suicidal ideations.

### Helpful Resources

In addition to the references already cited, there are a number of more mainstream resources physicians can use to learn about the effects of ACEs and the fundamentals of TIC. Nadine Harris’ TEDMED talk, “How Childhood Trauma Affects Health Across a Lifetime,”<sup>42</sup> provides a succinct and informative overview of the topic. The movies *Paper Tigers*<sup>43</sup> and *Resilience*<sup>44</sup> tell the stories of how other communities across America are embracing a TIC model of care. For more in-depth reading, there is Nadine Harris’ *The Deepest Well: Healing the Long-term Effects of Childhood*

*Adversity*<sup>45</sup> and Bessel van der Klok's book *The Body Keeps the Score: Brain, Mind, and Body in the Healing of Trauma*.<sup>46</sup>

### Limitations

Our study has several limitations. Accurate administration of the survey was dependent upon the Mercy Health Office of Medical Affairs having up-to-date and working physician and resident email addresses. Overall, the physician response rate to the survey was 56%. Familiarity with ACEs, use of screening for ACEs, and prevalence of ACEs in the 46% of physicians and resident physicians who did not complete the survey remains unknown. An attempt was made to minimize response bias by allowing study participants to respond anonymously.

Among the respondents, resident physicians, men, and white physicians are overrepresented, compared with attending physicians, women, and physicians in nonwhite racial groups. This study, notably, has a lack of racial diversity among respondents.

### CONCLUSION: THE FUTURE

Collectively, the findings from this study indicate a need to better educate our physician community about the health and behavioral sequelae of childhood trauma. Discussions about the benefits of, barriers to, and best practices for routine screening for ACEs need to take place. Conversations also should take place about how, once patients with a history of childhood trauma are identified, medical care can be optimally coordinated with the behavioral, health, and social services resources that are already available and currently being developed in our community.

Data from this study demonstrate that childhood trauma, as assessed by the ACE survey, occurs not only in patients but also—albeit to a lesser extent—in the physicians who care for them. Explanations for the differences in the prevalence of ACEs between nonphysician members of the Muskegon County community and the physicians who care for them remain to be explored. Further research into the physical and behavioral effects of ACEs on physicians has the potential to improve physician health and well-being and, by extension, clinical performance.

It is our hope that physicians in our community will make a serious effort to educate themselves about the effects of ACEs on human health and work to implement universal screening and a TIC approach in their clinical practices. We understand that most physicians do not have the time or resources to provide the specialized care that many of these patients need. However, by developing relationships, listening, making referrals, and coordinating care with existing community-based agencies and resources, physicians have the opportunity to improve the health of their patients. Additionally, they may also enjoy the benefit of professional and personal satisfaction that comes with being part of a TIC team. ♦

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### Disclosure Statement

Dr Stork is an investor in Greater Michigan Lithotripsy, Columbus, OH; Muskegon Surgery Center, Muskegon, MI; Theralogix IV, Rockville, MD;

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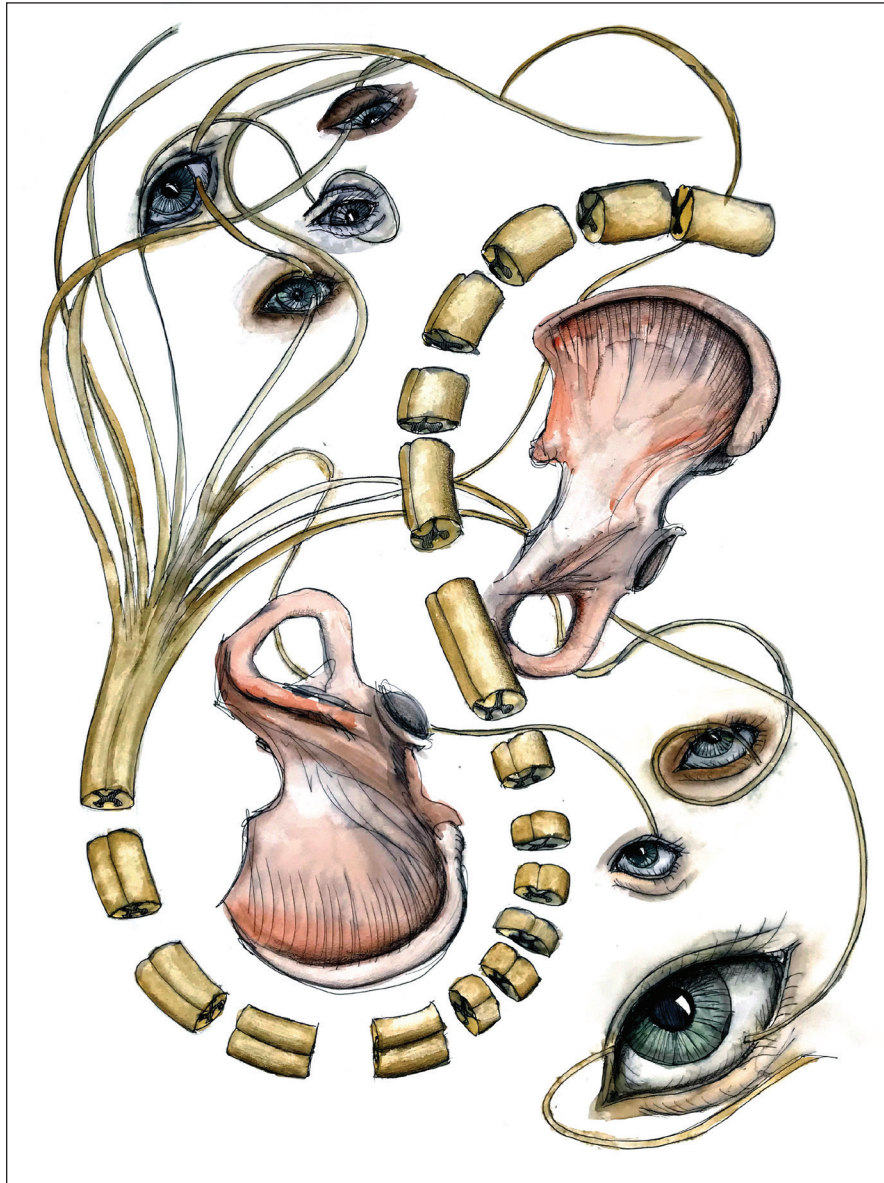
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## Twice the Odds

A person with an ACE score of two or more had twice the odds of hospitalization for autoimmune disease as someone with zero ACEs.

— Nadine Burke Harris, MD, b 1975, American pediatrician, author, and 1st Surgeon General of California



**Pain, Seeking Relief**  
watercolor, ink, and paper  
**Kristina Alton**

Per Ms Alton: "Pain management has been a topic of national debate throughout my medical education. The conversation surrounding the opioid crisis has particularly implicated medical practitioners, and as a physician in training, responsible prescribing of analgesics has been repeatedly emphasized during medical school. This artwork is a product of my reflection process on how this shift in the practice of prescribing has affected patients. I often hear accusations by practitioners that a patient is 'pain seeking,' and I often hear from patients that 'no one listens' to them when they complain of pain. This has been especially poignant in female patients with chronic pelvic pain. It seems very difficult to balance protecting patients from dangerous drugs and empathizing with patients who are suffering. I am interested in the intersections of culture, media, and medicine, and this issue has been particularly interesting to explore."

Ms Alton attended an arts magnet school during middle and high school, which introduced her to visual art. She continued to work on art in her free time as a pre-med and medical student. During her gap year between college and medical school, she became focused on anatomical illustrations with pen and watercolor. Her favorite part of medical school so far has been considering the ethical dimensions of patient care, and she feels privileged to have the ability to process difficult encounters she has with patients and physicians through art. She is a fourth-year medical student at University of North Carolina at Chapel Hill.

# Working to Achieve the Quadruple Aim

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## ABSTRACT

Quality improvement activities are essential to achieving the Institute for Healthcare Improvement's Quadruple Aim of improving the health of our patients and members, enhancing members' care experiences, reducing costs, and attaining joy and meaning for our physicians and care teams in the workplace. These activities are also essential in creating a learning health care system.

For more than a decade, the Kaiser Permanente National Quality Conference has been our premier national forum on quality. The conference brings together diverse stakeholders—from physicians and frontline staff to senior executive leaders, patients, and strategic partners—to connect, collaborate, accelerate learning,

and spread the work of our colleagues to achieve the Quadruple Aim. The leading-edge work presented each year reflects the interdisciplinary contributions and breadth and depth of work necessary to deliver on the mission of Kaiser Permanente to bring quality, cutting-edge, and person-centered health care to its patients.

This is the fourth year we have partnered with *The Permanente Journal* to share learnings from the conference with those who are unable to attend and with the broader, international journal readership. Through the more than 40 abstracts chosen from more than 120 submissions on the basis of scientific rigor, interest, and opportunity for spread, we demonstrate the important work being done in *quality* (safe, timely, effective, efficient, equitable, and person centered); *affordability*; *joy in the workplace*; and *tools* (evaluation, analytics, and informatics). Publishing quality improvement activities has considerable value, encourages precise adherence, and helps facilitate greater willingness to share improvement opportunities. We hope the readers of *The Permanente Journal* find this work thought provoking and a source of continued learning. ♦

## Disclosure Statement

The author(s) have no conflicts of interest to disclose.

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# Abstracts from the Kaiser Permanente 2020 National Quality Conference

*From: Northern California*

## 1. The Preparedness Assessment for the Transition Home (PATH): A Data-Driven Approach for Addressing Gaps in Caregiver Readiness and Capacity

**Michelle Camicia, PhD, MSN, CRRN, CCM, NEA-BC, FARN, FAHA; Carrie Robertshaw, DNP, MSN, FNP, CRRN; Deborah Raymond, MSN, MBA, RN, NEA-BC; Brian Theodore, PhD**

DOI: <https://doi.org/10.7812/TPP/20.046.01>

**Background:** The Preparedness Assessment for the Transition Home (PATH) is a 25-item, validated survey recently developed to assess caregiver preparedness and was found to have statistical significance in predicting 30- and 90-day outcomes on the health-related quality of life of caregivers of patients admitted for inpatient rehabilitation at Kaiser Foundation Rehabilitation Center (KFRC). A 7-item version (PATH-7) was also developed for use in the acute care setting for a diverse population of patients in need of caregivers.

**Methods:** There was no standardized method within Kaiser Permanente (KP) to assess and address gaps in caregiver preparedness before patient discharge, potentially elevating the risk of 30-day readmissions and other adverse outcomes. The PATH was administered mid stay for caregivers of stroke survivors at KFRC. Scores on the PATH informed a catalog of interventions to address gaps in preparedness. The catalog was designed as a standardized documentation note in KP Health-Connect. We collected health-related quality of life (caregivers) and 30-day readmissions (patients) for a cohort preimplementation of the program.

**Results:** The PATH assessment has strong psychometric properties (Cronbach's  $\alpha = 0.90$ ) and predicts caregiver's health status at 30-days and 90-days following a patient's discharge from inpatient care. Following this instrument validation, PATH and PATH-7 went live at Vacaville and Vallejo Medical Centers, starting with stroke patients in acute care (04/29/2019). The PATH was then expanded to inpatient rehabilitation at KFRC (10/01/2019) and was further implemented in phases to other populations as a standard of care in November 2019 (including pneumonia, chronic obstructive pulmonary disease, congestive heart failure, and sepsis). We present workflow considerations, barriers, and facilitators, and results on the effectiveness of the PATH and PATH-7 as a data-driven approach to bridge the gaps in caregiver preparedness using a catalog of interventions.

**Discussion:** The health of the caregiver can significantly affect the health of the care recipient. Many caregivers for Kaiser Foundation Health Plan (KFHP) members are also covered by KFHP (approx. 73% at KFRC), thus interventions for caregivers may have 2 times the impact on the health of our members. Therefore, this work is strategically important to KP. The implementation model and results in this presentation can serve as a blueprint for regional expansion of standardized caregiver assessment and intervention. The evaluation of pre- versus postimplementation of the PATH is currently funded by KP Community Benefits.

*From: Hawaii, Northern California*

## 2. Northern California to Hawaii—Health Achieved through Lifestyle Transformation (HALT)

**Hyewon Jun, MD, MPH; Mae Lynne Swoboda, MPH, CHES; Rajiv Misquitta MD, FACP, PT (NASM), RYT 200; Lisa Edwards MBA, RD**

DOI: <https://doi.org/10.7812/TPP/20.046.02>

**Background:** Chronic disease is the leading cause of death and disability in the US. Rates of chronic disease have never been higher, with cost of chronic conditions eating up 86% of all health care dollars spent. According to the World Health Organization, 80% of heart disease, stroke, and type 2 diabetes and 40% of cancer could be prevented, primarily with improvements to diet and lifestyle. However, Lifestyle Medicine is challenging because the fundamental goal is sustained behavior change.

**Methods:** With the foundational work of the authors Rajiv Misquitta, Lisa Edwards and their team at the South Sacramento Medical Center, they provided the Hawaii Region with training, materials and support to pilot their multidisciplinary program focused on behavior modification. Cardiology patients with diabetes or cardiovascular disease already referred to Lifestyle Medicine and/or dietitian programs were recruited. Patients participated in this 20-week evidence-based program. This program was a collaboration of a physician, lifestyle coaches, dietitians, and health educators in 2 Regions. A group session was followed by individual coaching the following week. Food samples were provided. We collected data from the electronic medical record on weight, waist circumference, lipids, blood pressure, diabetes control (hemoglobin A<sub>1c</sub>).

**Results:** The South Sacramento program has demonstrated positive 6-month outcomes for all patients enrolled in 18 cohorts which includes an average reduction of 26 units of insulin, decrease in hemoglobin A<sub>1c</sub> by 0.8% points, 6.8 % reduction in body weight and average decrease in waist circumference by 2.3 inches. Data collection is ongoing. Positive health-related outcomes have been observed for 2 of 4 cohorts from the Hawaii location and will be available at the National Quality Conference. Initial results from cohort 1 (6 participants) show a decrease in hemoglobin A<sub>1c</sub> by 0.5% points (p value = 0.634), percentage weight change 8.2 % with a p value of 0.017, and waist circumference decrease of 3.9 inches with a p value of 0.0096.

**Discussion:** Diabetes and cardiovascular disease are 2 chronic diseases with significant health and financial consequences. Within and outside of KP, clinicians understand the importance of lifestyle change, and we struggle because behavior change is hard. With the foundational work of the team at the South Sacramento Medical Center as presented at the 2017 National Quality Conference, the Hawaii Region was able to pilot their multidisciplinary program focused on behavior modification. Preliminary data align with the data from the foundational work. Strategies for successful spread of this program will be presented.

*From: Southern California*

## 3. Effective Patient Advisory Councils: Make Sure the Gang's All There!

**Kerry Litman MD, CPPS; Linda Fahey, RN, NP, MSN; Diana Palma, MHA; Nancy Gin, MD; Susan Mahler, MSE, PhD; com Mike Adamson; Alice Rademacher, MS**

DOI: <https://doi.org/10.7812/TPP/20.046.03>

**Background:** Patient Advisory Councils (PAC) are most effective in Kaiser Permanente (KP) when there is collaboration between Permanente Medical Group and Kaiser Foundation Health Plan and Hospital leaders, in partnership with engaged patient advisors. This session illustrates how this integrated approach and our proven PAC "Pathway to Success" will allow the PAC to become more effective and improve strategic initiatives, ensuring both patient advisors, physicians, and other leaders feel their time is worthwhile and that they are making a difference.

**Methods:** Problem: Lack of integrated leadership and standardized processes can reduce the

effectiveness of PACs. Intervention: Southern California Permanente Medical Group and Kaiser Foundation Health Plan and Hospital leaders now support all KP Southern California (KPSC) PACs. This, along with our PAC Pathway to Success, has greatly improved the effectiveness of 20 PACs. Comparison: KPSC PACs have adopted consistent strategies and tools with clearly improved effectiveness and outcomes. Outcome Measures: We measured impact: 1) number and quality of improvements resulting from PAC work; 2) number of presentations/committees/projects in which PAC advisors had an impact; and 3) hours volunteered by PAC advisors.

**Results:** Since implementing the PAC Pathway to Success and with uniform physician collaboration in the PACs, we have seen many improvements in their effectiveness. The high impact of patient collaboration in surveys of presenters to the regional PAC and high subjective scores for effectiveness of PAC collaboration were demonstrated. Process measures are hours volunteered by patient advisors and lists of projects improved. Specific examples include: Increased patient self-ordering of colorectal cancer kits via the online personal action plan after collaboration with the regional PAC; OpenNotes (patients ability to view their clinicians progress notes) implemented throughout KPSC in 2018 in part at the regional PAC's request; increased use of KPSC pharmacy opioid disposal sites after recommendations by our councils.

**Discussion:** Effective PACs don't just happen! Adding patient- and family-centered care physician leads to PAC teams in all KPSC councils, as well as standardizing successful practices from the PAC Pathway to Success, greatly increased meeting effectiveness and outcomes. We will share these "spreadable" techniques, tools, and approaches, which lead to "improvements that matter" to patients and that support organizational strategic goals. Also importantly, the time spent by your PAC team and your patient advisors is worthwhile, meaningful, and makes a difference for our members!

*From: Northern California*

#### 4. Elevating Care through Patient Engagement: Practical Strategies for Embedding the Member Perspective into Our Work

Rebecca Skiles, MHS; Stephanie Lotane; Cathy Fragola; Krista Rosa

DOI: <https://doi.org/10.7812/TPP/20.046.04>

**Background:** Patient engagement improves safety and quality outcomes, care experience,

and promotes joy in medicine. The Northern California patient- and family-centered care program supports our quality aim to embed diverse patient voices into organizational structures and care design by incorporating patient-centered practices and by strengthening our partnership with patients. This session offers strategies on how to embed patient advisors in our work so we can learn from their experiences, honor their preferences, and improve care delivery.

**Methods:** Patient engagement is recognized as an essential characteristic of a patient- and family-centered health care organization. Within Kaiser Permanente (KP) Northern California (KPNC), the journey to patient engagement formally began in 2010 and continues to advance. Though there are many paths to high-level engagement, critical success factors have included: institutional readiness to embrace transparency and open collaboration with patients and families, executive sponsorship and leadership support, raising awareness of patient- and family-centered care concepts and practices, understanding organizational priorities and how patient advisors can support them, understanding and capitalizing on each patient advisor's unique strengths, and measuring the impact of patient engagement.

**Results:** Since 2010, we've seen a dramatic increase in the volume of patient engagement work within KPNC. The number of Patient Advisory Councils, one platform of engagement, increased from 5 to 43, and the number of patient advisors has grown to more than 400—with 79 holding seats on organizational committees. We present quantitative and qualitative data from a variety of projects to demonstrate the positive impact patient engagement has had on staff and physician education, performance improvement, and committees such as quality and patient safety committees. We describe how these data are used for the advancement of patient- and family-centered care. Data include: Post-CME evaluation surveys efficiency measures pre- and postprocess redesign and testimonials from patients, staff, and clinicians.

**Discussion:** Excellence in care happens when staff, clinicians, patients, and family members work together. At KP, we have learned that Patient Advisors challenge and inspire us to do our best by connecting us to our purpose and making our work meaningful. The KPNC Region has made significant strides in successfully embedding the patient voice into areas of work that are high profile and high impact. Patient advisors and family-centered care leaders from KPNC present a roadmap, along with practical tools and strategies for authentically integrating the patient voice into the design of our systems and the delivery of care.

*From Georgia*

#### 5. Breathing Life into Data: Estimating Lives Positively Impacted by Chronic Disease Prevention and Control Programs at Kaiser Permanente Georgia between 2008 and 2018

Alan Bienvenida, MPH; Jacqueline Hensley, MPH; Kate Koplan, MD, MPH; Felipe Lobelo, MD, PhD, FAHA

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**Background:** Using the methods of Lives Impacted provides Kaiser Permanente (KP) Georgia (KPGA) with a human-centered approach to analyzing and presenting Healthcare Effectiveness Data and Information Set (HEDIS) data. It allows us to describe the performance and the effect of our health programs on an individual and community level. This process provides stakeholders with the understanding of the quality prominent in KPs' unique health care model that would otherwise be absent among other rating systems.

**Methods:** The research unit of KPGA and The Southeast Permanente Medical Group estimated the number of lives positively impacted by our health systems' chronic disease prevention and control activities among health maintenance organization commercial and Medicare membership. We analyzed HEDIS rates and eligible membership for 10 chronic disease indicators, between 2008 and 2018, for trends in health care performance. Number needed to treat and number needed to screen (NNT/NNS) estimates related to the 10 HEDIS metrics were identified through a literature review. Using a sensitivity analysis, we created a set of adjustment factors for members with multiple chronic conditions and applied the medical record number-based adjustment factor that yielded a conservative estimate of positively impacted lives at KPGA.

**Results:** Between 2008 and 2018, we estimate that KPGA positively impacted the lives of 15,600 patients by preventing chronic disease progression or complications among its health maintenance organization commercial and Medicare membership. In 2018, KPGA averaged a higher HEDIS performance rate among 10 chosen HEDIS metrics compared with the national average and other Georgia healthcare plans. Subsequently, KPGA impacted more lives compared to other health care plans in Georgia, after adjusting for membership levels (Commercial—92 to 133 lives, Medicare—20 to 59 lives). Prospectively, we estimate that KPGA can positively impact 600 more lives annually. This increase would require a

25% increase in eligible membership growth, and an average HEDIS rate among chosen metrics of 90% and 98% for both commercial and Medicare product lines, respectively.

**Discussion:** The Lives Impacted report highlights KPGA's historical journey to its current position as the quality-leading integrated health care delivery system in Georgia. Through its efforts to prevent and control chronic disease among its membership, KPGA positively impacted the lives of more than 15,000 individuals over the past 10 years. In that same period, KPGAs HEDIS performance consistently exceeded the national standard. In Georgia, KPGA positively impacted more lives and reported higher HEDIS performance rates than all other health care plans. Most importantly, the methods of Lives Impacted bring life and context to health care performance data that is often dry and difficult to interpret.

*From Northern California*

## 6. Reducing Cesarean Section Surgical Site Infections: Multidisciplinary Implementation of a Novel Bundle within an Integrated Health Care System

**Neeru Gupta, MD; Eric Hunt, MD, PhD; Mary Kay Ausenhus, RN, MSN; Franklin Keathley, RN, MBA; Samantha Delehant, MBA, DPT, CMPT; Frederick Cabasa, MS**

DOI: <https://doi.org/10.7812/TPP/20.046.06>

**Background:** Surgical site infections (SSIs) are the most common complication of surgery in the US, and of the surgeries in women, cesarean section is the most commonly performed surgery. The rates of SSIs in Kaiser Permanente Northern California (KPNC) were higher than average and climbing, leading to increased maternal morbidity and costs. Preventing infection enhances care experience by allowing families to focus on their new family member.

**Methods:** In 2018, the KPNC Perinatal Patient Safety Program (PPSP) created an evidence-based bundle directed at decreasing SSIs in cesarean deliveries. The SSI bundle was implemented across all cesarean sections, excluding emergency surgeries. The bundle elements included: Reinforcing sterile technique, skin preparation, weight-based antibiotic administration and redosing, hyperglycemic control in diabetics, as well as new practices including vaginal preparation, maintaining normothermia, and azithromycin administration. The bundle was initiated at 2 medical centers as pilot projects, then spread to the remaining 13 sites. Outcome measures used the overall Standardized

Infection Ratio (SIR) per the National Healthcare Safety Network NHSN, as well as the Complex SIR, at both regional and medical center levels. Medical center adherence to the bundle elements was captured for process improvement with a Tableau dashboard.

**Results:** In January 2019, implementation of the bundle moved from routine scheduled cesarean sections, to include urgent/nonemergent cesarean sections across KPNC. Regional and local leadership support via conference calls, supporting materials, and regular tracking of metrics continued throughout the implementation timeline. A significant reduction in the KPNC SIR was appreciated from an average of 2.02 to 1.3 ( $p = 0.01$ ) from January 2019 to July 2019 vs the comparable preimplementation time frame in 2018. The complex SIR during this time frame also significantly dropped from 2.99 to 1.38 ( $p = 0.01$ ). Since implementation, 73% of our medical centers have seen a reduction in their cesarean section SIR.

**Discussion:** After 9 months of implementation, medical centers continue to consistently optimize bundle element best practices. At this time, data supports that the developed SSI bundle is effective at reducing SSIs in cesarean deliveries and can be implemented in a variety of hospital settings providing obstetric care. The continued implementation is anticipated to further reduce postsurgical infections and maternal morbidity. Multidisciplinary partnership in the creation of the bundle, implementation and documentation is critical to successful implementation. The strategic process developed can be translated to other projects in women's health and to other services working on performance improvement.

*From Georgia*

## 7. A Multidisciplinary Approach to Improving Medicare Medication Adherence

**Beth Barham, PharmD; Carole Gardner, MD, AGSF; Debbi Baker, PharmD, BCPS**

DOI: <https://doi.org/10.7812/TPP/20.046.07>

**Background:** Medication adherence improves patient safety and chronic condition outcomes; and hospitalizations, morbidity, and mortality decline. Reconciling medications, educating practitioners, and providing feedback promote adherence. Enhancing convenience and affordability, patient engagement at pharmacy point of sale, and patient outreach are effective strategies. Individual patients require varying levels of engagement. Pharmacy assis-

stants are equipped to resolve selected barriers (affordability and navigating complex systems) and triage clinical adherence barriers (adverse effects, taking differently than prescribed, and self-discontinued) to a clinical pharmacist.

**Methods:** Kaiser Permanente Georgia's (KPGA's) multidisciplinary team developed several initiatives for Medicare members who are prescribed statins, renin angiotensin system (RAS) antagonists and/or diabetes medications. Benefit cost share changes facilitate adherence. Practitioners receive training and reports. Kaiser Permanente HealthConnect tools adopted from Kaiser Permanente Southern California provide decision support and patient education; and higher prescription default quantity promotes adherence. Pharmacy assistants contact members with low adherence, as well as those on diabetes medications who have not filled a statin prescription (statin use in persons with diabetes [SUPD]). When pharmacy assistants proactively identify adherence barriers, they triage patients to the appropriate clinical resource for resolution. Clinical resolution results in either continuation of medication at the appropriate dose or deprescribing.

**Results:** After broadening these initiatives in 2017, KPGA improved Medicare Star performance to achieve 5 Stars on all triple-weighted Patient Safety metrics. Before this, our adherence performance predictably declined every year during third and fourth quarter. After fully implementing pharmacy assistants to address adherence, KPGA was able to bend the trend and to demonstrate improved sustained performance during 2018 third and fourth quarters. In 2019, the behavior change in our population remains apparent; we began the year with higher baseline performance, indicating sustainability aligned with resources. In calendar year (CY) 2017, statin use = 83.8% (4 Stars), RAS = 85.2% (4 Stars), diabetes = 82.4% (3 Stars), and SUPD = 84.7% (5 Stars). In CY 2018, statin use = 89.1% (5 Stars), RAS = 89.7% (5 Stars), diabetes = 87.8% (5 Stars), and SUPD = 85.8% (5 Stars).

**Discussion:** Owing to socioeconomic and other factors leading to health disparities, our community experiences high medication non-adherence rates. According to the Centers for Disease Control and Prevention, nonadherence to RAS medications in our community ranges from 19.5% to 25.7% among Medicare beneficiaries. With our initiatives, and especially with the addition of a program in which pharmacy assistants contact patients directly, KPGA reduced RAS nonadherence to 9.9% in 2018. This exceptional performance has been noted during interregional pharmacy discussions, resulting in

initiative spread to other Regions. We will continue the program, reevaluate required resources and retrain practitioners. We appreciate the opportunity to share tactics. Adopting this program would help other Regions improve performance.

*From Northern California*

## 8. Drug Dealer, MD, Meets The Pain Management Rehabilitation Program

**Karen Peters, PhD; Barbara Gawehn, RN, LAc; Dhiruj Kirpalani, MD; Maureen Wenski, PT, DPT and Kimthy Pham, PharmD**

DOI: <https://doi.org/10.7812/TPP/20.046.08>

**Background:** The US consumes more than 80% of the world's opioids, while representing less than 5% of the world's population. Some say it is symptomatic of a fragmented health care system. The Pain Management Rehabilitation Program's (PMRP's) response is a patient-centered integrated model whose active ingredient is educating patients and physicians about the relief-seeking mechanism underlying chronic pain and addiction. Opioid and benzodiazepine prescriptions are dramatically reduced by using a destigmatizing approach that offers support to physicians and meets patients' needs.

**Methods:** Chronic pain patients with any level of complexity and motivation enter a full continuum of care. Patients enter 1 of 2 mind-body treatment tracks depending on their motivation to abstain. This integrated model includes supportive tapering, interdepartmental comprehensive treatment plans, active primary care involvement and primary care education that includes physician-patient dialogue. Education about relief seeking and why abstinence from addictive substances and medications is optimal for central nervous system retraining for chronic pain management is foundational to the program. Use of opioids and benzodiazepines are measured 1 year pre- and postparticipation in the program.

**Results:** Patients who attended the intensive track ( $n = 230$ ) reduced opioid prescriptions by 79% and benzodiazepine prescriptions by 86%. Patients with minimal motivation who attended 4 to 6 sessions of the chronic pain education track ( $n = 46$ ) reduced opioid prescriptions by 51% and benzodiazepine prescriptions by 30%.

**Discussion:** Significant benzodiazepine and opioid prescription reductions are achieved in both addicted and nonaddicted chronic pain patients with varying levels of motivation in an integrated program that emphasizes education about the relief-seeking mechanism and how abstinence optimizes the potential to retrain the

brain for chronic pain management. Integrating care with other departments is key to treating the complex patient, as well as educating and supporting physicians. This approach earned PMRP the distinction of a new model of care in *Drug Dealer, MD* by Anna Lembke, MD, and was featured on New York's NBC Nightly News, showcasing Kaiser Permanente's innovative power in delivering cutting edge care and addressing a national crisis.

*From Northwest*

## 9. Autism Services Transformation: A Triple Aim Approach to Applied Behavior Analysis

**Lisa Denike, MD; Sarah McGee, RNC, MSN; Charlene Weaving, RN, MSN; Krystle Alligood, MS; Matt O'Connell, MPH; Kristen Morris, MA**

DOI: <https://doi.org/10.7812/TPP/20.046.09>

**Background:** Applied Behavior Analysis (ABA) is an evidenced-based therapeutic approach for the treatment of Autism Spectrum Disorder (ASD). Although ABA has become the standard of care for this vulnerable population, many Kaiser Permanente Regions still struggle to effectively manage these externally provided services. In the Northwest, this has resulted in lengthy care delays, wide variation in practice norms, inconsistent coding practices and patient safety concerns.

**Methods:** A multidisciplinary team, led by licensed behavior analysts, implemented a quality assurance program in alignment with the STEEP (safe, timely, effective, efficient, equitable, and patient-centered) framework, using the Plan-Do-Study-Act (PDSA) model for quality improvement. Comprehensive changes were made to our utilization management (UM) processes, with a focus on improving efficiency and codifying billing practices across our network. Key learnings from a pilot phase resulted in a practitioner evaluation program centered around 3 components: Treatment plan review, clinical on-site evaluations, and a caregiver satisfaction survey. A population management tool was developed to quantify practitioner performance and empower case managers to make data-driven decisions regarding care.

**Results:** Efforts to overhaul our UM and practitioner contracting processes led to an 85% increase in patient volume compared with baseline. Concurrently, we saw a 56% decrease in time from ASD diagnosis to ABA therapy initiation [20.9 wks;  $n = 152$  vs 9.1 wks;  $n = 137$ ]. This is significant for a population where early intervention is crucial to therapeutic success. Although total cost for services rose because of the

increase in patient volume, annual per member cost has decreased 16% and continues to trend downward. Finally, Emergency Department utilization declined 9%, indicating that aggressive and maladaptive behaviors are being managed in the appropriate care setting.

**Discussion:** The ABA quality assurance program has provided our clinicians and staff with the processes and tools necessary to ensure that our members receive patient-centered, high-quality services from our contracted practitioners. Since implementation, we have expanded access, reduced wait times, established quality standards, and improved affordability. Next steps will be to continue partnering with other Regions to facilitate data sharing and model spread, while building upon our evaluative framework in 2020 and beyond.

*From Northern California*

## 10. Care Experience: The Redwood City (3-Year) Journey of HCAHPS Star Rating Improvement

**Barbara Hounslow; Amy Young, RN, MBA; Ashu Goyal, MD; Poonam Kapadia, MD**

DOI: <https://doi.org/10.7812/TPP/20.046.10>

**Background:** Improving the patient experience (as measured by Hospital Consumer Assessment of Healthcare Providers and Systems [HCAHPS]) is not just the right thing to do for our patients, research shows that it also improves clinical outcomes. Since the Centers for Medicare and Medicaid Services (CMS) has added Star Rating to HCAHPS, improvements in ratings have been challenging for many hospitals. At the Kaiser Permanente (KP) Redwood City Medical Center year-over-year increases in the Summary Star Rating have been possible through building an organizational culture that is improvement focused, patient-centered, and incorporates multidisciplinary engagement.

**Methods:** The Redwood City Medical Center focused on the "All Inpatient" population for targeted improvements in 4 of the 9 HCAHPS measures for "Communication with Nurses, Communication about Medicines, Discharge Information, and Care Transitions." For each HCAHPS dimension a specific bundle of behaviors and performance-improvement work was deployed. In addition, key foundational work was completed in year 1, which included a Care Experience (CE) strategic plan, culture building that emphasizes the purpose of the work, and incorporation of the high-reliability principles to evidence-based practices for CE. Year 2 and year 3 added a CE governance structure, a service

recovery program, and coaching and monitoring of the evidence-based practices.

**Results:** The HCAHPS Summary Star Rating is a comprehensive measure that is publicly reported and includes 11 dimensions of care as defined by the CMS. At the KP Redwood City Medical Center, the Summary Star Rating improved from 3.6 Star Rating at the end of the 2016/2017 performance year to a 4.1 Star Rating at the end of 2018/2019 performance year. In this same time frame, the dimensions for recommend the hospital and discharge information improved from a 4-Star Rating to a 5-Star Rating; the measures for nurse communication, communication about medicine, and care transitions all improved from a 3-Star Rating to a 4-Star Rating.

**Discussion:** Improving our patients' experience in the hospital requires a specific, tactical plan for targeted improvements tailored to each of the HCAHPS dimensions of care. When this is combined with a strong commitment to building a culture of organizational excellence, it creates a framework for CE success. This session will discuss how to blend tactics, culture, and a CE governance structure to improve the overall experience of our patients.

*From Northwest*

## 11. Skilled Nursing Facility Transitions of Care (Vohs/Lawrence Single Site Finalist 2020)

**Yvonne B. Rice, PharmD; Hannah M. Austin, MBA; Preston Peterson, MD; Jose G. Benuzillo; David M Mosen**

DOI: <https://doi.org/10.7812/TPP/20.046.11>

**Background:** Patients discharged from a skilled nursing facility (SNF) to home are at increased risk of subsequent hospital admissions than patients discharged directly home from hospitals. An enhanced care coordination bundle specifically addresses needs of this target population including complex medication issues and coordination of follow-up care.

**Methods:** The target population is 1280 older adults who transitioned to home from contracted SNFs between 12/1/2016 and 02/28/2018 in the Kaiser Permanente Northwest east service area. The intervention is the execution of a SNF transition bundle that includes risk stratification, a transition hotline number, standardized discharge summary and instructions, medication reconciliation by a pharmacist, a follow-up call with a transition nurse, and follow-up appointment with a practitioner within 7 days. The target population was compared with 453 patients discharged from contracted SNFs outside the east

service area. The success measures are decreased 30-day hospital readmission rate and decreased harmful medication discrepancies.

**Results:** Multistage logistic regression models were used to ascertain the effect of the intervention on 30-day hospital readmissions. Mediation analysis was conducted to disentangle the impact of the transitional-care bundle components. Pharmacist medication reconciliation plus nurse follow-up calls were directly associated with lower 30-day hospital readmissions (odds ratio [OR] = 0.69; 95% confidence interval [CI] = 0.47 - 0.99;  $p = 0.047$ ). Pharmacist medication reconciliation plus a follow-up call with a nurse were associated with completion of follow-up appointments with a practitioner (OR = 8.70; 95% CI = 6.92 - 10.93;  $p < 0.001$ ). When controlling for pharmacist medication reconciliation plus nurse follow-up calls, practitioner follow-up appointments were significantly associated with reduced 30-day hospital readmissions (OR = 0.56; 95% CI = 0.36 - 0.85;  $p = 0.008$ ). Harmful medication errors were 91% less likely to occur in the intervention group than in the control group (OR = 0.09; 95% CI = 0.051 - 0.195;  $p < 0.001$ ).

**Discussion:** Medication issues are complex and confusing for patients after SNF transitions of care and require dedicated resources to optimize reconciliation in the home. Coordination of care is improved with transition-nurse calls including family education, assistance with follow-up appointment and transportation, financial assistance, coordinate across multiple teams, and action on acute symptoms. Contracted SNFs can be influenced to support safer medication processes, discharge processes, and patient education. Improved workflows are needed to reduce duplication, rework, and build efficiency. The next step is to spread the SNF transition bundle to all contracted SNFs in the Kaiser Permanente Northwest Region.

*From Northern California*

## 12. Creating Healthy Work Environments: "I am living in mine"

**Laure Lisk, RN, MS, CPHQ, CPHRM; Elizabeth Scruth PhD, MPH, RN, CNS, CCNS, CCRN, FCCM, FCNS, CPHQ; Bronwyn Cox, MSN, RN; Vilma Cadiz, MSN, MBA, RN; Vanessa A Martinez, MSN, MHA, RN; Kristine Wilson, RN, MSN, CPHQ; Jacqueline (Jacquie) Buckley, RN MBA, MSN, CCRN-K, CPHQ; Maria Galletto, MSN, RN, CNL, CPHQ**

DOI: <https://doi.org/10.7812/TPP/20.046.12>

**Background:** It is well known that unhealthy work environments contribute to medical errors and ineffective delivery of care. How does

this affect a group of remote nurses monitoring patients through a predictive analytic model? Conflict, stress, and systemic behaviors that obstruct the ability of individuals and organizations to achieve excellence can affect all groups of people. Evidence reveals organizations with inconsistent processes from an unhealthy work environment create barriers in the delivery of safe patient care.

**Methods:** In a group of virtual quality nurse consultants (problem), what is the effect of using evidence-based team strategies and tools (intervention), when compared with no intervention (comparison), to foster a healthy work environment (outcome)? Operationalizing a virtual nursing unit that functions 24/7 from remote locations created challenges for staff to feel engaged in department workflows and decision making. Leadership set goals in 2019 to increase engagement among a group of highly trained and educated nursing staff. Goal attainment was demonstrated by successful year-end evaluations, organizational survey, and results of the American Association of Critical Care Nurses (AACN) Healthy Work Environment (HWE) survey.

**Results:** There are 6 HWE standards: 1) skilled communication: Maintain frequent communication; 2) true collaboration: Involve nurses in making decisions; 3) effective messaging: Consistent use of data-driven, logical decision-making processes; 4) appropriate staffing: Right mix of nurses; 5) meaningful recognition: Formal reward and recognition systems; and 6) authentic leadership: Give nurse leaders the authority to make key decisions. The team completed the AACN HWE survey and the annual People Pulse Survey at Kaiser Permanente. Results showed that the team scored "Excellent" on many of the standards. The nurse leaders examined these results then targeted areas for intentional action. Team members participated in 1 of 4 task forces: Virtual Teams, Policy and Procedures, Education, and Health and Wellness, and presented updates during meetings.

**Discussion:** Awareness of the challenges, recognition of differences, and intentional actions by leaders to provide opportunities for full staff engagement can result in staff feeling a greater sense of fulfillment with work. Incorporating data-driven decision making acknowledges the professional contributions of the virtual nurses to improve patient outcomes. Feeling valued at work can lead to a healthy work-life balance with greater joy. Building meaningful connections among the team offline is the next phase of this team's growth. The development of a Health and Wellness Committee to promote human connection is in progress. Staff members are engaging as team members in community service events.

From: Northern California

### 13. A Novel Hospitalist-run Postdischarge Clinic Leading to Substantial Reductions in Readmission Rates

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DOI: <https://doi.org/10.7812/TPP/20.046.13>

**Background:** Patients discharged from the hospital are at risk for adverse events including clinical decompensation and hospital readmission. "Posthospital syndrome" is a documented phenomenon that negatively affects patient well-being and the financial health of health care institutions. The Bridge Clinic in Richmond, CA, has shown that early follow-up with a hospitalist substantially reduced readmission rates for patients discharged home. In addition, primary care physicians and hospitalists reported Bridge Clinic enhanced their ability to care for recently discharged patients.

**Methods:** Kaiser Permanente (KP) Richmond members who were discharged home were scheduled for a Bridge Clinic visit with a Hospital Medicine physician within 2 to 5 days of discharge. Physicians followed a specific script and performed interventions on the basis of common posthospital complications and symptoms. At the conclusion of this visit, patients were scheduled a subsequent follow-up appointment with their primary care physician. With all other readmission prevention strategies remaining unchanged, the readmission rate was compared between 2017 (limited patients seen in Bridge Clinic) and 2018 (all discharged patients seen in Bridge Clinic). The outcome measured was 30-day readmission rates.

**Results:** In 2017, a subset of discharged patients was referred to Bridge Clinic. The 2017 referral guidelines were based on comorbidities and predicted readmission risk. In 2018, the program expanded so that all patients discharged home from KP Richmond were booked a Bridge Clinic visit scheduled within 2-5 days of leaving the hospital. The number of patients cared for in Bridge Clinic increased by 57% in 2018. With all other readmission reductions strategies remaining unchanged, there was a resultant 25% reduction in readmission rate (16.9% to 12.6%) when comparing 2017 with 2018.

**Discussion:** Hospitalized patients have become an older, sicker population at increasing risk for readmission. Hospitalists are uniquely skilled at managing acute disease trajectory and recognizing early signs of decompensation even after patients are discharged. The Bridge Clinic in Richmond, CA is a novel hospitalist-run

postdischarge clinic that has shown substantial benefit in preventing hospital readmissions. Limitations are a small sample size and retrospective data review. Expanding Bridge Clinic to KP Oakland in a step-wise manner would allow for randomized, prospective analysis of the effects of this intervention. This larger cohort would also facilitate subgroup assessment to identify specific target populations.

From Northern California, Northwest, Southern California, Program Offices

### 14. Implementing a Digital Mental Health Ecosystem—Getting to Scale

Trina Histon, PHD, Han-Chun Liang, MD, FACHE, Tina S Han, Scott Heisler, RN, MBA

DOI: <https://doi.org/10.7812/TPP/20.046.14>

**Background:** Develop a digital ecosystem to meet the needs of the 20% to 25% of our members who present to specialty mental health with subclinical levels of depression and anxiety to increase capacity in specialty mental health for patients with higher acuity. As the project evolved, clinicians recognized the desirability and appropriateness of leveraging the new solutions for both patients with subclinical levels and as an adjunct to care for patients along the care continuum.

**Methods:** Members were supported in the area of mild to moderate acuity for depression and anxiety in several care pathways in specialty behavioral health. Providing digital mental health tools to support members as part of care path or self-care using cognitive behavioral therapy and mindfulness meditation. Tools and training for clinicians were provided to refer new content and digital health care tools across a variety of clinical pathways. We measured engagement, referral rate, pre- and post-Patient Health Questionnaire-9 depression scores to determine response, remission and member and practitioner satisfaction.

**Results:** Early signals show higher than industry standard member engagement in applications for initial and long-term engagement and high rates of referral from trained clinicians. Members appreciate having more options. The ecosystem has a 79% of trained clinicians referring to digital tools and pre- and postresponse and remission for cognitive behavioral therapy tools track to published literature. Qualitative data collection from clinicians and members is ongoing and member feedback reflects how the digital tools are supporting their healing. "My sleep has gone from 3 to 8 hours a night, and my blood pressure has gone down. It gives you a little bit of control over your situation, and

it empowers you." "I am continually surprised at the number of patients [who], when given a choice, choose an app I prescribe for support over specialty mental health and show significant reduction of symptoms."

**Discussion:** Acceptance of these digital mental health tools is high among the 300 referring clinicians and 8000 members referred (per 61% referral rate and 40% engagement rate as of October 2019). Training clinicians to leverage these tools is key to success. Making the referral process easy is key to referral via proactive office encounter or Kaiser Permanente HealthConnect. The tools are a standard of care and support concretizing the homework therapists give members between sessions. These tools are showing early signs of benefit for care along the continuum.

From Northwest

### 15. Multidisciplinary Patient-Centered Support of Opioid Tapering

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DOI: <https://doi.org/10.7812/TPP/20.046.15>

**Background:** Facing a nationwide opioid crisis and a lack of evidence to show what type of intervention is most effective for supporting patients during an opioid taper, primary care physicians (PCPs) are faced with limited time and resources to support patients through this complex process. Kaiser Permanente Northwest's (KPNW's) innovative approach—the multidisciplinary opioid support team—has provided evidence of a successful method for the following: Opioid dose reduction, affordability, improvements in patient safety, function, and pain control; and an increase in clinician satisfaction.

**Methods:** We included patients prescribed opioids for chronic pain (exclusions: Cancer, hospice, palliative care). The team (clinician lead, social worker, pain management pharmacists) provides chronic pain education to PCPs and supports patients with individualized tapering/pain management. Before 2010, primary care opioid tapers either didn't occur or ceased because of inadequate support. In 2009 ("preteam"), KPNW spent \$1.6 million/mo on opioids, and the average daily MME (morphine milligram equivalent) was 96.8. By December 2018, the cost had decreased to \$300K/mo, and the average MME was 36.6.

Team support led to reduced opioid use, improved patient safety, and clinician job satisfaction.

**Results:** Our team's educational and support campaign has experienced overwhelming success, including: More than \$19 million in cost savings with decreased opioid utilization from 2010 to 2018, 94% decrease in the number of patients with MME > 300 and 77% decrease in the number of patients with MME > 90. From 11/2013 to 12/2018, 46% decrease in the number of patients with chronic concurrent benzodiazepine and/or opioid use. From 2014 to 2017, 53% of patient respondents stated that they could participate in more activities important to them; 80% rated their pain as improved or unchanged as a result of the taper (February 2013 to February 2015 survey data). Of participating clinicians, 96% agreed that the training sessions changed how they managed patients with chronic pain (February 2011 survey data).

**Discussion:** The success of the KPNW multidisciplinary opioid support team provides evidence of the profound impact that providing more support to PCPs to manage opioid changes can have—a strategy that led to reduced opioid use while also improving patients' quality of life. This program shines a light on the need to expand resources for nonpharmacologic pain treatment options that help improve a patient's function and reduce reliance on pharmacology. The team is a highly adaptable resource able to meet evolving opioid-related safety needs (eg, reducing concurrent opioid and benzodiazepine use) and provides PCPs and patients with valued support.

*From Colorado, Georgia, Hawaii, Northern California, Northwest, Southern California, Program Offices*

## 16. Chronic Kidney Disease Moonshot: Interregional Nephrology Chronic Kidney Disease Management Program to Delay Progression to End-Stage Renal Disease

Sijie Zheng, MD, PhD, FASN; Mark Rutkowski, MD; Alvina Sundang, MBA

DOI: <https://doi.org/10.7812/TPP/20.046.16>

**Background:** Chronic Kidney Disease (CKD) affects 14% of US population and 440,000 members across Kaiser Permanente (KP). Approximately 4000 members start dialysis annually. KP currently has approximately 15,000 members on dialysis. Progression along the CKD stages, patient mortality, and hospitalization rate increase dramatically, especially in patients with poorly controlled diabetes, hypertension, and poor

adherence with laboratory tests and medications. Although nephrologists are managing late stage CKD (stage 4 and ESRD) members with high comorbidities, a vast majority of early stages of CKD (stage 1-3) are mainly managed by primary care physicians. Therefore, care coordination is critical to delay the progression of CKD.

**Methods:** In 2018, the KP interregional nephrology group initiated a 10-year "CKD Moonshot" program with 2 goals: 1) decrease the adjusted rate of chronic glomerular filtration rate (GFR) < 30 (or end-stage renal disease [ESRD]) per 100,000 members, and 2) reduce the adjusted mortality for CKD from 3 to 5 members. The goal is for each Region to implement methods in slowing CKD progression. In collaboration with primary care physicians, each Region's Nephrology Department developed tools, including educating primary care physicians in early CKD management, using of electronic health record to monitor the percentage of patients who have albuminuria measured, angiotensin converting enzyme inhibitors and angiotensin receptor blockers (ACE-I/ARB) utilization, and using risk-prediction modeling and others to help delay progression of CKD.

**Results:** Preliminary, across all KP Regions, the age-, sex-, and race-adjusted CKD progression to GFR < 30 or ESRD decreased from 80 per 100,000 members to 59 per 100,000 members from the second quarter of 2018 to the first quarter of 2019.

**Discussion:** Setting up an ambitious goal at KP nationally and monitoring each Region locally, using the KP advanced electronic medical record system, focusing on ensuring CKD members have creatinine and urine protein measured, and monitoring ACE-I/ARB usage can lead to improvements in decreasing progression of late stage CKD (stages 4-5) or ESRD.

*From Northern California*

## 17. Way Ahead of the Curve: Leading the Nation in Increasing the Rate of Peritoneal Dialysis

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DOI: <https://doi.org/10.7812/TPP/20.046.17>

**Background:** Chronic kidney disease (CKD) is a major public health problem affecting approximately 14% of the US adult population. There are 444,000 members who meet criteria for CKD across Kaiser Permanente (KP). In 2018, approximately 4000 members initiated dialysis across the program nationally, with approximately 25% of those starts involving peritoneal dialysis (PD). This is in stark contrast to national US Renal

Data System (USRDS) data where < 10% of end-stage renal disease (ESRD) patients start renal replacement therapy with PD. Given known and potential advantages of PD over hemodialysis, the KP Northern California (KPNC) Region started a program to expand peritoneal dialysis in 2008.

**Methods:** Between 2008 and 2017, KPNC implemented a systemwide, patient-centered approach to increase peritoneal dialysis use. This included: 1) member and caregiver education, 2) physician education and support tools, 3) system-level improvements to streamline processes, and 4) regular monitoring and continuous quality improvement programs. We compared 90-day and 1-year mortality and hospitalization for any cause among high-dimensional propensity score-matched adults initiating PD or hemodialysis.

**Results:** Among 13,500 eligible KPNC members in the study population (7840 men [58.1%] and 5660 women [41.9%]; mean [standard deviation] age, 64.3 [14.4] years), initiation of PD increased from 15.2% of all new dialysis members in 2008 to 33.8% in 2018, which was substantially higher than national trends (6.1% in 2008 and 9.7% in 2016). Among the 2974 members who initiated PD from 2008 to 2017, 2387 (80.3%) continued PD at 1 year after initiation, with a significant increase in age-, sex-, and race-standardized rates from 2008 (69.1%) to 2017 (84.2%). Age-, sex-, and race-standardized 1-year mortality for patients receiving PD and hemodialysis did not change substantially across this 10-year period (17.3% to 15.5% for hemodialysis,  $p = 0.89$  for trend; and 5.5% to 7.3% for PD,  $p = 0.12$  for trend).

**Discussion:** Large-scale expansion of peritoneal dialysis is feasible and safe when using an integrated, coordinated care approach as in KPNC. There is an opportunity for Permanente Medicine programs to adopt the successful practices developed in KPNC and improve outcomes for members with advanced kidney disease requiring dialysis.

*From Mid-Atlantic States*

## 18. Mid-Atlantic States Hospital Patient Day Rate Reduction for Extended Length of Stay Patients

Claire Pagano, MHA; Pam Galley; Farzaneh Sabi, MD; Jean Langley, RN; Tracye Brewer, LCSW-C

DOI: <https://doi.org/10.7812/TPP/20.046.18>

**Background:** In December 2018, the Kaiser Permanente (KP) Mid-Atlantic States (KPMAS) implemented an Extended Length of Stay (ELOS) Program, which was based on the KP Northern California model, with a regional team to track

long length of stay for patients in a medical or surgical bed type. The program was initially designed with a focus on members with at least a 30-day length of stay, but quickly expanded to include members with inpatient stays of 20 days or longer and complex case management to prevent unwarranted hospital stays.

**Methods:** The KPMAS ELOS team reduced length of stay for patients with complex cases by employing 2 primary tactics: 1) prospective identification of patients who meet length of stay criteria, and 2) socialization of the team as a resource through the hospital-based Patient Care Coordinators (PCCs). The former was accomplished by monitoring authorizations in a spreadsheet workbook; the latter was accomplished by increased awareness of the team as a referral-based resource. Increasingly, complex case calls and family meetings were arranged—often at least 7 to 8 calls or meetings per week—to resolve social and medical issues with a multidisciplinary team.

**Results:** Since the ELOS program's inception, a paired *t*-test was used to validate a decline in ELOS patients by 2.25 average daily census postintervention (95% confidence interval,  $p < 0.001$ ). This translates to 821 inpatient days annually across 490 patients. Additionally, more than 300 patients not meeting ELOS criteria were evaluated by the team during complex calls. Notably, as the competencies of the ELOS team became better socialized, the team's interventions scaled to patients who, although not meeting length-of-stay criteria, had known social barriers to discharge that would result in extended hospital stays. This is important from an analytical perspective because these interventions would not be captured in a targeted analysis of patients with a length of stay greater than 20 days but would have an impact on the population's length of stay.

**Discussion:** Given the early signs of success with the ELOS Program, KPMAS intends to expand the scope beyond members in medical and surgical bed types and include neonatal intensive care unit, pediatrics, and intensive care unit. Participants on the ELOS multidisciplinary case calls and meetings have grown to include legal, pharmacy, ambulatory case management, palliative care, subspecialty physicians, and behavioral health. Additional tools for social support will become available as KPMAS operationalizes community-based resources through the Thrive Local and Healthy Planet initiatives. As KPMAS has more historical data in the postintervention period, research to control for seasonality and membership mix will further the understanding of the ELOS initiative's efficacy.

*From Southern California*

## 19. Transitional Care Center: A Center for Medical and Nonmedical Excellence

Nkem Chukwumerije, MD, MPH;  
Parnika Kodali, MHA

DOI: <https://doi.org/10.7812/TPP/20.046.19>

**Background:** In 2016, at the Panorama City Medical Center, only 75% high-risk patients were receiving posthospital, follow-up care. Given that 24% of our high-risk patients are readmitted, it is fair to assume that no follow up results in higher utilization. For those that did receive follow-up care, it varied depending on the physician. Of more than 1000 Kaiser Permanente members screened Southern California, 78% stated they have an unmet social need. One percent of our members incur 23% of our health care spending in Southern California. A significant percentage of Emergency Department and hospital utilization is caused by unaddressed psychosocial needs of our members. Most posthospitalization appointments with a primary care physician (PCP) focus on medical needs only.

**Methods:** We included high-risk members with complex needs when discharged from the hospital (criteria: Length of stay, comorbidities, ED visits, acuity). We created a 40-minute medical assessment by a physician, a pharmacist led medication reconciliation, a social worker to assess social and behavioral needs, a care navigator to secure resources, and a care coordinator to manage the care plan for up to 90 days. A single-centered retrospective study was used to evaluate pre- and postutilization of high-risk patients who were treated in the Transitional Care Center (TCC) and compared with a similar control group who received care with a PCP. The demographics of both groups were evaluated to ensure similar representation. There was decreased inpatient, Emergency Department, and urgent care utilization for high-risk patients.

**Results:** The results showed a 55% decrease in utilization for the TCC patients compared with the control group yielding in approximately \$2,145,099 in cost avoidance. In addition, one to one patient time with pharmacist showed a projected cost savings of \$385,000. Of 140 members surveyed, 100% were satisfied in the care they received and felt they had the support they needed.

**Discussion:** Connecting patients and families with appropriate resources and supporting them will increase the quality of care and patient adherence to the care plans, which in turn decreases utilization. Limitation for the program include

funding, scalability, and faster spread. Next steps include identifying more patients from other services such as Emergency Department, skilled nursing facilities, and primary care that can benefit from the TCC program

*From Colorado, Georgia, Hawaii, Mid-Atlantic States, Northern California, Northwest, Southern California, Program Offices*

## 20. The Impact of Unit-Based Teams' Engagement with Employee Well-being: Findings from Kaiser Permanente's 2019 C Everett Koop Award Application

Ben Simons, MA; Leslie Pole, MA; Nicole VanderHorst, MA; Kelli Woods; Michelle Mancuso, MPH; Karen Stoeffler, MPH; Maria Dee; Kathy Gerwig, MBA; Dave Schweppe, MPH, CPHIMS

DOI: <https://doi.org/10.7812/TPP/20.046.20>

**Background:** Kaiser Permanente (KP) launched its national workforce wellness program in 2010 with the goal of creating the healthiest workforce in the health care industry. The unit-based teams (UBT) Health and Safety Champion program launched at the end of 2015, as a primary initiative to address the organization's employee well-being priorities. The program consists of a network of more than 3300 champions who embed health and well-being into the workplace and day-to-day work activities of our employee population.

**Methods:** There are 132,000 union-represented employees who are members of a UBT, along with 20,000 managers and 22,000 physicians. More than 90% of UBTs have Health and Safety Champions, who bring well-being messaging and education to their peers and initiate team well-being projects. Our analyses examined health and business performance outcomes for employees in UBTs who successfully completed well-being projects during a specified time frame vs those in UBTs who did not complete a well-being project. The outcome measures examined included absenteeism rates, workplace injury rates, Culture of Health Index results, blood glucose test results, and financial outcomes.

**Results:** The population of employees in UBTs who successfully completed well-being projects exhibited lower average sick day rates, better blood glucose test results, and higher culture-of-health scores than the population that did not. Specifically, employees on teams that successfully completed well-being projects had approximately 1 less sick day per employee per year during the 3-year period of 2016 to 2018. These lower absenteeism rates translate to

beneficial financial outcomes for KP. UBTs with a project that met its target also had significantly higher culture-of-health scores than those with no project and those with a project that did not meet the target. And employees on teams that successfully completed projects showed consistently favorable normal, diabetic, and combined prediabetic or diabetic test results.

**Discussion:** Aside from engagement with well-being, the study and comparison populations we examined are similar in terms of workforce and demographic characteristics. Though self-selection bias may have influenced the outcomes we observe for the study population, there is likely a high degree of variation across all teams and individuals that make up the study population. Therefore, there is compelling evidence that the demonstrated results could be attributable to participation in well-being efforts at KP. These results support a continuation and possibly strengthening of the UBT employee well-being initiatives at KP.

*From Southern California*

## 21. Diagnostic Excellence—Getting it Right at the Right Time: Building Cultural Awareness

Ronald Loo, MD; Nancy Gin, MD; Michael Kanter, MD; Mimi Hugh, MA, MPH; Maricruz Arteaga-Garavito

DOI: <https://doi.org/10.7812/TPP/20.046.21>

**Background:** As highlighted by the Institute of Medicine in 2 key publications (To Err is Human in 1999, Improving Diagnosis in Healthcare in 2015), diagnosis is among the most critical and complex challenges clinicians face every day, and diagnostic errors are a significant patient safety concern. Misdiagnosis not only takes a toll on patients and their families, but also on health care practitioners, and their colleagues. Raising awareness of the breadth of the problem, explaining common ways errors are made, and reminding practitioners of solutions and resources to mitigate errors are steps toward diagnostic excellence.

**Methods:** An educational video for clinicians was successfully developed to raise awareness of the factors that lead to diagnostic errors and how to achieve diagnostic excellence. The research-based content was developed with input from internal subject matter experts and leaders, including patient advisors, to convey key messages and strategies that include: Explanation on how and why diagnostic errors are made, how to avoid making diagnostic errors, how to improve decision making by engaging and collaborating with patients and teammates, how to document

differential diagnoses, and outlined the available resources and systems that support clinicians and patients in assuring diagnoses that are timely, accurate, and communicated efficiently.

**Results:** The video is a requirement for all Southern California Permanente Medical Group physicians, and participation is monitored through knowledge checks. Viewers' feedback is gathered for continuous improvement. In addition, physicians can obtain continued medical education and maintenance of certification on completion. The material presented is beneficial to diverse health care practitioners, and the scope can be expanded to incorporate viewers from outside the Southern California Permanente Medical Group. The value of having leaders involved in the video demonstrates organizational commitment, and including patients and clinicians aligns the shared purpose of diagnostic excellence with our key stakeholders' perspectives and expertise. This enduring material is part of a larger strategy to achieve diagnostic excellence. Other initiatives that complement this work include guides to enhance patients-clinician partnering and diagnostic clinical reasoning support systems.

**Discussion:** The video was launched to raise awareness regarding the factors that lead to diagnostic errors and how to achieve diagnostic excellence; broader distribution of the materials is being prepared. The learning objectives are: 1) understand how and why diagnostic errors occur; 2) identify what can be done to avoid diagnostic errors and improve the decision-making process; 3) demonstrate the value of engaging and collaborating with patients and teammates; 4) show the importance of documenting a differential diagnosis; and 5) share available resources and systems that support clinicians and patients in assuring diagnoses are timely, accurate and communicated efficiently.

*From Southern California*

## 22. A Multidisciplinary Perioperative Optimization Program for High Risk Elderly Patients improves Surgical Quality and Utilization Outcomes

Letitia T. Bridges, MD, MBA Jonathan Lipana, MD Terri Williams, RN

DOI: <https://doi.org/10.7812/TPP/20.046.22>

**Background:** High acuity elders undergoing high-risk procedures are the primary drivers of inpatient utilization. Additionally, these patients disproportionately experience perioperative complications including higher than baseline

lengths of stay, postoperative intensive care days, escalations of care, in-hospital delirium, falls, loss of functional status, postdischarge returns to care, all-cause readmission rates, and perioperative mortality. Consistent implementation of current standards of care around geriatric procedural care have been shown to substantially mitigate the impact of operative care for these vulnerable members.

**Methods:** Approximately 25% of our perioperative members drive 49% of our perioperative utilization and cost. The perioperative optimization team interventions include the creation of a multidisciplinary team, development of cross functional standardization in preoperative medical and functional assessment practices, delivery of nonmedical assessment and intervention, virtual medical review by an anesthesiology practitioner, robust education and caregiver preparedness training, a consistent care navigation function, a documented goals of treatment conversation, refinement of multidisciplinary workflows to ensure operational alignment and the creation of weekly multidisciplinary reviews. All data are collected, analyzed, and reported bimonthly.

**Results:** The Perioperative Optimization Program (POP) was implemented in Southern California in 2015. Since its inception, more than 1700 high-risk elderly patients undergoing high-risk operative procedures have completed the program. Data suggests that patients are being consistently identified and referred for intensive intervention. The program has generated 1) a 33% reduction in surgical patient day rate (PDR), 2) a 38% reduction in hospital readmissions, 3) a 37% reduction in post discharge Emergency Department visits, 4) a 17% reduction in post-hospital skilled nursing facility utilization, and 5) a 25% decrease in perioperative access demand for adult primary care. Additionally, nonbeneficial treatment conversations have diverted 21 patients from unnecessary operative intervention during the last year. The annualized cost savings for these interventions is approximate 2 million dollars. Patient and caregiver feedback has been positive regarding the effectiveness, the consistency, and the accessibility of the care.

**Discussion:** The Perioperative Optimization Program has successfully demonstrated that an evidence-informed, coordinated, perioperative experience for high-risk elders undergoing high-risk procedures can deliver improvement across all 6 domains of quality. Simultaneously in Southern California, the POP+ Program, developed to address specific high-risk patients undergoing high-risk surgery, drives affordability in this patient demographic. Given these consistent results, this model of perioperative care for high-

acuity patients could be implemented within all perioperative evaluation programs.

*From Southern California*

### 23. Healthy Balance: Impact and Lessons Learned from an Evidence-Based Weight Management and Diabetes Prevention Program

**Sean Hashmi, MD; Jimmy Wannares, MPH; Danielle Altman, MA; Guangxi Zheng; Anna Marie Salvador, MPH; Chris Rapp, MHA; Faith Ruperto-Ramirez; Denice Waters**

DOI: <https://doi.org/10.7812/TPP/20.046.23>

**Background:** Kaiser Permanente Southern California (KPSC) has 4.6 million members and an obesity prevalence of 37%. Obesity is a leading cause of preventable death and is associated with type 2 diabetes and hypertension. KPSC's Healthy Balance is a Centers for Disease Control and Prevention (CDC) recognized 12-month weight management and diabetes prevention program. More than 160 staff received curriculum, motivational interviewing, and documentation training to facilitate more than 200 tracks in English and Spanish in 52 locations to provide services to more than 40,000 KPSC members since 2017.

**Methods:** Healthy Balance is delivered through 16 in-person, group-based sessions and 6 phone-based coaching sessions. We included KPSC members who initiated Healthy Balance and had the opportunity to participate for 12 months between 2/28/18 and 8/31/19 and who met the following CDC Diabetes Prevention Recognition Program (DPRP) eligibility criteria: age older than 18 years, nonpregnant, clinically overweight, a prediabetes diagnosis, and no prior type 1 or 2 diabetes diagnosis ( $n = 2546$ ). Attendance, physical activity minutes, and body weight were documented at each session. The primary outcome based on comparing first and last weight measurements collected was average weight loss of starting body weight.

**Results:** Of the 2546 DPRP eligible members, 10% ( $n = 255$ ) met DPRP evaluation criteria (attended at least 3 sessions during months 1-6 and spent at least 9 months in the program). Among the group of members who met DPRP evaluation criteria, we found the following: 88.6% attended at least 9 in-person sessions in months 1-6; 78.4% attended at least 3 sessions in months 7-12; physical activity minutes were documented in 84% of sessions attended; body weight was documented in 98.3% of sessions attended; and the average weight loss achieved was 5.8% of starting body weight. Overall, session atten-

dance was high, participants remained engaged throughout the 12-month period, and average weight loss was clinically significant.

**Discussion:** Healthy Balance is a successful program for weight reduction and type 2 diabetes prevention. Sustained weight loss of 3% to 5% of body weight can have significant clinical benefits, and weight loss of 5% to 7% can lower the incidence of type 2 diabetes. Major facilitators of program success include: No cost to members, strong evidence base, combination of delivery modalities, motivational interviewing, continuous monitoring of process and outcome measures, and regular collection of feedback from program facilitators and participants. We are working on improving access for vulnerable and hard-to-reach populations, targeting individuals with a higher readiness to change, and enhancing program retention.

*From Northern California*

### 24. The "Perfect Pee" Keeps Young Girls Antibiotic Free

**Poonam Kaushal, MD**

DOI: <https://doi.org/10.7812/TPP/20.046.24>

**Background:** In the Greater Southern Alameda Area (GSAA), 70% of urinary complaints treated with antibiotics did not have positive urine culture in girls between 3-8 years old in 2018. This impacts children and the community by creating unnecessary antibiotic exposure, leading to eventual resistance. This impacts the healthcare system by inappropriately using pharmacy and lab resources.

This work inspired by this realization is important for 3 reasons: 1) it reduces unnecessary antibiotic exposure; 2) it addresses appropriate pharmacy and lab utilization and 3) it reveals root cause of urinary discomfort to parents.

**Methods:** The unnecessary antibiotic use in girls ages 3 to 8 years with urinary complaints is concerning because of the largely underrecognized diagnosis of vulvovaginitis in a majority of the cases. I created a practitioner education program and the "Perfect Pee" handout to be given to parents by practitioners. A medical assistant was provided with a standardized "clean catch urine collection" handout to guide parents. I collected data on the percentage of unnecessary antibiotics prescribed. Data from the GSAA in 2018 revealed 70% of patients who received antibiotics did not have positive urine cultures with the rate at the Fremont clinic being 80% in June 2018. After educational sessions and review with practitioners, unnecessary antibiotic

usage rate dropped to 25% in June 2019. After implementing handouts with patients, the unnecessary antibiotic rate dropped further to 1%.

**Results:** GSAA data in 2018 revealed 70% of patients who received antibiotics did not have a positive urine culture. Data was obtained from the Department of Research from January 2018 to June 2018 for outpatient Pediatric Clinics in Fremont, San Leandro, and Hayward, CA. Specifically, reviewing the data from the Fremont clinic in June 2018, this rate was 80%. After practitioner education and ongoing parent education with use of newly created handouts, the rate has dropped to 1% in 2019.

**Discussion:** The most important learning of this project is that we can apply process improvement practices to affect clinical outcomes. Specifically, this study quantifies the ineffective diagnosis of urinary tract infection in young pediatric females and demonstrates the improvement after education and implementing standardized practices. Antibiotic resistance affects our community at multiple levels, so quantifying ways to help reduce the burden of resistance is compelling. Furthermore, appropriate diagnosis and management of vulvovaginitis has a compelling impact on pharmacy and laboratory utilization.

*From Southern California*

### 25. Beyond the Baby Blues: Improving Psychosocial Screening and Follow up Care for Obstetrics Patients

**Lawrence Lurvey, MD; Lyn Yasumura, MD; Melanie Pitts, MPH; Liza Eshillian Oates, MD**

DOI: <https://doi.org/10.7812/TPP/20.046.25>

**Background:** Psychosocial conditions are common during the prenatal and postpartum periods, with 15% to 30% of patients experiencing at least 1 condition. Research indicates a significant impact of psychosocial conditions on maternal and child health outcomes, including increased incidence of maternal suicide, spontaneous abortion, preterm birth, birth defects, and long-term maternal and child psychological and physiological concerns. Additionally, each of the psychosocial conditions can be a risk factor for the other psychosocial conditions, escalating patient experiences.

**Methods:** The Kaiser Permanente (KP) Southern California team developed a single, evidenced-based screening questionnaire for depression, anxiety, substance use, and intimate partner violence. Screening now occurs once a trimester and postpartum with a proactive office

encounter alert for staff. If a patient screens positive, the practitioner receives a best practice alert to refer the patient to social medicine for further assessment and coordination of appropriate follow-up care. This process is aligned with standards specified by the American College of Obstetricians and Gynecologists and the US Preventive Services Task Force. KP Washington and KP Northern California provided essential information for adoption of best practices.

**Results:** Data are provided for 3 metrics: Percentage of patients screened by trimester, percentage of patients who screened positive, and percentage of patients who screened positive and were seen by social medicine. Before the process change, 50% of patients were screened for depression with a 14% positive rate, and 66% of patients were screened during all trimesters for intimate partner violence with a 2% positive rate. The screened positive rates were well below the expected rates identified in research. Data were not previously collected for substance use. Overall screening increased to 87% in a single month after implementation, with a 19% positivity rate for any of the conditions. The postimplementation data set also provided insights on screening by demographic variables, which the team plans to address next.

**Discussion:** Communication is key to hardwiring improvement. During the development phase, the team involved department representatives, KP HealthConnect, and KP.org stakeholders early in aligning workflows and crafting the program, for a truly multidisciplinary effort. During and postimplementation, the team used a combination of site visits, learning sessions, toolkits, and postimplementation calls and emails to communicate updates to the local teams, determine and fix issues, and drive performance. The team is exploring expanding a similar process to teen patients in pediatrics. As the questionnaire is already built into KPHC and KP.org, simple modifications can be applied to screen additional populations of patients.

*From Southern California*

## 26. Screening and Intervention for Adverse Childhood Experiences (ACEs) at Pediatric Well-Child Visits

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DOI: <https://doi.org/10.7812/TPP/20.046.26>

**Background:** The 1998 Kaiser Permanente Centers for Disease Control and Prevention

Adverse Childhood Experiences (ACEs) Study has revolutionized the understanding of childhood trauma and its long-term health effects. Two-thirds of adults have at least 1 ACE and 12% have 4 or more. Exposure to toxic stress in childhood during crucial periods of brain development leads to disrupted neurodevelopment, emotional and cognitive impairment, and ultimately chronic disease, disability and early death. Pediatricians can be on the frontline of preventing, screening for, and healing toxic stress.

**Methods:** Screening occurs at the 3-, 5-, 10-, and 13-year-old well-child visits. Parents (or 13-year-olds on their own) receive an ACE questionnaire and indicate how many of the questions are true for their child (or themselves if 13) without identifying the specific questions. The children and their families are provided education, resources, and support depending on the number of ACEs identified and the presence or absence of any concerning symptoms. Data collection includes the percentage of patients with an ACE score of 0, 1-3 and 4+. Potential long-term outcome measures include health care utilization, chronic illness and behavioral problems.

**Results:** Since July 16, 2018 we have screened 11,000 children at their 3- and 5-year-old well-child visits and have now included 1475 10-year-olds and 1361 13-year-old well-child visits. This equals 53% of the target population for 3- to 5-year-olds, 37% of 10-year-olds, and 32% of 13-year-olds. Of the 3- to 5-year-olds, 16% (948/5892) had an ACE score 1 or higher, and 6% (58/948) had substantial enough findings to be referred for follow-up. Of the 10-year-olds, 30% (162/546) had an ACE score of 1 or higher, and 4% (6/162) had substantial enough findings to be referred for follow-up. Of the 13-year-olds, 28% (122/432) had an ACEs score 1 or higher, and 11% (13/122) had substantial enough findings to be referred for follow up.

**Discussion:** As an important part of a Whole Child Wellness approach, screening for ACEs can be accomplished within the established framework of our pediatric well-child visits. Extending this project to additional clinics and older age children will increase our data sets and allow us to further evaluate the prevalence of ACEs within our pediatric population. The availability, quality and effectiveness of trauma-informed interventions designed to build resiliency and to heal the effects of toxic stress must also be evaluated through real-time surveying of referred patients as well as short-term and long-term tracking of health outcomes.

*From Hawaii*

## 27. Caring for Hawaii's People Like Family, One Call at a Time

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DOI: <https://doi.org/10.7812/TPP/20.046.27>

**Background:** The Kaiser Permanente Hawaii call center is the front door to members' health care experience. Despite having the same call volumes as 2018, Hawaii members were hanging up 10% more in 2019. In April 2019, in an effort to support each other across islands, agents started cross training to take other island calls. Unfortunately, agents got lost searching for information in each island's separate tools, resulting in 1-minute increased phone call time across the Region.

**Methods:** The call center serves 254,039 members across 5 islands, agents are located on Oahu Island, Maui Island, and the Big Island. Job aides contained slang or ambiguous workflows "because that's the way it's always been." Intervention: Two nurses were assigned to be "always ready" for critical calls; the regional Call Center homepage was redesigned using 6S strategy; online workflows were implemented in intake process and language standardization across islands, reducing acronyms/slang. Comparing reimplementation with postimplementation revealed that reducing steps and time searching increased agent productivity. Efficiency in calls equals the ability to take more calls, which equals fewer calls abandoned.

**Results:** Staff satisfaction increased from neutral to satisfied within 2 months because of ease of tools and change in workspace. The abandon (hang-up) rate decreased by a factor of 4, owing to call center agents' ability to manage and pick up calls faster. Between March 2019 and September 2019, the hang-up rate decreased from 16% to 4%. Time to answer a call decreased from 5.5 minutes to 52 seconds. Average time on call decreased from 3.6 minutes to 3.35 minutes.

**Discussion:** Culture integration is critical in change management. *Kālia i kanu'u—Ha'aha'a*, which means striving to the top (achieve and accomplish) and doing it with humility. Because of Hawaii's size, we are, in the end, servicing our *ohana*: friends, families, neighbors, and the communities we serve. When we care for our members like family, we are living out our mission. Front line engagement from all islands was essential to achieve buy-in, Availability across all islands to attend the same meetings

was challenging. Putting the member's experience first helped resolve disputes. Our Region's call centers will become 1 toll-free number by January 15, 2020.

*From Washington*

## 28. Variations on a Theme: Improving Communication of Safety Information

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DOI: <https://doi.org/10.7812/TPP/20.046.28>

**Background:** The high-reliability model was launched over a decade ago at KPWA. Since that time, the serious safety event rate has decreased significantly. The rate of unusual occurrence reporting, which includes both errors and near misses, has remained stable. Regardless, team members frequently comment that event reviews and investigations are not consistently shared or distributed broadly. Additionally, staff feedback still indicates a level of discomfort in raising safety concerns.

**Methods:** The Kaiser Permanente Washington (KPWA) Patient Safety team piloted the following communication tools in 2019: 1) "huddle cards" reinforcing reliability principles, 2) safety stories using a standard template and incorporating associated safety concepts and tools to be used by the Care Delivery Leadership Team, 3) weekly safety message for senior leaders, 4) monthly safety message included with harm report.

**Results:** Five cases have been provided to the KPWA Care Delivery Leadership Team using the new standard template. Themes alternate monthly between patient safety and workplace safety. Five "huddle cards" have been developed for with a focus on speaking up for safety. Safety messages have been included in the weekly updates for senior leaders since January 2019 (n = 42). Themes include: 1) 1 to 3 unusual occurrences from the previous week and their link to a reliability tool, 2) overdue unusual occurrence reviews and how they impede safety improvement, 3) unusual occurrences that may be associated with a community or national safety alert, and 4) delays in care. Harm report message themes have included: 1) job aids for safety reporting, 2) links to safety training, and 3) focus on red rules (ie, rules that cannot be broken).

**Discussion:** Direct feedback from managers and leaders indicates that the communication tools are being used. Next steps will include: 1) development of quarterly surveys of frontline staff members to determine whether they have

received the information from their managers, 2) measurement of utilization of message links, and 3) exploring ways to use the rounding tool to assess staff knowledge of the standardized messages.

*From Hawaii, Northern California, Southern California, Program Offices*

## 29. Peer Mentors Matter: Patients Supporting Patients through Healthcare Journeys

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DOI: <https://doi.org/10.7812/TPP/20.046.29>

**Background:** For Kaiser Permanente members, support from someone who has successfully managed a similar health care journey can be of significant benefit. For staff and practitioners, health care teams are finding peer support and mentoring a needed and compassionate offering for their patients. The cost is minimal, peer support and mentors find it rewarding, and recipients find it improves their health care journey. This type of support is what patients have been continually requesting.

**Methods:** Evidence shows survival benefit in patients with good social networks, including peer mentor-support programs. Including patients in the design of the program contributes to its relevance and success. A customizable and accompanying framework, models, and accompanying toolkit provide the basis for launching and sustaining programs. Seasoned champions orient participants to the launching and oversight planning guides, templates, and toolkit. The toolkit includes practical tips and information for starting and managing one's own program.

**Results:** An improvement project found that those who had a peer mentor compared with those without a mentor had a: 25% greater reduction in anxiety, a 49% greater understanding of next steps, a 126% greater feeling of confidence in shared decision making, and a 47% greater feeling of support. Those without a mentor were the only ones to mention needing more proactive communication or emotional support. Anecdotal evidence from the Kaiser Permanente's Oakland Breast Care Center notes clinical staff benefit from mentoring given to anxious patients. They report a reduction in the number of anxiety-driven calls and emails. Additionally, they report patients with peer mentors come better prepared to clinic visits

with well-thought out questions or concerns. During this pilot program there were no patient safety incidents reported by patients or peers.

**Discussion:** For Kaiser Permanente any method of delivering peer mentorship must be supported by evidence, its use endorsed by clinical staff, fully compliant, adaptable to the population being served and must seamlessly integrate with personalized care/treatment plans. It must also be conservative in use of resources, including clinical staff time. The peer mentoring model meets those criteria and the member's goals of needing empathetic support, active listening, and the embodiment of hope. Connecting members to one another reduces anxiety and increases trust of the treatment team. This appears to be true regardless of the nature of the healthcare journey.

*From Colorado, Georgia, Hawaii, Mid-Atlantic States, Northern California, Northwest, Southern California, Washington, Program Offices*

## 30. Designing Excellence in Cancer Care

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DOI: <https://doi.org/10.7812/TPP/20.046.30>

**Background:** We see patients during the course of their lifetimes, not just when they receive a cancer diagnosis. This presents a unique opportunity to bring more healthy life years to our members, and to comfort and give confidence to them and their families. Kaiser Permanente (KP) is creating a coordinated, enterprisewide strategy for becoming a global leader in cancer care. National strategies can benefit from collaborating with members and clinicians to test initial direction and integrate a human-centered design approach.

**Methods:** Building on foundational research and stakeholder insights from the Interregional Oncology Chiefs, Research and KP leaders, our team drafted working strategy elements: Point of view, mission, vision, measures, prioritization criteria, and emerging focus areas. We then employed KP's human-centered design methods: co-creation workshops with Patient Advisory Councils and oncology leaders, solution iteration, storytelling, documentary film, video ethnography, and insights development through feedback synthesis. We are currently incorporating feedback and bold ideas from our members, clinicians, and leadership to refine the strategy.

**Results:** The final strategy will be iterated on the basis of member and clinician insights, and their suggested edits and experience stories. We engaged with more than 60 members and 30 clinicians for this stage of work. We found that human-centered design is leading to a more compelling foundation for the strategy. Preliminary findings include: Cocreation as a key business differentiator for KP; a desire for customized, rather than standardized or optimized, treatment and coordination of care; a desire for the most advanced screening approaches; and the importance of compassionate care to overall strategy. Implementation of the final strategy will integrate a broad range of regional and national perspectives in order to improve on measures such as population level morbidity, mortality, and care experience satisfaction.

**Discussion:** Refining and continuing the work with a human-centered design approach sets KP up for success in bold, enterprisewide strategies. We see this approach consistently leading to broader alignment, easier integration of solutions, and long-term reputational benefits with members. Our next steps are to incorporate member and clinician feedback into the strategy, establish the infrastructure and regional alignment to deliver excellent cancer care to our members and families, and continue to be human-centered across all our work.

*From Southern California*

### 31. Home Based Cardiac Rehabilitation (HBCR)—A virtual program to improve members' lives.

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DOI: <https://doi.org/10.7812/TPP/20.046.31>

**Background:** Cardiac rehabilitation has been traditionally underutilized across the US. An October 2015 article in the *Journal of the American Medical Association* found that only 32.6% of patients who were referred to cardiac rehabilitation attended at least 1 session. Obstacles to participation include transportation, financial, and family demands. Participation has been clinically proven to reduce rehospitalizations, decrease secondary events, and lower mortality.

**Methods:** Disease burden related to behavior issues (poor diet, sedentary lifestyle, stress, etc) is significant in the US. The Centers for Disease Control and Prevention reports that nearly \$3 tril-

lion are spent on people with chronic or mental health conditions. The number-one killer referenced is heart disease and stroke with 859,000 Americans dying each year. Our intervention translates the program of cardiac rehabilitation into a digital format. We collaborated with Samsung to design a phone and wearable app. Efficacy in completion rates was proved through a pilot, then scaled to the entire Southern California region in 2018. Our primary methods of measure were physician referrals and completion rates.

**Results:** Since the 13-site launch beginning in 2018, referrals to the home-based program have grown by 118%. We also found the combination of nurse case management and device accountability has produced strong results. Graduation from the program requires completion of at least 6 of 8 visits (intake, telephonic weekly meetings, graduation). Through September 2019, 6865 patients have been referred, 4397 were enrolled, and 3711 have successfully completed the program for a 84% completion rate compared with historical completion rates of 46%. Results of the program were published in the September 2019 edition of the *Journal of Cardiopulmonary Rehabilitation and Prevention* and presented at the American Association of Cardiopulmonary Rehabilitation Annual Meeting (September 2019).

**Discussion:** Several improvements have leveraged existing Kaiser Permanente services since the launch of the program. One was the integration of a Wellness Coaching program through Center for Healthy Living to strengthen behavior change beyond 8 weeks. Further planned improvements include the addition of wireless scales for tracking patient weight, integrated blood pressure management and glucometers. It is important to note that the fully loaded cost of the internal virtual program is less expensive per patient than the average third-party administered program. The Kaiser Permanente Georgia Region has evaluated the program and will be implementing it in early 2020. We anticipate similar extensions into other Kaiser Permanente Regions and applications.

*From Southern California*

### 32. Developing an Acute Care for the Elderly Framework—Becoming an Age-Friendly Health System

**Letitia Bridges, MD; Karineh Moradian, MHA; Shant Bairian, MPA**

DOI: <https://doi.org/10.7812/TPP/20.046.32>

**Background:** Kaiser Permanente health care systems have experienced increases in inpatient

demography, medical and social complexity, and disproportionate harm for elder adults in acute settings of care. There are increased rates of delirium, functional decline, malnutrition, polypharmacy, and a lack of social or financial resources. The literature proposes numerous evidence-based inpatient geriatric care models that have proved very effective. Yet, most only reach a small portion of those who could benefit. Thus, there is an ever-widening gap between what we know is quality care and the care that we deliver in the inpatient setting.

**Methods:** We set out to align care with specific health outcome goals and care preferences, document goals of treatment conversations, create mechanisms to get to know the patient, and create social needs assessments. Goals were to implement judicious use of medications to optimize safety in elder adults, actively to deprescribe of high-risk medications, and to implement age-related dose adjustment. In terms of cognitive processing, we sought to prevent, identify, treat, and manage delirium; to deliver cognitive screening; to create a delirium team; to implement ambulatory referrals for cognitive dysfunction and for depression screening. A primary outcome goal was to ensure that older adults maintain their functional status at admission through practitioner education, electronic medical record mobility documentation, care board to identify walking goals, and family education.

**Results:** The Acute Care for the Elderly (ACE) framework was implemented in Southern California in 2015. Since its inception, the leadership team has created an ACE unit and disseminated the ACE principles across the inpatient setting of care. The program has generated 1) a percentage decrease in delirium, 2) a percentage decrease in 85+ patient day rate, 3) an increase in safety-related pharmaceutical interventions, 4) an improvement in the hospitalwide mobility metric for the inpatient population age 65 years and older, 5) an increase in "what matters" conversations at critical decision-making points, 6) member satisfaction surveys, 7) process measures, and 8) decrease in skilled nursing facility utilization.

**Discussion:** Hospitalwide ACE initiatives are an important first step toward building an age-friendly health care system. Physician, nursing, pharmacy and administrative leadership engagement from the inception of the initiative has been the key to the success of our journey. Communication and collaboration around the 4Ms (mentation, medication, mobility, and what matters) across the continuum of care was the catalyst in driving our team toward providing an exceptional care aligned with age-friendly hospital system principles.

*From Northern California*

### 33. My Medications Matter: Improving patient experience through evidence-based communication to educate patients on new medications

**Heather Brown, PT; Mary Linda Rivera, RN; Ashu Goyal, MD; Barbara Hounslow; Megan Mira, MSN, CNL, RN; Doug O'Brien, PharmD; Julia Loughlin; Stephanie Muci, MBA, MPH; Sarah Lahidji, MHA**

DOI: <https://doi.org/10.7812/TPP/20.046.33>

**Background:** Communicating with our patients about their medications is a critical part of patient safety and experience. A 2017 gap analysis of our Hospital Consumer Assessment of Healthcare Providers and Systems survey data revealed that Kaiser Permanente (KP) Northern California (KPNC) was performing at 1-star for the side effects question, which makes up half of the Medication Communication Composite score and motivated an interdisciplinary team of Kaiser Foundation Health Plan and Hospital and The Permanente Medical Group members to work toward improved medication communication. The team leveraged insights from KP Southern California and Program Office partners to design the program.

**Methods:** The program targeted patients in adult services and maternal and child health in KPNC hospitals to drive an improved experience for communication regarding newly prescribed medications, focusing on the medication's purpose and potential side effects. The program includes: Developing multidisciplinary oversight teams; training frontline care team members (physicians, physician assistants, nurses, and pharmacists) in using the evidence-based communication practices (Ask 3 Teach 3, teach-back, and the use of the words possible side effects); a playbook to guide to implementation and spread; and a standardized medication handout as a supplemental visual aid for our patients to better understand their newly prescribed medications.

**Results:** The My Medications Matter (MMM) program was developed and initiated in 2017 and has been implemented in all 21 hospitals in KPNC as of 2019. Overall, there has been a 1.2 increase (in the Medication Communication Composite score) for 2019 performance year end (PYE) which is the largest HCAHPS composite gain to date in the Region. For PYE 2019, there were 4 facilities that experienced a star increase over baseline; resulting in the Region meeting its target (78.4 linear mean points, 3 Stars). KP's Sacramento Medical Center experienced the greatest increase with a 3.3 linear mean point improvement in the Medication Communication

Composite. Further analysis of the overall Medication Communication Composite reveals that the question focusing on explaining side effects has improved by 2.0 linear mean points for PYE 2019.

**Discussion:** The foundational principles of MMM include: A multidisciplinary team approach, the use of evidence-based communication practices, and the development and use of the medication handout. By ensuring the successful implementation of these principles, MMM has resulted in an improved experience for our patients during their hospitalization, as evidenced by the largest HCAHPS composite gain to date in KPNC. The strength of our Kaiser Foundation Health Plan and Hospitals and The Permanente Medical Group partnership is enabling us to expand the program to other specialty units and home health in KPNC. The foundational principles can be adopted to support other patient experience initiatives and to spread across Regions.

*From Colorado, Georgia, Hawaii, Mid-Atlantic States, Northern California, Northwest, Southern California, Washington, Program Offices*

### 34. Better Together: Performance Improvement and Human-Centered Design—Creative Problem Solving for Health Impact

**Scott Heisler MBA, RN; Jeffrey K Hall, MFA; Jennifer Cunha, MBA; Jenn Cheung, MPH**

DOI: <https://doi.org/10.7812/TPP/20.046.34>

**Background:** Health care is going through a tectonic shift with new players, such as Amazon, com, bringing disruptive new ideas into the industry. Health systems must evolve, and our employees must be equipped with effective and creative problem-solving techniques and approaches. In partnership since 2016, the Kaiser Permanente (KP) Improvement Institute and the KP-Care Management Institute's Design Consultancy collaborated to combine performance improvement and human-centered design to enable KP employees to develop the interdisciplinary and member-centered creative problem-solving skills necessary in today's health care ecosystem to innovate and operationalize meaningful customer-centered outcomes.

**Methods:** Across multiple industries, performance improvement and human-centered design are key strategic capabilities because member and customer experience are crucial to the success of transforming organizations. These capabilities are especially important in health care because it is an industry in which the patient, family, staff, and clinician voice is critical. We have

an opportunity to be even more operationally efficient in our care delivery models and better stewards of health care resources. The KP Improvement Institute is an internal platform with multiple tiers of programs designed to equip KP clinicians and staff with best-in-class knowledge and skills that empower them to deliver on KP's mission to provide high-quality and affordable health care experiences for our members.

**Results:** From 2016-2019, the integration of HCD@KP (human-centered design at KP) programs within the KP Improvement Institute enabled KP to reach more than 6,000 KP employees with the combination of performance improvement and human-centered creative problem-solving capabilities. The results of the HCD@KP program are high on satisfaction from participants, with the average score being 9.2 out of 10. In our 2019 survey of advanced program graduates, 100% (65/65) reported their training is important to their department. In 2019, 87% of participants agreed that they are regionally supported to use their HCD@KP skills; signaling that the spread of HCD@KP across the organization is rapidly becoming a strategic priority.

**Discussion:** Truly delivering person-centered care involves engaging with members and end-users such as clinicians and staff at every stage of our work while simultaneously using best practices to operationalize those insights into meaningful systems change. Combining HCD@KP and performance improvement together is a critical problem-solving approach that enables us to truly deliver on person-centered care. Individuals and teams within KP must be supported with best-in-class mindsets, methods, and tools. Through the KP Improvement Institute's robust training infrastructure and subject matter expertise, KP can support our staff in learning and applying both approaches to achieve better outcomes.

*From Colorado, Georgia, Hawaii, Mid-Atlantic States, Northern California, Northwest, Southern California, Washington, Program Offices*

### 35. High-Quality Outcomes for Transplant Patients: The National Transplant Services Quality Program and Collaboration with Transplant Centers

**Rebecca La Londe, MPH, RN; Geri LiBetti, MSN, FABC; Dana Weisshaar, MD, FACC; Laura O'Neill; Allison Tomimatsu; Ronald Potts, MD**

DOI: <https://doi.org/10.7812/TPP/20.046.35>

**Background:** For high-complexity, low volume, high-cost treatments, such as organ transplant, a

system of interregional collaboration allows for consistency and excellence across Kaiser Permanente (KP). KP's National Transplant Services (NTS) Department uses a Clinical Management Subcommittee model to share knowledge and to leverage combined volume of cases across Regions to lead in the development of best practices. This is a model similar to the one in use for the Emerging Therapeutics Group with many components that could be applicable to other complex populations.

**Methods:** KP's transplant population is composed of more than 20,000 pediatric and adult patients nationally. NTS organizes its interventions and measures around safe, timely, effective, efficient, person-centered, and equitable dimensions of care. We investigate and report safety and risks and member concerns through a real-time quality reporting system that leverages KP transplant coordinator expertise. A data solution that allows "real-time" data via KP Insight is not only a powerful tool for quality analysis, but also meaningful to a practitioner counseling a patient regarding treatment options and outcomes. Center of Excellence outcomes are monitored with publicly reported outcomes as well as real-time assessment as indicated.

**Results:** NTS has established a network of high-performing centers across the country. Included in contracted centers are those centers with higher transplant rates outside of KP service areas, which allow increased access to transplant. KP has achieved better than benchmark outcomes for solid organ and blood and marrow transplant patient and graft survival at 1 and 5 years, and lengths of stay below the national average. Rates of KP members receiving timely referral for diagnoses potentially treatable with transplant, according to evidence-based guidelines, are monitored and reported to regional clinical leaders. Patient guidelines for referral are published in the Clinical Library to facilitate these referrals. Feedback requested from patients via surveys consistently reveals more than 90% are satisfied or highly satisfied with their transplant experience.

**Discussion:** Our members receive care within a transplant network under the direction of a programwide quality oversight committee that ensures selection of high-quality transplant centers, monitors quality measures and patient safety, and facilitates performance and quality improvement activities. Future steps are to identify opportunities to increase organ donation and boost organ procurement organization performance in areas served by KP and to explore opportunities to address variation in transplant center access to care as well as long-term post-transplant management.

#### From Program Offices

### 36. The National Safety Committee, the Odyssey Begins ...

Patrick Courneya, MD; Nancy Gin, MD; Joan Gelrud, MSN, CPHQ; Scott Young, MD, NSC; Jeff Convissar, MD, CPHRM; Julie Vilardi, MS, NP; Kathleen Music MSHA, JD, CPHRM, CPPS, Dot Snow MPH, ;

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**Background:** The lack of a common strategy for safety suggested a need for a consistent infrastructure to support enterprise safety. Prioritization of safety-focused work and competition for funding and resources varies within the Enterprise. Additionally, the expectation of a nimble national group directed the composition of the National Safety Committee (NSC) membership to be representative by discipline not Region. Collaborative relationships as well as effective decision support are an anticipated outcome of the formation of the NSC.

**Methods:** Variability across the enterprise in vision, metrics, and evidence-based safety practices fostered inefficient application of resources and siloed efforts. The NSC launched work groups to address 4 areas: Safety initiatives, safety science education, safety culture, and safety event reporting. Additionally, the NSC endorsed the National Situation Management team as a forum to triage, respond to, and address serious, organizationwide safety situations in a coordinated, multifunctional manner. Assessment of the effectiveness and output of the NSC in its first year was conducted. Number and effectiveness of assessments performed, initiatives supported, educational programs introduced, and amount of increase in appropriate event reporting were measured.

**Results:** Organizationwide safety awareness as measured through an Safety Attitude Questionnaire and People Pulse learning climate index results have been used to drive activity; Team STEPPs (Team Strategies & Tools to Enhance Performance and Patient Safety) trainings; prioritized initiatives on the basis of aggregated data, including examination of diagnostic excellence and perinatal safety performance; a project to allow use of a single repository for event data from multiple reporting systems provide recognized improvement outcomes. An unparalleled level of collaboration occurred and transparency and mutual support across the enterprise is evident. We demonstrated that bringing renewed safety focus for Kaiser Permanente's (KP's) 12.3 million members, 220,000 employees, and 22,000 practitioners resulted in increased safety awareness, improved clinical outcomes and experience, and

decreased worker injuries. From the boardroom to the frontline, the drivers of the safety management system inform KP's decisions and actions.

**Discussion:** Learning from the establishment of the NSC informed the launch of the National Medication Committee and will aid in the creation of the 2 remaining KP National Quality Committee subcommittees. Sustaining a system approach to safety throughout KP will require vigilance and commitment from all parties, Regions, and partners. Periodic monitoring of the enterprise safety culture will be imperative to maintain and improve a psychologically safe environment in which to give and receive health care. Gaining increased perspective and addressing the human factor and system causes of errors and injuries is the planned goal of the NSC.

#### From Northwest

### 37. Deprescribing Tools and Processes to Assist with Performance on Polypharmacy Measures

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DOI: <https://doi.org/10.7812/TPP/20.046.37>

**Background:** The Centers for Medicare and Medicaid Services (CMS) began reporting 2 pharmacy quality alliance (PQA) polypharmacy measures in patient safety reports for the 2018 measurement year: Use of Multiple Anticholinergic Medications in Older Adults and Use of Multiple CNS-Active Medications in Older Adults. These 2 measures are thought to be replacements for the Use of High-Risk Medications (HRM) in the Elderly measure scheduled to retire for the 2021 rating year (2019 measurement year).

**Methods:** The Kaiser Permanente Northwest (KPNW) Region identified 3405 older adults taking tricyclic antidepressants (TCAs). This represented more than 25% of all high-risk medication prescribing, making the medication class a good candidate for deprescribing efforts. Between July 2018 and November 2018, KPNW implemented a multipronged intervention including physician education and enablement, patient education, pharmacist deprescribing, and informatics support. Prescription volumes and measure performance before the third quarter of 2018 were measured. CMS polypharmacy measure performance over time. Initial analysis of TCA prescription volume per member per month (PMPM), quantity PMPM, process outcomes, and patient feedback are used as leading indicators.

**Results:** KPNW observed a 28% decrease in the average number of TCA prescriptions per 1000 Medicare members per month in the 11

months following the intervention compared with the 8 months before the intervention. This decrease persisted after taking approximately 5 months to reach a steady state. Anticholinergic or central nervous system-active medications were successfully discontinued in 57% (122/213) of polypharmacy patients deemed appropriate for pharmacist intervention. The target medication(s) had already been changed or discontinued in 8% (18/213). An additional 6% (12/213) have been triaged to pharmacist specialists for review owing to regimen or disease complexity. Patient satisfaction with pharmacist deprescribing assistance was evident from patient comments including “I have not felt this good for years” and “I have my life back. Before, I was just existing.”

**Discussion:** In the months immediately following the multipronged deprescribing approach, overall Medicare population exposure to 1 of the common classes involved in polypharmacy, TCAs, decreased. Because evidence of a link between TCAs and falls and cognitive decline exists, decreasing exposure is a safety imperative. More than 50% of patients receiving pharmacist deprescribing assistance were successful in discontinuing 1 or more high-risk medications. Initial unsolicited patient feedback indicates improved member satisfaction and quality of life, although more formal evaluation is needed. Further analysis is warranted to better understand each intervention's unique contribution to decreased use so that future interventions may be strategically implemented.

*From Northern California*

### 38. Designated Decision Maker: Making Life Care Planning a Part of Routine Health Care

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**Background:** Most people plan for aspects of life such as finances or retirement, but many may not plan for their health. A key strategy in Kaiser Permanente (KP) Northern California (KPNC) to make planning easier was to implement the practice of collecting whom patients would want to speak on their behalf if they were unable to speak for themselves, known as a designated decision maker (DDM). The practice has been widely adopted contributing to an increased understanding of life care planning (LCP).

**Methods:** In KPNC, our strategy is to assess patients about the DDM/Advance Health Care Directive (AHCD) at every visit. All patients older

than age 55 years visiting their physicians' office are asked to identify a DDM. All hospitalized adult patients also identify a DDM if not previously designated. This information is entered into the electronic medical record so that it is accessible to all members of the care team and hence increases the probability of goal concordant care. The patients are also asked to visit KP online site (KP.org/lifecareplan) or to attend a class to learn how to complete an AHCD.

**Results:** As of November 2019, 60% (more than 716,000) of adults older than age 55 years and 92% of patients older than age 18 years who are admitted to the hospital have identified a DDM or submitted an AHCD. Since January 2019, more than 126,000 members older than age 55 years have a documented DDM or scanned AHCD, so we know who speaks for them when they are unable to speak for themselves. Our hospital and emergency medicine physicians have found this information very useful, especially when a patient is unable to make a health care decisions secondary to confusion or delirium. We are continuously monitoring outcomes and designing workflows to increase AHCD completion, for example, using secure message outreach from personal physicians to members.

**Discussion:** Various surveys have shown that patients would like to have their health care wishes in writing. However, few patients are asked about their wishes and fewer patients have put their wishes in writing. We have educated patients and members of our care team and have used a population-based approach to make LCP a part of routine, normal care. We will continue to use technology solutions, input and work from all members of the care team, the patient voice, performance improvement processes and data to help us elicit members goals and wishes and systematically enter this into the electronic medical record, which will continue to support goal-concordant care.

*From Southern California*

### 39. The aging bundle—a strategic approach to improve wellness, outcomes, and affordability

Sheldon Lewin, LCSW; Hassan Movahedi, MD, PhD

DOI: <https://doi.org/10.7812/TPP/20.046.39>

**Background:** Orange County, CA is home to nearly 3.2 million residents and to 457,031 (14.3%) older adults (ages 65 years and older). By the year 2045, the number of older adults is projected to increase to 17.3%. This popula-

tion will continue to increase at a rapid pace, while all the other age group populations will decrease. Upstream and downstream tactics and strategies can strengthen quality and safety outcomes, improve outcomes of the greater community as a whole, and lead to greater health care affordability.

**Methods:** Addressing social determinants of health, partnering with community resources, and applying an “aging bundle” to hospitalized patients has helped to decrease our patient day rate by 5% since 2017. Our vision is that this continued work will improve patient and family satisfaction, improve other health outcomes, increase the completion rate of advanced directives, and lead to greater independence for our aging population.

**Results:** Since 2017, patient day rate decreased by 5%; discharge rate increased by 10%; and despite increased disease burden, our average length of stay has not increased substantially.

**Discussion:** It is critical to have a strategic analysis for your community on aging to help appropriately direct resources and efforts. An inpatient “aging bundle” applies quality and safety science (multidisciplinary team) to aging patients who are at highest risk of rehospitalization and failure to live independently in the community. Developing relationships with community partners can help provide stabilizing services that are custodial in nature but critical for successful aging. Creating a resource sheet of community benefits and partnerships can be a one-stop shopping resource for care teams, patients, and families.

*From Northern California*

### 40. The Kaiser Permanente Northern California Gastric/Esophageal Program—A New Model of Multidisciplinary Cancer Care Delivery

Yan Li, MD, PhD; I-Yeh Gong, MD; Ellie Chan, MD; Sirisha Karri, MD; Hoa Le, MD; Edmond Schmulbach, MD; Tilak Sundaresan, MD; Swee Teh, MD; Simon Ashiku, MD; Brian Missett, MD; James Morris, MD

DOI: <https://doi.org/10.7812/TPP/20.046.40>

**Background:** Before the institution of this program, management of patients with gastric/esophageal (G/E) cancer was characterized by inconsistencies and occasionally incomplete diagnostic workup, lack of timely referral to all the necessary subspecialties, and inefficient utilization of clinical resources. This formed a barrier to optimal surgical and medical treatment.

**Methods:** Design meetings were held to discuss gaps in the current practice, and a regional multidisciplinary G/E program was developed by a team of medical oncologists, surgeons, gastroenterologists, and radiation oncologists to provide standardized care pathways for all G/E cancer patients in Kaiser Permanente Northern California (KPNC). Diagnostic and treatment guidelines were established by the team, collaborations were formed with the Division of Research and the System X IT team, and KPNC leadership support was sought to endorse the establishment of high-volume specialty surgical centers and the hiring of regional patient care coordinators.

**Results:** All new KPNC cases of G/E cancer are now immediately identified at the time of biopsy by early-use using algorithmic analysis of the pathology database. A regional multidisciplinary team of subject matter experts triages each case early in the care pathway using a consensus diagnostic algorithm. Appropriate cases are referred to a virtual multidisciplinary Regional Case Conference that meets weekly to formulate individualized, evidence-based care plans in a timely manner. Surgical candidates receive treatment at designated high-volume specialty surgical centers, and chemotherapy and/or radiation therapy is administered at local facilities under the guidance of the Regional Case Conference experts. Regional patient care coordinators serve as the primary liaison to the patient, guiding them through the care sequence to ensure timely, coordinated care and an excellent care experience.

**Discussion:** Early outcomes have demonstrated the value of the program. These strategic changes have resulted in exceptional, nation-leading surgical outcomes. All operable gastric cancer patients received standard perioperative chemotherapy followed by D2 lymphadenectomy. This avoided the use of resource intensive and toxic adjuvant chemoradiation therapy. Adherence to a standardized diagnostic laparoscopy has led to the identification of an additional 25% of gastric cancer patients having metastatic disease. This program spared a significant amount of medically unnecessary and morbid surgeries and ensured appropriate patient care. We will collaborate with the Division of Research to analyze the collected data for further program development.

*From Colorado, Georgia, Hawaii, Mid-Atlantic States, Northern California, Northwest, Southern California, Washington, Program Offices*

#### 41. Operational Excellence: Catheter Associated Urinary Tract Infection (CAUTI) Prevention and KP Rounding

#### Illustrate the Journey to Becoming a Highly Reliable Organization

**Kim Horn; Greg Adams; Joan Gelrud, MSN, CPHQ; Ellen Lee; Kathleen Music, MSHA, JD, CPHRM, CPPS; Dot Snow, MPH, CPPS, CPHQ; Celine Gray, MBA; Abigail Mulhern, MHA, RN, CPPS; Dang Nguyen, MPH, MBA, CSP, CIH; Tawny Belleau, RN, BSN, CIC, CPHQ; Jodie Torena**

DOI: <https://doi.org/10.7812/TPP/20.046.41>

**Background:** After years of improvement, workplace and patient safety and care experience performance plateaued across Kaiser Permanente (KP). The journey to becoming an highly reliable organization (HRO) requires commitment to performance improvement and is transformational to the entire ecosystem. Addressing the need for enterprisewide efforts requires acceptance of the critical mandate for safe, high-quality care and experience for patients, the workforce, and practitioners every place, every time. This mindset is essential to becoming an HRO.

**Methods:** Lack of reliable, high-performance inpatient and workplace safety and care experience exposed the need for standard expectation of manager and departmental engagement. Assessment of the current state; focus on improvements for reliability and effectiveness; share and spread of benchmarked best practices and learnings across KP; employment of technology and testing; and shift mindset to an integrated approach disrupting current state of siloed work was addressed. Identification of baseline data and agreement on shared goals across the enterprise; adoption of key practices supported by playbooks, and improvement from baseline on workplace and patient safety and care experience measures are integral parts of the project.

**Results:** Engagement of the regional presidents in sponsoring and driving the work resulted in agreement of methods, assessment of baselines, and unprecedented collaboration across the enterprise to achieve commonality of practices and goals. Catheter Associated Urinary Tract Infection (CAUTI) Prevention and KP Rounding are in different phases of implementation and spread. Learnings, along with results to date, will be shared. Metric improvement is in early stages and requires continued monitoring, adjustments in approach, and course correction as needed.

**Discussion:** Highlights from the Catheter Associated Urinary Tract Infection (CAUTI) Prevention and KP Rounding initiatives will illustrate how an integrated approach to care experience and safety that focuses on building culture, man-

agement systems, and domain-specific practices drive highly reliable and sustained performance. Sustaining operational excellence work includes dedicated monitoring of outcome measures, validating expected behaviors and providing effective coaching for employees, recognizing and reinforcing positive behaviors to improve culture, and external benchmarking for actionable comparison of results.

#### *From Northwest, Southern California* 42. Impact of a Fully Integrated Regional Antibiotic Stewardship Program and Penicillin Allergy Delabeling on Antibiotic Utilization, Clinical Outcomes, and Costs

**Eric Macy, MD, MS; Katie Sharff, MD; Tracy Barton, PharmD; Steve Spindel, MD; Andrew Leitz, MD, PhD; Jodi Longueil, PharmD**

DOI: <https://doi.org/10.7812/TPP/20.046.42>

**Background:** Antibiotic resistance is a growing problem in the US with at least 2 million people infected annually with resistant bacteria. The use of antibiotics is the most important factor leading to antibiotic resistance around the world, and up to 30% of prescribed antibiotics are unnecessary. Improving antibiotic use is a medication and a patient-safety issue.

**Methods:** The fully integrated Kaiser Permanente (KP) Northwest (KPNW) Antibiotic Stewardship Program (ASP) team collaborates for virtual rounding and reviews patients receiving high interest antimicrobials. Feedback is directly provided to clinicians. Blood cultures for the Region are monitored by an infectious disease pharmacist to ensure appropriate treatment. Change is driven by leveraging education and informatics. Penicillin allergy delabeling includes low-risk allergic individuals with history of benign rash more than 1 year previously, somatic symptoms, or unknown history. These patients receive oral amoxicillin 250-mg challenge and 1 hour of observation to rule out clinically significant immunoglobulin E (IgE)-mediated hypersensitivity and 5 days of observation to rule out a delayed-onset T-cell-mediated hypersensitivity.

**Results:** The KPNW integrated team approach to antimicrobial stewardship has the lowest days of therapy per 1000 patient days for broad-spectrum antibiotic utilization and the lowest antibiotic cost per 1000 patient days compared with the other KP Regions from 2017 through 2019. The San Diego Service penicillin allergy tested 1205 adults and children. Of the

399 (33.1%) who underwent skin testing first, 6 (1.5%) were skin test positive. There were 7 (1.8%) skin test negative individuals who had acute positive oral challenge reactions. In the 806 (66.9%) who had a direct oral amoxicillin challenge, 2 (0.2%) had acute positive reactions and 9 (1.1%) had delayed positive reactions. There were 25 (2.1%) confirmed to have an IgE or T-cell-mediated hypersensitivity.

**Discussion:** ASP has been shown to optimize the treatment of infections and reduce adverse events associated with antibiotic use while reducing the potential to develop resistant infections, thus preserving the therapeutic effectiveness of antimicrobials. Accurate allergy information drives optimal antibiotic choice. KPNW's patient-centered ASP model and KP Southern California's penicillin delabeling program are models that could be expanded to other KP Regions to improve stewardship outcomes.

*From Northern California*

### 43. The Enhanced Recovery After Surgery Common Pathway: Fewer Postoperative Complications and Reduced Opioid Exposure Across Northern California

Derrick Lee, MD; Vivian Reyes, MD; Shirley Paulson, DNP, MPA, RN, NEA-BC; Danielle Lerer, MPH; Jessica Galin, MPH; Bryan Philips, MPH; Vincent Liu, MD

DOI: <https://doi.org/10.7812/TPP/20.046.43>

**Background:** One in 4 patients undergoing major surgery will experience a postoperative complication. Of surgical patients, 6% will develop new persistent opioid-use disorder. Enhanced Recovery After Surgery (ERAS) care pathways can reduce the likelihood of a complication, promote faster recovery, and reduce opioid exposure. However, ERAS pathways are generally designed to be procedure-specific, which is resource-intensive to develop individually. Also, once multiple pathways coexist, they can be difficult to implement reliably owing to interpathway variation.

**Methods:** We developed a "common" ERAS pathway that could be applied to all adult inpatient surgeries performed across 10 surgical specialties. Procedures involving a skin incision and anesthesia were included, both elective and urgent. The common pathway interventions include education, shortened fasting, carbohydrate loading, a simplified multimodal analgesia (MMA) protocol, early ambulation, and early nutrition;

and they replaced and/or supplemented the preexisting 6 procedure-specific pathways. The pathway went live across 21 facilities in November 2017 and expanded to include outpatient surgery in November 2018. We performed pre-post and control chart analyses that included: American Society of Surgeons National Surgical Quality Improvement Program (NSQIP) complications, length of stay, and opioid consumption. We also measured adherence process measures.

**Results:** Implementation of the common pathway enabled the rapid expansion of our ERAS program from 30,000 patients/y to 130,000 patients/y in 1 to 2 years. Kaiser Permanente Northern California now provides the benefits of enhanced recovery to approximately 90% of its applicable adult surgical population. Combined adherence to 4 core process measures currently exceeds 70% for elective procedures. Combined rates of postoperative NSQIP complications were reduced by 17% (7.7% preoperative to 6.4% postoperative). This includes a 28% reduction in pneumonia rates (0.84% preoperative to 0.60% postoperative). Length of stay in our ERAS population, which included both inpatient and outpatient procedures, decreased by more than 0.2 days since January 2015. Inpatient opioid consumption rates decreased from 21.8-mg to 8.7-mg IV-morphine equivalents/d during the same period, driven by greater than 70% adoption of MMA.

**Discussion:** This is the first report of a "common" ERAS pathway that can be universally applied across surgical specialties. We were able to quadruple the capacity of our program to more than 130,000 patients/y (90% of our applicable volume) and simultaneously achieve reliable implementation (70% adherence). We also were able to demonstrate a significant reduction in postoperative NSQIP complications as well as a reduction in exposure to postoperative opioids. Patients also required slightly less time in the hospital to recover. A "common" pathway may be the preferred approach to rapidly and reliably expanding an ERAS program.

### *From Colorado, Georgia, Mid-Atlantic States, Northwest, Southern California, Washington* 44. Every Moment Matters: Strength in Standards

Hans Donkersloot, MBA, MSHA, Evelyn Nodal, MPH CPXP, Sara Flores

DOI: <https://doi.org/10.7812/TPP/20.046.44>

**Background:** The American Society for Quality (ASQ), states that "Standards provide organizations with the shared vision, understanding,

procedures, and vocabulary needed to meet the expectations of their stakeholders." Within a person-centered context, it is critical to establish clear standards on what patients and members will experience when interacting with a health care organization. On the basis of the consumer and our member's voices, Kaiser Permanente (KP) has established a set of 9 experience standards that are being used to anchor improvement conversations across multiple Regions.

**Methods:** Historically, KP has deployed standards in various Regions and care settings, but until 2016, there was no common approach or language. Using a variety of sources including patient advisors and established evidence, an initial set of enterprise standards was created, socialized, and deployed across KP for the purpose of better aligning our decisions, actions, and behaviors with what our patients and members value. This common language established a more purposeful approach to experience improvement and a solid grounding in our member's expectations.

**Results:** Reflecting our member's voice and expectations, the standards have been received well across our Regions and by our care delivery teams. Many tools, templates, and videos were created to support deployments that could be aligned with regional resources, priorities, and language. Several Regions created innovative and inspirational sessions where standards were explored in-depth, and plans for implementation were shared. There are several known areas where experience metrics were affected in a positive way. More than 20,000 KP participants have taken the introductory Web-based learning module called "The KP Experience."

**Discussion:** Currently, there have been increasing discussions on what is often referred to as "Bringing the Standards to Life," which is when decisions, actions, and behaviors are informed by the standards as they are integrated into day-to-day operational thinking. Establishing clear standards is foundational, but is only a starting point. Building on a continuous improvement mindset, it is important for KP teams to keep the standards front and center in regular discussions about the experience they are delivering to their members or customers. By including the voice of the member and the customer in these discussions, we can accelerate the identification and adoption of new person-centered behaviors and processes. ♦

Little Stories of Big Moments—  
Stories and poems written by  
clinicians in 15 minutes in writing  
workshops about meaningful  
moments in their work and  
life of practicing medicine. To  
better communicate health care  
experiences, our intention is to  
use graphic images with simple  
clinician or patient stories.  
Professional artists were asked to  
create a visual representation of  
the story.

## “Lifeboat”

Abby Caplin, MD, MA<sup>1, 2, 3</sup>

E-pub: 03/18/2020

Perm J 2020;24:10.048

<https://doi.org/10.7812/TPP/10.048>

Dad ponders family photos  
wondering  
if he ever knew those people  
they look so familiar ...  
a catch in his breath  
as he knows he is missing  
something.

His blue-veined hands  
with inflamed knuckles  
submit to new love Mildred,  
respond to orders  
as she recounts

childhood memories  
clear as yesterday  
through her lungs,  
trachea, larynx,  
throat and lips  
over and over  
and over,  
and again.

“Take some tea,” she insists,  
over and over  
and over  
and again  
though my cup sits full.  
“No, thank you,” I say.  
“No, thank you,” I persist,  
until her anger surges  
and she spews,  
“Get out!”

Together they cling—  
a tottering raft in roiling waters  
Dad’s eyes scanning the horizon  
anticipating trouble

but his concerns drown  
in her persistent screams  
to ignore my circling  
lifeboat.

Papers accumulate  
circulate  
junk mail and bills  
magazines and wills  
treasured mounds of pulp  
like garrisoned cargo,

they navigate the world  
with a rusty compass—stuck  
the pointer heading out to sea  
and over and over  
and over the  
edge—

leaning on each other  
entwined love  
brittle bodies  
where together they once  
had a full brain  
they have less now,

yet she carries enough  
defiance for them both  
enough to last a life  
time  
it is running  
over and over and  
over and  
out. ❖

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Accompanying artwork  
by Jim Roldan



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Jim Roldan is a visual artist, illustrator, and educator in East Hampstead, NH.

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Little Stories of Big Moments—  
Stories and poems written by  
clinicians in 15 minutes in writing  
workshops about meaningful  
moments in their work and  
life of practicing medicine. To  
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use graphic images with simple  
clinician or patient stories.  
Professional artists were asked to  
create a visual representation of  
the story.

## My Footsteps on the Floating Dock

Michael Parchman, MD<sup>1</sup>

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The sun came up, illuminating the tops of the peaks in a rose-colored glow, as wisps of clouds scuttled along their snow-covered highways. The mountains seemed impossibly high, brooding over green-clad hills, reflected in the iron-grey water that lapped at my feet. Seagulls circled,

some landing and cracking shellfish open along the shore. A fresh wind rippled the surface of the water, where mere inches to feet below the surface, the bed was covered in mussels, clams, and oysters, thick on top of each other.

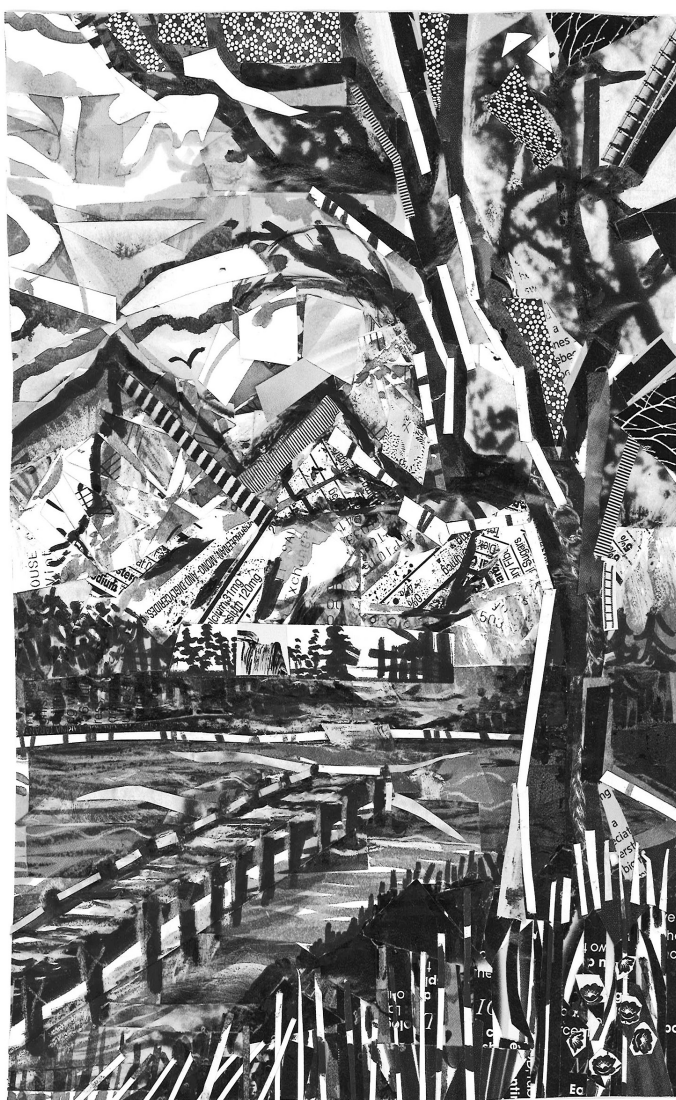
A mountain stream rushed between the cabins and emptied out onto the rock-strewn tidal flat, its flow disappearing among the rocks, shells, and seaweed until it trickled into the water. Boats tied to the long dock bobbed in the water, tugging at their mooring lines as if wishing to be free. My footsteps on the floating dock sent ripples across the surface of the water from underneath the dock as I walked. I peered into the crystal-clear water, certain that I had earlier seen the circular ripple of fish rising to the surface to feed, looking for their movement, but none were to be found, perhaps so well camouflaged by their color against the background of shellfish that they were unnoticeable.

The fresh evergreen scent was on the wind, along with a faint smell of smoke from some distant fireplace chimney. I examined the rocks on the beach, thinking about how much my wife would love to fill our car with them for her garden in the backyard. I walked back to the waterfall, noting the careful placement of stones, rocks, and plants at odd angles, thinking about how this might look in our yard. ❖

### How to Cite This Article

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Accompanying artwork  
by Ayla Leisure

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### Artist Information

Ayla Leisure is a mixed media artist creating and dreaming in Portland, OR. More of her work may be seen at: [www.aylaleisure.com](http://www.aylaleisure.com)

## REVIEW ARTICLE

# Comprehensive Outpatient Management of Low-Risk Pulmonary Embolism: Can Primary Care Do This? A Narrative Review

David R Vinson, MD<sup>1,3</sup>; Drahomir Aujesky, MD, MS<sup>4</sup>; Geert-Jan Geersing, MD, PhD<sup>5</sup>; Pierre-Marie Roy, MD, PhD<sup>6</sup>

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## ABSTRACT

**Introduction:** The evidence for outpatient management of hemodynamically stable, low-risk patients with acute symptomatic pulmonary embolism (PE) is mounting. Guidance in identifying patients who are eligible for outpatient (ambulatory) care is available in the literature and society guidelines. Less is known about who can identify patients eligible for outpatient management and in what clinical practice settings.

**Objective:** To answer the question, "Can primary care do this?" (provide comprehensive outpatient management of low-risk PE).

**Methods:** We undertook a narrative review of the literature on the outpatient management of acute PE focusing on site of care. We searched the English-language literature in PubMed and Embase from January 1, 1950, through July 15, 2019.

**Results:** We identified 26 eligible studies. We found no studies that evaluated comprehensive PE management in a primary care clinic or general practice setting. In 19 studies, the site-of-care decision making occurred in the Emergency Department (or after a short period of supplemental observation) and in 7 studies the decision occurred in a specialty clinic. We discuss the components of care involved in the diagnosis, outpatient eligibility assessment, treatment, and follow-up of ambulatory patients with acute PE.

**Discussion:** We see no formal reason why a trained primary care physician could not provide comprehensive care for select patients with low-risk PE. Leading obstacles include lack of ready access to advanced pulmonary imaging and the time constraints of a busy outpatient clinic.

**Conclusion:** Until studies establish safe parameters of such a practice, the question "Can primary care do this?" must remain open.

## INTRODUCTION

The initial site of care of patients with newly diagnosed, acute, symptomatic pulmonary embolism (PE) is undergoing a transition away from routine hospitalization for select low-risk patients.<sup>1-3</sup> The supporting evidence for outpatient management (without hospitalization) continues to mount and has involved multiple countries and different types of health care systems, including, for example, a

multinational randomized controlled trial in academic medical centers and a recent controlled pragmatic trial in community hospitals in the US.<sup>4,5</sup> Outpatient (ambulatory) care for eligible low-risk patients is endorsed by specialty societies around the world.<sup>6-9</sup> The practice improves the health care community's resource stewardship and spares patients the costs, inconveniences, and risks associated with unnecessary hospitalization.<sup>10,11</sup>

However, little is known about who can identify patients eligible for outpatient management and in what clinical settings. A stable, ambulatory patient with PE-related complaints may present to a variety of venues, including the primary care clinic, specialty (or secondary care) clinic, or the Emergency Department (ED). Comprehensive outpatient PE care requires diagnostic confirmation, determination of outpatient eligibility, anticoagulation, patient and family education, and arrangement for close follow-up. This level of care necessitates that the clinician coordinate

laboratory, radiology, pharmaceutical, and educational resources (Table 1).

Which of the above settings can provide such care? What is the evidence that primary care clinics can marshal the resources needed for outpatient management of acute PE? Or that they have the time and staffing to do so? To address these questions, we undertook a narrative review of the literature.

## METHODS

One of us (PMR) recently published a narrative review of outpatient PE management<sup>1</sup> that we in this current review have adopted, modified, and expanded. The original search was a systematic review from January 1950 to December 2016 using PubMed and Embase, with a manual search of references used in the main studies. We used the search terms *pulmonary embol\** or *pulmonary thromboembol\** and *outpatient\** or *ambulatory care* or *home care* or *home treatment*. Studies were included only if they were published in English and explicitly mentioned the outpatient treatment setting or early hospital discharge of patients with acute, symptomatic, objectively proven PE. We excluded abstracts, editorials, and reviews.<sup>1</sup>

For this current narrative review, we ran a second search from January 1, 2017, through July 15, 2019, using the same sources, search terms, and eligibility criteria. From the expanded collection of studies, we excluded those not reporting outpatient management (defined here as discharge to home from the ambulatory clinic, the ED or specialty unit, or within 48 hours [ $\leq 2$  nights] of hospitalization for observation), not reporting PE-specific clinical outcomes for patients with nonincidental PE, not specifying venues of care (ED vs clinic), discharging patients to a patient hotel, and those with secondary analyses of datasets already included in the review.

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Keywords: ambulatory care, primary health care, pulmonary embolism, risk assessment, systematic review

## RESULTS

We identified 26 eligible studies.<sup>4,5,11-34</sup> As of July 15, 2019, we found no studies of comprehensive PE management provided in a primary care or general practice clinic. In 19 studies the site-of-care decision making occurred in the hospital-based ED (or ambulatory care unit) or after a short period of supplemental outpatient or inpatient observation.<sup>4,5,11-27</sup> In 7 studies, site-of-care decision making occurred in a specialty clinic.<sup>28-34</sup> The research on this topic has been recently accelerating, because 10 of the 19 ED studies were published since January 1, 2017.<sup>5,11-19</sup> We report findings from the included studies in Table 2 (studies published on or after January 1, 2017) and Table 3<sup>a</sup> (studies published before January 1, 2017). Both Tables 2 and 3<sup>a</sup> are organized by patient care setting (ED/ambulatory care unit and specialty clinic). Seventeen studies are prospective in nature, and 16 include more than 100 outpatients (range = 30-544 outpatients). The research on outpatient PE management is an international endeavor, because the 26 studies were conducted in 16 countries.

Table 2 and Table 3<sup>a</sup> illustrate the variety encompassed under the broad umbrella of outpatient PE management. Variation is evident across the spectrum of care: Who arrives for evaluation (walk-ins such as to the ED vs a referred population, as seen in many specialty clinics); how patients are identified as eligible for home care (physician discretion vs explicit criteria, which also vary widely; one study used a separate risk stratification score for patients with cancer-associated PE<sup>23,35</sup>); whether observation is required and, if so, for how long; pharmacotherapy (eg, low-molecular-weight heparin [LMWH], warfarin, or a direct oral anticoagulant [DOAC]); the nature of postdischarge follow-up care; and the timing of outcome metrics. Differences continue beyond the variables reported in Table 2 and Table 3<sup>a</sup>, such as extent and content of patient education.

Despite the diversity of approaches to outpatient PE management illustrated here, the clinical outcomes are reassuring. The combination of careful patient selection, appropriate treatment, attentive patient and family education, and close follow-up (Table 1) facilitates favorable outcomes, as attested by the low incidence of adverse outcomes across the studies.

**Table 1. Elements and resources involved in comprehensive outpatient pulmonary embolism care, regardless of clinical setting**

Element	Resource <sup>a</sup>	Examples <sup>a</sup>
Diagnostic evaluation	Laboratory	D-dimer
	Radiology	Chest radiography, computed tomography pulmonary angiography (CTPA); compression ultrasonography
	Nuclear medicine	Ventilation-perfusion imaging
Determination of outpatient eligibility	Oxygen saturation	Peripheral cutaneous oxygen saturation
	Laboratory	Biomarkers of right ventricular dysfunction, eg, troponin
	Radiology	Compression ultrasonography, assessment of right ventricular dysfunction, eg, CTPA or echocardiography if deemed appropriate
	Consultant	Thrombosis specialist (ie, pulmonologist, hematologist, or internal medicine physician), emergency medicine physician
Anticoagulation	Laboratory	Complete blood cell count, creatinine clearance
	In-office medications	Initiate treatment before pulmonary imaging or discharge to pharmacy, depending on pretest risk assessment
	Pharmacy	Direct oral anticoagulants, low-molecular-weight heparins <sup>b</sup>
Education of patient and family	Information on the disease and the treatment, including what to expect and what to watch for	Physician or nurse: Conversation supplemented with printed or electronic discharge instructions; pharmacist: Proper medication use (including subcutaneous injections if low-molecular-weight heparins are indicated), adverse effects, complications
Arrangement for close follow-up	Appointment access	Primary or specialty care; telephone-based anticoagulation management services, if available

<sup>a</sup> Resources for the diagnostic evaluation and the determination of outpatient eligibility assume the performance of a thorough history and physical examination, including basic vital signs. Resource availability and clinical application vary greatly by patient, clinician, and practice setting. We report here only common examples, which may or may not be indicated in every case. See Table 2 and Table 3 (available from: [www.thepermanentjournal.org/files/2020/19.163T3.pdf#20-34](http://www.thepermanentjournal.org/files/2020/19.163T3.pdf#20-34)) for illustrations of variation in practice.

<sup>b</sup> For some patients who are uninsured or have limited pharmacy coverage, additional personnel (eg, social workers) may be needed to help with medication procurement.

## DISCUSSION

### Two Sites of Outpatient Pulmonary Embolism Care Described in the Literature

#### 1. Emergency Department (and Ambulatory Care Unit)

Much of the research on comprehensive outpatient PE management that we identified in our literature search has been undertaken in traditional hospital-based EDs (Table 2 and Table 3<sup>a</sup>). The ED is a natural venue for outpatient PE research because many patients with suspected or newly diagnosed PE present themselves (or are directed) to its doors, which are conveniently open 24/7. The acceptance of all-comers includes patients with PE arriving by ambulance, who are a higher-acuity population and can constitute in some settings approximately 20% of the entire PE population in the ED.<sup>15</sup> The ED has easy access to laboratory, radiology, and nuclear medicine studies to pursue and secure a PE diagnosis (Table 1).<sup>36</sup> Continuous cardio-pulmonary monitoring is readily available

if needed. If a 12-hour to 24-hour period of formal observation is indicated, some EDs just extend the patient stay, whereas others transfer care to an affiliated outpatient observation or clinical decision unit.<sup>37</sup> Some studies of outpatient PE management include up to a 24-hour observation period in their definition of outpatient care. The meaning of outpatient itself varies, as there is no established definition. In some PE studies, outpatient care includes a stay in the *inpatient* setting. We note those studies of expanded ED care in Table 2 and Table 3<sup>a</sup>.

When the time for disposition arrives, the ED can easily risk-stratify their patients with PE to identify those eligible for discharge to home (more on this later in this section).<sup>38</sup> On the treatment side, the ED can initiate anticoagulation therapy and begin patient education, which can continue when the patient is introduced to the pharmacy before or just after discharge. Thrombosis specialists are often available at all hours for consultation. Facilitating

postdischarge follow-up care is the 1 element of comprehensive PE care that can be difficult for some EDs to achieve.<sup>39,40</sup> Post-ED follow-up can include more than just general practitioner or specialty clinic appointments; some health care organizations also provide a pharmacy-led, telephone-based outpatient anticoagulation team (anticoagulation management services) that follows-up with these patients, whatever their anticoagulant.<sup>39,41,42</sup>

A variation of the traditional ED care delivery model is the UK's hospital-based ambulatory emergency care unit.<sup>43</sup> Patients are accepted into the unit by clinician referral only and are limited to those who are likely manageable as outpatients,<sup>12</sup> including patients transferred in via ambulance. Most of these units are not open around-the-clock. Proximity to the affiliated medical center gives these ambulatory care units ready access to the laboratory and advanced imaging resources needed for the diagnosis and risk stratification of patients with acute PE.

## 2. Specialty Clinic Setting

In some countries outside the US, such as Canada, it is not the ED to which patients with diagnosed or suspected PE are referred. Specialty-run thrombosis clinics have featured prominently in the literature on outpatient PE management (Table 3<sup>a</sup>). The specialty that manages these "clot clinics" varies and includes internal medicine, pulmonology, hematology, and vascular medicine. Oncology clinics can also provide comprehensive care for their stable, outpatient care-eligible patients with PE, and sometimes share tasks with pharmacists.<sup>44</sup> These secondary care thrombosis clinics, like the ED, have the skill set and resources to provide care from diagnosis to treatment, risk stratification, and discharge, and, contrary to the ED, specialty clinics can provide their own follow-up care. The disadvantages compared with the ED is that these clinics often do not receive ambulance traffic, nor are they always open around-the-clock. Another difference is that specialty-run clinics are not usually equipped with continuous cardiopulmonary monitoring, although the importance of this component of care in assessing outpatient eligibility is not known. For many hemodynamically stable patients with low-risk PE, 1 or 2 sets of vital signs may be sufficient to confirm stability.

Several society guidelines address criteria for outpatient PE site-of-care decision making without specifying the training and experience of the decision maker.<sup>6,9</sup> The British Thoracic Society, however, is more explicit: If PE is diagnosed by a general practitioner in the outpatient setting in the UK, the patient should be transferred to the ED or an ambulatory care unit,<sup>12,45,46</sup> as explained earlier, where they can be evaluated by a consultant or a clinician "designated to undertake this role within the department with consultant advice available."<sup>7</sup>

## Paving the Way for Comprehensive Primary Care-based Pulmonary Embolism Management

The growing literature on the safety and effectiveness of outpatient management of PE in the ED and specialty clinic setting have set the stage for management of select patients with low-risk PE in the primary care setting. Two other factors have helped pave the way for primary care physicians to expand their role in PE management: Decentralization of management of deep vein thrombosis (DVT) and simplification of pharmacotherapy.

### Decentralizing Deep Vein Thrombosis Management

For select patients with DVT, a similar shift in site of care—from the ED to the primary care clinic—began years ago in the US and is now well established in some countries, such as France. After the advent of LMWH, one of our medical centers in the US, part of a large integrated health care system, developed an outpatient clinical care pathway for select patients with DVT.<sup>47</sup> Initially, all patients with newly diagnosed DVT were directed to the hospital-based ED for risk stratification to inform site-of-care decision making. Over time, it was realized that for some low-risk patients the temporary transfer of care to the ED was superfluous—the referring primary care clinician was just as capable of identifying which patients were eligible for outpatient treatment and managing these patients without recourse to the ED. Our medical center then pulled together a multidisciplinary team to design, implement, and monitor a clinical care pathway to enable general practitioners to provide comprehensive outpatient DVT management.<sup>48</sup> Today such practice has become

more common in multiple settings around the world.<sup>49</sup> Perhaps such a change is on the horizon for select patients in the right practice settings with acute symptomatic PE.

### Simplifying Pharmacotherapy

A more recent shift in pharmacotherapy away from vitamin K antagonists, such as warfarin, might facilitate the provision of comprehensive PE care in the primary care setting.<sup>50</sup> Recent society guidelines recommend DOACs, also known as nonvitamin K (or novel) oral anticoagulants, as the preferred agents for most patients with acute PE.<sup>6,7,9,51</sup> The DOACs avoid some of the complexities associated with vitamin K antagonists, such as regular laboratory monitoring and dose adjustments, as well as many food and drug interactions.<sup>52</sup> Even greater ease of administration is achieved with DOACs that are approved as monotherapy for PE (eg, rivaroxaban and apixaban), obviating the need for a 5- to 10-day lead-in period of subcutaneous LMWH therapy required with some DOACs (eg, dabigatran and edoxaban). The acquisition costs of DOACs, however, are an ongoing concern, particularly among socioeconomically disadvantaged populations, for whom out-of-pocket costs might be prohibitive.<sup>53</sup> The efficacy and safety of DOACs in patients with cancer-associated PE are currently under investigation.<sup>54-56</sup> Because DOACs have been associated with an increased risk of gastrointestinal and possible genitourinary tract bleeding, they should be used with caution in patients with malignancies in these regions.<sup>57</sup> The 2019 European Society of Cardiology guidelines recommend that in "patients with an anticipated low risk of bleeding and without gastrointestinal tumours, the choice between LMWH and edoxaban or rivaroxaban is left to the discretion of the physician, and the patient's preference."<sup>9</sup> Access to DOACs alone, however, is insufficient to facilitate outpatient PE care without concurrent implementation of the structural processes of care needed to support ambulatory PE management.<sup>58</sup>

## Exploring the Primary Care Setting for Comprehensive Pulmonary Embolism Management

In this review of the literature we failed to identify any studies meeting our eligibility criteria that describe PE management

contained entirely in the primary care clinic setting, that is, comprehensive primary care clinic-based management. The lack of literature on this model of care delivery does not mean that such care is not being provided—we know anecdotally that it is. Lack of a published description of this care model, however, prevents a critical understanding and analysis of its execution by the medical community at large and impedes its expansion and adaptation to other clinics. In advance of such literature, we introduce the 4 key elements required for comprehensive care of patients with acute PE in the primary care setting: 1) outpatient diagnosis, 2) identification of patients eligible for outpatient care, 3) patient education, and 4) timely follow-up.

### 1. Pursuing the Outpatient Diagnosis of Pulmonary Embolism

The most difficult and challenging aspect for securing the diagnosis of PE in primary care is identifying which patients with PE-related complaints warrant diagnostic evaluation. Both underimaging and overimaging may cause harm; the former contributes to a delay in diagnosing a potentially fatal condition, and the latter, in the case of computed tomography pulmonary angiography (CTPA), can lead to needless complications from intravenous contrast medium (eg, allergic reaction and contrast agent-induced acute kidney injury) and exposure to radiation (eg, breast cancer), not to mention poor resource utilization. Nevertheless, once a suspicion is clear and ruling out PE becomes imperative, the management of patients with suspected PE typically relies on the combination of pretest probability (ie, the clinical assessment based on historical and examination findings) and selective D-dimer testing, both readily available in primary care.<sup>36</sup> We will address these separately.

*Assessing pretest probability:* Owing to the frequency and lack of specificity of the signs and symptoms of PE, the clinical decision to investigate appears to be mainly subjective. A promising starting point in the evaluation of a patient with possible PE is the PE rule-out criteria.<sup>59–61</sup> When applied to patients with a low pretest probability of PE as judged by physician gestalt, these criteria can exclude PE solely on clinical grounds, without the need for laboratory or radiology testing. A randomized trial

found that *ED patients* with very low pretest probability who had none of the specified 8 criteria could safely forgo additional diagnostic evaluation, including a D-dimer test, with reassuring outcomes.<sup>62,63</sup> The PE rule-out criteria are advocated by the American College of Physicians for use by *outpatient physicians*,<sup>36</sup> but they may not be ready for broad application in primary care until they are validated in this setting.

Patients who have 1 or more of the PE rule-out criteria or for whom the criteria are not applicable (because patients are not low risk by gestalt) need additional pretest probability stratification using one of several evidence-based clinical prediction rules widely endorsed by society guidelines.<sup>6,8,9,36</sup> Five of these prediction tools for PE diagnosis have been validated in primary care and are easily applied in this setting: The original Wells, modified Wells, simplified Wells, revised Geneva, and simplified revised Geneva models.<sup>64</sup> Whereas efficiency was comparable for all 5, the Wells rules demonstrated the best performance in terms of lower failure rates, that is, the lowest risk of missed PE when imaging was withheld.<sup>64</sup> Performance of these rules can vary considerably depending on differences in disease prevalence and practice environment, where both case mix and physician experience vary.<sup>65,66</sup>

*Using D-dimer in the assessment:* Patients with low to moderate pretest probability of PE should receive D-dimer testing. A low D-dimer value in this population safely excludes PE. Specifically for primary care, a meta-analysis found this to be true also for the use of rapid point-of-care D-dimer assays.<sup>67</sup> Results of a prospective study in Dutch primary care settings confirmed that the combination of the Wells score with a qualitative point-of-care D-dimer assay safely excluded the diagnosis in patients with suspected PE, comparing favorably with similar studies performed in secondary and tertiary care settings.<sup>68</sup> D-dimer values show improved efficiency when interpreted in light of age as well as pretest clinical probability.<sup>69–71</sup> A structured diagnostic approach that is built around a simplified Wells rule is the YEARS algorithm, which has demonstrated good performance in the ED and inpatient settings.<sup>70</sup> A large prospective study of the YEARS algorithm is under way to validate a risk-stratified use

of D-dimer (rather than a 1-size-fits-all approach) in the primary care setting.<sup>72</sup>

*Obtaining advanced pulmonary imaging:* The probability assessment crosses the threshold for advanced imaging if the patient has a high pretest probability for PE or a low to moderate pretest probability with an elevated D-dimer value.<sup>36</sup> Research findings have established the effectiveness and safety of validated strategies for the diagnosis of acute PE in the ambulatory care setting.<sup>64,68,73</sup> Multidetector CTPA is the imaging method of choice in most patients with suspected PE. A ventilation-perfusion scan is preferred for patients with severe renal failure.<sup>9</sup> Which physician specialty orders advanced imaging, however, varies considerably across practice settings and may be subject to established local (or national) patterns of care as well as physician schedule, staffing, and time of day. In some practice settings, the primary care physician has ready access to timely pulmonary imaging and radiology interpretation and can proceed with imaging if indicated. We see this in action in one of our own practice settings (DRV). For example, in a real-world study of outpatient PE management in the US, 14.5% of 1703 ED patients arrived with a diagnosis in hand, thanks to a pulmonary imaging study ordered by an outpatient clinician, most commonly primary care physicians.<sup>5</sup> However, timely and convenient advanced imaging services are not available to all primary care clinics. In these cases, patients may need to be referred to the ED, ambulatory care unit, or specialty clinic for reassessment and ordering of diagnostic imaging if indicated. In some countries, such as the Netherlands and the UK, primary care physicians who identify patients in need of advanced PE imaging customarily transfer them to a higher level of care to confirm the diagnosis.<sup>7,73</sup>

### 2. Identifying Patients with Pulmonary Embolism Who are Eligible for Ambulatory Care

If a primary care physician sought to provide comprehensive care for select patients with newly diagnosed acute PE, the next step would be determining eligibility for outpatient management. The broader topic of outpatient PE care has been much studied, as the results in Table 2 and Table 3<sup>a</sup> attest, although none of these studies speak directly to the primary care

setting. The CHEST criteria to determine outpatient eligibility are simple and sensible. The patient should be “clinically stable with good cardiopulmonary reserve; no contraindications such as recent bleeding, severe renal or liver disease, or severe thrombocytopenia (ie, <70,000/mm<sup>3</sup>); expected to be compliant with treatment; and the patient feels well enough to be treated at home.”<sup>76</sup> Treatment compliance requires a certain level of health literacy, motivation, and psychosocial stability, factors commonly included in the eligibility criteria of outpatient PE studies (Table 2 and Table 3<sup>a</sup>).<sup>74</sup>

Numerous prognostic models are available to aid the physician in identifying low-risk patients who may be eligible for outpatient management.<sup>75</sup> The validated instruments most well studied to guide the disposition decision are the PE Severity Index and its shortened counterpart, the simplified PE Severity Index (Table 4).<sup>76,77</sup> Both indexes provide estimates of 30-day all-cause mortality.<sup>4,78,79</sup> The simplified PE Severity Index identifies fewer patients who are eligible for outpatient care than the original.<sup>75,80</sup> It is, however, easier to remember than the original, a distinction less meaningful in this day of autopoulating electronic clinical decision-support tools.<sup>80</sup> The European Society of Cardiology has incorporated the PE Severity Index into its risk stratification system.<sup>9</sup> When used in site-of-care decision making, short-term mortality estimates are combined with commonsense contraindications to ambulatory care, as several studies have done (Table 2 and Table 3<sup>a</sup>).<sup>5,81</sup>

Index scores can be used in a strict fashion; for example, only patients with lower-risk class I or II scores on the PE Severity Index are considered for ambulatory care,<sup>4,18</sup> or in a looser, informative fashion, in which mortality estimates contribute to the decision-making process but do not categorically govern it.<sup>5,12,82</sup>

The American College of Chest Physicians endorses this more flexible use of the PE Severity Index in their recent PE guideline, stating, “We consider clinical prediction rules as aids to decision making and do not require patients to have a predefined score (eg, low-risk PE Severity Index score) to be considered for treatment at home.”<sup>76</sup> This approach of using prognostic rules as

Table 4. Pulmonary embolism severity indexes		
Parameter	Original score <sup>a77</sup>	Simplified score <sup>b76</sup>
Demographic characteristics		
Age/y	+1	
Age > 80 y	—	+1
Male sex	+10	—
Comorbid illness		
Cancer (active or history of)	+30	+1
Heart failure (systolic or diastolic)	+10	+1 <sup>c</sup>
Chronic lung disease (includes asthma)	+10	
Clinical findings <sup>d</sup>		
Pulse ≥ 110/min	+20	+1
Systolic blood pressure < 100 mmHg	+30	+1
Respiratory rate ≥ 30/min	+20	—
Temperature < 36°C	+20	—
Arterial oxygen saturation < 90% <sup>e</sup>	+20	+1
Altered mental status <sup>f</sup>	+60	—

<sup>a</sup> A total point score for a given patient is obtained by summing the patient's age in years and the points for each applicable prognostic variable. Point scores correspond with the following classes that estimate escalating risks of 30-day all-cause mortality: ≤ 65 points, class I; 66-85 points, class II; 86-105 points, class III; 106-125 points, class IV; > 125 points, class V. Patients with 85 points or less (classes I and II) are considered low risk and eligible for ambulatory care consideration.<sup>4</sup>

<sup>b</sup> A total point score for a given patient is obtained by summing the points for each applicable prognostic variable. Patients with 0 points are considered low risk.

<sup>c</sup> The 2 variables were combined into a single category of chronic cardiopulmonary disease, that is, a patient is awarded 1 point for having either heart failure or chronic lung disease.

<sup>d</sup> The most abnormal vital signs in the direction of interest were used. Some studies include prearrival findings from emergency medicine services or the referring clinic.<sup>5,15</sup>

<sup>e</sup> With or without supplemental oxygenation.

<sup>f</sup> Acute or preexisting disorientation, lethargy, stupor, or coma.

an adjunct to clinical judgment has been adopted by other guideline committees in site-of-care recommendations for other clinical conditions. For example, the UK's National Institute for Health and Care Excellence (NICE) guideline for adult pneumonia recommends that physicians “use clinical judgement in conjunction with the CRB65 score<sup>[83]</sup> to inform decisions about whether patients need hospital assessment.”<sup>84</sup> Clinicians are advised to “consider” hospitalization for patients with higher-risk scores.

A second, validated, commonly used approach to identify patients with PE who are eligible for home discharge focuses on outpatient management exclusion criteria (Table 5). The first such list originated in Canada, where it has been safely used for decades.<sup>34,85,86</sup> These were expanded to form the Hestia criteria (Table 5), which also perform well in varied settings (Table 2 and Table 3<sup>a</sup>).<sup>20,24</sup> A similar list of outpatient exclusion criteria was employed in a large multinational outpatient PE trial that identified home eligibility on the basis of

low-risk classification by the PE Severity Index (Table 5).<sup>4</sup> How the 2 overall strategies (mortality estimates plus exclusion criteria vs exclusion criteria alone) compare in terms of safety and efficiency has not been well studied. An international randomized controlled trial of the 2 approaches recently completed enrollment (clinicaltrials.gov identifier: NCT02811237).<sup>87</sup> This and similar studies will help define the role these tools can play in assisting site-of-care decision making.

Most of the above patient identification strategies do not require routine evaluation of right ventricular function in hemodynamically stable, low-risk patients. Selective use of echocardiography and serum biomarkers, such as troponin, accords with the recommendation of leading society guidelines.<sup>6,7</sup> The 2019 PE guidelines of the European Society of Cardiology, however, are the exception, calling for routine imaging of the right ventricle, even in otherwise low-risk patients, using CTPA or echocardiography.<sup>9</sup> Some evidence suggests that such testing may add clinically useful

prognostic value even in normotensive patients with low-risk PE, although this is still being worked out.<sup>88-91</sup> Routine testing of right ventricular function has been incorporated into some clinical pathways to identify patients with PE who are eligible for outpatient care (Tables 2 and 3<sup>a</sup>).<sup>18,92</sup> However, adding N-terminal B-type natriuretic peptide to the Hestia rule does not appear to improve risk stratification for outpatient PE treatment.<sup>20</sup> What role the assessment of right ventricular function will play in the determination of primary care clinic-based outpatient eligibility is unclear.

If outpatient PE management is a viable option for the primary care patient with acute PE, the physician should work together with the patient to arrive at a mutually agreed-on site-of-care treatment plan (transfer of care vs home discharge).<sup>93,94</sup> Who better to take into account a patient's values and preferences in shared decision making than the physician who knows the patient best? Few studies have evaluated shared decision making in any aspect of venous thromboembolic disease management; site-of-care decision making from the primary care clinic is not

among them.<sup>95</sup> Also given the paucity of literature on comprehensive primary care-based PE management, the evidence used in the shared decision-making discussion would have to be drawn from the broader outpatient PE literature performed in the ED and specialty clinic settings (Tables 2 and 3<sup>a</sup>).

### 3. Patient Education

Once the diagnosis of PE is established and eligibility for outpatient care is confirmed, additional responsibilities fall on the clinic that is entertaining comprehensive outpatient management (Table 1). The first among these is patient education. Topics here include at a minimum the risk factors, course, complications and prevention of PE; anticoagulation dosing, duration, medication interactions and adverse effects; and when and where to seek medical evaluation for new or worsening symptoms. Society guidelines in both Europe and the US recommend DOACs as the drugs of choice in the treatment of acute PE.<sup>6,9</sup> Some DOACs, however, such as dabigatran and edoxaban, require a 5- to 10-day lead-in with a LMWH, in which case instruction on subcutaneous medication administration

will be necessary. In some practice settings, patient education of this sort lies principally with the nursing staff.

Currently, most society guidelines recommend at least 3 months of anticoagulation in the treatment of a first episode of acute PE, barring major contraindications.<sup>6,9,51</sup> The decision to extend anticoagulation therapy beyond 3 months depends on weighing the risks of venous thromboembolic recurrence with the risk of bleeding and can be a complex calculation in which patient preference and consultation with a thrombosis specialist factor prominently.<sup>9</sup>

### 4. Timely Follow-up

Timely follow-up after initial home discharge is important to assess symptom control; evaluate for the effectiveness of anticoagulation therapy and its adverse effects; and continue patient education on the disease, its treatment, and the prevention of recurrence and complications. The optimal timing and frequency of initial postdischarge follow-up has not been established, as the variation in Tables 2 and 3<sup>a</sup> attests. Most outpatient PE studies and clinical care pathways include an initial outpatient clinic appointment within 7

**Table 5. Criteria used to exclude patients with acute pulmonary embolism (PE) from outpatient management**

Categorization <sup>a</sup>	Criteria used in randomized controlled trial of PE Severity Index <sup>a</sup>	Criteria used in Hestia Study <sup>b24</sup>
PE factor		
Pain	Chest pain necessitating parenteral opioids	Severe pain needing intravenous pain medication > 24 h
Hemodynamics	SBP < 100 mmHg	(SBP < 100 mmHg + pulse > 100/min) or unstable by clinical judgment or requiring ICU care
O <sub>2</sub> saturation	Hypoxemia	> 24 h of O <sub>2</sub> supply needed to maintain O <sub>2</sub> saturation > 90%
Prearrival anticoagulation	Therapeutic oral anticoagulation	PE diagnosed during anticoagulation therapy
Treatment	Not included	Requiring thrombolysis or embolectomy for reasons other than hemodynamic instability
Comorbid condition		
Bleeding or risk thereof	Active bleeding or high risk of bleeding	Active bleeding or high risk of bleeding: GI bleeding or surgery ≤ 2 wk ago, stroke ≤ 1 mo ago, bleeding disorder or platelet count < 75 × 10 <sup>9</sup> /L, uncontrolled hypertension (SBP > 180 mmHg or DBP > 110 mmHg), or by clinician judgment
Renal function	Severe renal failure	Creatinine clearance < 30 mL/min according to Cockcroft-Gault formula
Liver function	Not included	Severe liver impairment by physician judgment
Pregnancy	Pregnant	Pregnant
Heparin intolerance	Not included	Documented history of heparin-induced thrombocytopenia
Psychosocial factor		
Psychosocial factor	Barriers to adherence or follow-up; imprisonment	Medical or social reason for admission > 24 h (infection, malignancy, no support system)

<sup>a</sup> The tripartite categorization of PE factors, comorbid conditions, and psychosocial factors has been used elsewhere.<sup>74</sup>

<sup>b</sup> The 11 Hestia criteria were originally framed as questions; if any were answered in the affirmative, outpatient treatment was contraindicated.

DBP = diastolic blood pressure; GI = gastrointestinal; ICU = intensive care unit; O<sub>2</sub> = oxygen; SBP = systolic blood pressure.

days.<sup>39</sup> Follow-up thereafter can be tailored to the patient's needs. An additional feature of long-term management of patients with a history of PE is to monitor for recurrence as well for the development of chronic thromboembolic pulmonary hypertension.<sup>96</sup> The aspects of long-term outpatient PE management that typically follow discharge from the ED or hospital are well within the established purview of primary care in the countries in which we practice.

### Case Example

We include a hypothetical case example in the Sidebar: Case Example to illustrate the components of comprehensive primary care-based PE management that we have discussed in this narrative review (Table 1).

### Advantages and Risks of Comprehensive Primary Care-based Pulmonary Embolism Management

Advantages of comprehensive primary care-based outpatient PE management are expected at the patient level. These include maintaining continuity of care throughout the course of PE management by reducing the care transitions that can jeopardize patient safety.<sup>97</sup> Maximizing home time (ie, time alive and out of a health care institution) and minimizing ED and hospital visits are additional important patient-centered outcomes.<sup>98,99</sup> In the US it also will save patients out-of-pocket costs, which can be substantial. These patient-level factors may contribute to improvements in patient satisfaction and quality of life. Benefits may also be seen at the public health level, with reductions in overall health care expenses and a better stewardship of hospital resources.<sup>10,11,100</sup>

How the risks of this newer model—in terms of unplanned ED visits and hospitalization, and short-term major hemorrhage, recurrent venous thromboembolism, and mortality—compare with transferring care to the ED or specialty care clinic, however, is unknown. As our literature review findings demonstrate, little research has been undertaken on comprehensive PE care in the primary care setting. To begin to address this deficit, one of us (DRV) has a retrospective cohort study under way that will shed some light on this new model of PE care delivery, at least as practiced in a

community-based, integrated health care system in the US.<sup>101</sup> Far more research, however, will be needed before this novel approach to PE management is well understood in its varied settings and optimized in terms of operations and outcomes.

### Limitations

We acknowledge several limitations of this narrative review. First, our search methods were limited by pragmatic constraints and excluded studies not in the English language, not cited in PubMed or Embase, and not referenced in the included studies or leading systematic reviews of outpatient PE management. Nevertheless, it is unlikely that our principal finding—that there is little research on comprehensive primary care-based PE—will be overturned by a more thorough search. Second, we did not address the management of acute PE in pregnancy, as it requires special considerations with diagnosis and treatment.<sup>9</sup> Third, the lack of research on primary care-based PE management precluded a more formal systematic review and left us to draw inferences about the requirements of primary care-based management from outpatient care in other settings, particularly hospital-based ED and specialty clinics. Pulmonary embolism research in these 2 settings may not be immediately translatable to the primary care clinic setting, given differences in case mix, disease prevalence, physician training and experience, and access to testing resources. Future studies emerging directly from the primary care setting will help fill the many gaps currently in the literature. Last, our limited experiences prevent us from speaking to the breadth of diversity encompassed under the banner of primary care, although we have published broadly on PE diagnostics and treatment and represent 3 specialties—primary care, internal medicine, and emergency medicine—and different practice settings in 4 countries. We look to other authors to supplement this initial foray into a what is sure to be a broad subject of investigation.

### CONCLUSION

To the larger research question, “Can primary care do this?,” that is, provide comprehensive outpatient management for low-risk patients with acute PE, we

have 3 answers, which address the topic from skill-based, logistical, and evidence-based perspectives. The first answer arises from a general knowledge about the training, skills, and experience characteristic of primary care clinicians. (Two of the authors of this review are board-certified primary care physicians, in the US and the Netherlands, respectively.) General practitioners are skilled in risk stratification, frequently sorting out which patients with headache need cranial imaging, which patients with epigastric pain would benefit from laboratory testing, which patients with pneumonia can safely forgo hospitalization, and so on. With a little guidance, these clinicians could become just as adept at identifying which stable patients with acute PE may be eligible to bypass the hospital, and even forgo ED transfer. We anticipate that trained general practitioners, with direction from specialty guidelines, treatment pathways, or clinical decision-support systems, and ready access to on-call thrombosis specialists, can be capable of providing comprehensive outpatient PE management. Our first answer, then, is yes, absolutely; primary care physicians have the risk-stratification capabilities and informational resources to manage select low-risk patients with acute PE without needing to routinely transfer care.

The physician's knowledge base and diagnostic skills, however, are not the only variables in the equation, as there are several logistical considerations that must be addressed. For example, how accessible are the necessary laboratory and radiology services? Is advanced pulmonary imaging located nearby, and are timely appointments and radiology interpretations available? Are clinical staff available to assist with patient education? Does the physician have the extra time to coordinate this complex operation, time that is sure to exceed a routine appointment duration? Some care delivery systems may be more conducive to comprehensive outpatient PE management than others. Even if the primary care physician *can* provide comprehensive management of select low-risk patients with acute PE (answer 1), they cannot provide such care if their practice location, setting, staffing, or operational constraints do not accommodate the requirements of this new model of PE care

delivery (answer 2). Primary care physicians who believe that their practice is already overburdened may not welcome a resource-intensive expansion of responsibilities. The additional burden of PE care may be attenuated by designing clinical care pathways that lighten the cognitive load on physicians, share responsibilities, and streamline patient flow.

Our third approach to our research question is not as amenable to an answer as the first 2, for it looks to the literature for primary care specific evidence-based guidance. As we found in this narrative review, little has been published that describes and analyzes the practice of primary care-based comprehensive PE management. There is much we do not understand. What

characteristics of primary care clinicians are associated with outpatient care? How are primary care clinicians selecting their patients for outpatient care? In what patients is screening for right ventricular dysfunction necessary? Should routine assessment of right ventricular dysfunction be required of the primary care risk stratification protocol? What are the risk

### Case Example

A 32-year-old woman presents to your primary care office in the morning with a 3-day history of intermittent, mild, lateral right-sided pleuritic chest pain and mild dyspnea with moderate exertion. She says she has no fever, coryza, hemoptysis, or leg complaints. She returned home last week to San Francisco, CA, after a 10-day family vacation in Auckland, New Zealand. She has no abnormalities in her medical history. Her only medication is an oral estrogen-progestin contraceptive, which she began 3 months ago. Neither she nor her relatives have a history of thrombophilia nor venous thromboembolism. You are working in a multispecialty group that has an established outpatient pulmonary embolism (PE) diagnostic algorithm, based on the American College of Physicians Best Practice Advice,<sup>1</sup> and a disposition pathway, based on the American College of Chest Physicians CHEST guideline and expert panel report.<sup>2</sup>

Her vital signs are normal, including a cutaneous peripheral oxygen saturation. The results of her heart, lung, and limb examinations are also normal, as is a 12-lead electrocardiogram and chest radiograph. Using the original Wells criteria, you calculate that she has a moderate pretest probability for acute PE, so you send her to the on-site laboratory for a serum D-dimer, which returns a result at 1075 ng/dL (normal value for her age is < 500 ng/dL). Her complete blood cell count, renal function, and aspartate aminotransferase level are normal. Because of her moderate pretest probability, you administer an initial dose of a direct oral anticoagulant (DOAC) approved as monotherapy for PE and arrange for a computed tomography pulmonary angiography (CTPA) early that afternoon at the affiliated radiology suite across town. They call to inform you that she has a right-sided lobar embolism and no evidence of right ventricular enlargement or dysfunction.

She and her partner return to your office. Her second set of vital signs are relatively unchanged. You explain to them the diagnosis, the need to begin a 3-month course of a DOAC, and the options they have for when to discontinue oral contraceptive treatment.<sup>3-5</sup> In evaluating her site-of-care options, you calculate her PE Severity Index score.<sup>6</sup> Her 32-point score places her in the lowest mortality-risk category (class I) and, because of her lack of contraindications to outpatient care, including the Hestia criteria, she is eligible to safely forgo hospitalization.<sup>2,7-9</sup> She also meets the American College of Chest Physicians criteria for outpatient care.<sup>2</sup>

Using a shared decision-making model, you discuss the benefits and risks of the next site-of-care options. For the first option, they can drive to the local affiliated Emergency Department, which has access to her electronic health records, including your note and today's laboratory and radiology results. She then may be discharged home from the Emergency Department or observed overnight. Alternatively, they can go to the pharmacy down the hall, pick up her anticoagulation and analgesic medications, then go home. She and her partner prefer the second option. You write her a note for 1 week off work. While the clinic nurse completes the patient education that you began, the office staff schedules her for a telephone appointment with you in 2 days and an in-office visit in 1 week. The couple decides to continue oral contraception for the next 8 weeks with plans to switch to an intrauterine device 1 month before discontinuing anticoagulation.

Her 3-month PE treatment course is uneventful. No additional venous thromboembolism or other complications develop over the subsequent 2 years.

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profiles, treatment, and outcomes of patients managed exclusively in the primary care setting? Is the practice safe? Is it efficient? How can it be improved? What is its impact on the patient care experience and the clinician's experience? On a comparative level, do the selection criteria need to be more conservative than those used in the ED or specialty clinic? Are the outcomes similar to those of patients sent home from the ED or specialty clinic? There is a sizable gap in the literature that needs to be filled if we hope to understand this yet unexplored facet of outpatient PE management. Until then, our third answer to the question, "Can primary care do this?" must be that we do not know for certain yet. We look forward to what we will learn as this field of research expands. ❖

\* Available at: [www.thepermanentejournal.org/files/2020/19.163T.pdf#20-34](http://www.thepermanentejournal.org/files/2020/19.163T.pdf#20-34)

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**Hydrangea**  
botanical sample, ink, watercolor

**Latifat Apatira, MD**

From Dr Apatira: "*Nature printing* is a centuries-old printmaking technique used to create detailed, life-sized images of natural objects, such as plants, for study and art. Ink is directly applied to a freshly picked plant and the plant's image is then transferred by sandwiching the plant between 2 sheets of paper and then rubbing its surface by hand, capturing a precise and clear print, an impression of life."

Dr Apatira is a plant enthusiast, mixed-media artist, nature photographer, and Internal Medicine Resident at Kaiser San Francisco in CA. More of Dr Apatira's work can be seen at [www.titilayola.com](http://www.titilayola.com).

## CLINICAL PRACTICE

# Pharmacist Medication Management of Adults with Attention Deficit: An Alternative Clinical Structure

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## ABSTRACT

**Introduction:** Attention-deficit/hyperactivity disorder (ADHD) is one of the most common psychiatric conditions in youth. This disorder can persist into adulthood, with an estimated prevalence of 4.4% to 5.2% in the US.

**Objective:** To review adult ADHD diagnostic criteria, adult clinical presentation, and resulting impairments in function and to describe our adult psychiatry clinic's pharmacist-comanaged ADHD medication management program as a model to provide safe and effective care that is accessible, efficient, and well monitored.

**Methods:** The program consists of 1) screening (urine toxicology, diagnostic evaluation, data collection) by physicians, 2) program participation and treatment agreement with establishment of care goals, and 3) patient maintenance and monitoring. Pharmacists in the Department of Psychiatry manage refills, distributing the clinical caseload among a broader clinician base.

**Results:** This program created a standardized protocol for assessment, referral, and follow-up of adult patients with ADHD, with close monitoring and titration of controlled medications, systematic use of screening measures, and a stimulant treatment contract.

**Discussion:** Development of this program and workflow model could increase care delivery efficiency, potentially improving patient satisfaction and outcomes. There is a great need to use alternative patient management strategies such as this to maintain access to high-quality care while there is a nationwide need for more psychiatric clinicians.

**Conclusion:** We believe this program offers a solution to a component of this growing problem, and other clinical sites would benefit from such a program. Next steps include analysis and publication of results of implementation, including patient outcomes, engagement in treatment, and satisfaction.

## INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is one of the most common childhood and adolescent psychiatric conditions with a childhood diagnosis rate of 7.8%.<sup>1</sup> Most children with ADHD (60%-85%) will continue to meet criteria for the disorder during their teenage years,<sup>1</sup> and studies have shown that ADHD can persist into adulthood.<sup>2,3</sup> Epidemiologic studies of ADHD

using a representative sample of adults aged 18 to 44 years have estimated the current prevalence to be 4.4% to 5.2% in the US<sup>3,4</sup> and a 2.8% prevalence of ADHD in adults across the 18 countries surveyed.<sup>3</sup> Adult ADHD is increasingly recognized as a global health issue. Prevalence data on adult ADHD support the notion that there is a need for clinicians to focus on understanding the impact of ADHD in their adult patients, which can often be underdiagnosed and undertreated.<sup>5</sup> Additionally, this influx of adult patients requires thoughtful screening and evaluation regarding potential ADHD and consistent management of medications. When the prevalence of this condition is considered, management of these patients can pose a substantial impingement on access to already strained Psychiatry Departments.

Published data suggest that up to 90% of those with adult ADHD did not have the diagnosis in childhood.<sup>6-8</sup> This finding may suggest a distinct developmental trajectory, a delay in diagnosis owing to stigma or resource limitations, or effective coping strategies that facilitate sufficient successes to progress through childhood until adult workplace demands overrun these strategies.<sup>6-8</sup> Other possible explanations include a change in informant reporting of ADHD symptoms (adult patient directly seeking treatment vs parent and teacher reports in a child), a deficit of attention reflecting one or more other mental health disorders than ADHD, or childhood ADHD that was masked by the family environment or a high intelligence quotient.<sup>9</sup> These theories suggest that a program that improves access to clinicians for evaluation and management of adult ADHD may prove beneficial to patients and allow for management of these patients such that Psychiatry Departments are able to care for them efficiently.

In this article, we review the diagnostic criteria for adult ADHD, the clinical presentation commonly seen in adults, and the functional impairments that can occur with ADHD in day-to-day life. Finally, we share a description of our adult ADHD medication management program, which is dually managed by the Psychiatry and Pharmacy Departments. The program is an example of a care model that provides safe and effective care that is accessible, efficient, and well monitored. We believe this program has the potential to greatly enhance the patient care experience.

## REVIEW OF LITERATURE

## Diagnosis of Attention-Deficit/Hyperactivity Disorder

The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V) diagnostic criteria for ADHD are used in both children and adults. These criteria include a persistent pattern of inattention and/or hyperactivity-impulsivity symptoms that clearly interfere with development and have a direct negative impact on, or reduce the quality of, social, academic, or occupational functioning. In Table 1, the symptoms of ADHD are divided into 2 criterion domains: Inattention (criterion A1)

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**Table 1. DSM-V diagnostic criteria for attention-deficit/hyperactivity disorder (ADHD)<sup>10</sup>**

ADHD predominantly inattentive symptoms (criterion A1)	ADHD predominantly hyperactive-impulsive symptoms (criterion A2)
Fail to give close attention to details or make careless mistakes	Fidget with hands or feet or squirm in chair
Have difficulty sustaining attention in activities	Difficult staying in seat appropriately
Do not appear to listen (mind seems elsewhere)	Run about or climb excessively; extreme restlessness in adults
Do not follow through with instructions	Have difficulty engaging in activities quietly
Have difficulty organizing tasks or activities	Act as if "driven by a motor"
Avoid or dislike tasks requiring sustained mental effort	Talk excessively
Lose things necessary for tasks	Blurt out answers before questions are completed
Are easily distracted	Have difficulty awaiting turn
Are forgetful in daily activities	Interrupt or intrude upon others

DSM-V = Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition.

and hyperactivity/impulsivity (criterion A2). There are 3 presentation types: Predominantly inattentive (patient meets criterion A1 only), predominantly hyperactive/impulsive (patient meets criterion A2 only), and combined type (patient meets both criteria A1 and A2). For a diagnosis of ADHD, whether in childhood or adulthood, symptoms must have emerged before age 12 years, and symptoms must be present in 2 or more settings (ie, school, home, work, with friends or relatives, or other activities) for at least 6 months.<sup>10</sup> In adults, ADHD is more likely characterized by symptoms of inattention rather than overt manifestations of hyperactivity or impulsivity.<sup>11</sup> In addition, the DSM-V requires fewer symptoms to establish a diagnosis of ADHD in individuals older than 17 years; adults need just 5 of 9 criteria in either inattention or hyperactivity/impulsivity criterion areas instead of the 6 of 9 criteria used for children and adolescents. There are also modifiers to indicate severity or whether the disease state is in partial remission.<sup>10</sup>

### Clinical Presentation and Impact of Impairment

Adult ADHD is often comorbid with other psychiatric disorders. In US samples, adults with ADHD were more likely than adults from the general population to have co-occurring psychiatric disorders, including mood disorders, anxiety disorders, any substance use disorder, or intermittent explosive disorder. The rate of comorbid psychiatric disorders in adults with ADHD tends to increase with age.<sup>4,12,13</sup> Many times, adults with ADHD are diagnosed and treated for a comorbid condition, but the ADHD goes unrecognized or untreated. Adults with ADHD also are at higher risk of having comorbid medical disorders, such as obesity, sleep disorders, asthma, and migraines.<sup>14</sup> Because of the impact of ADHD symptoms on the management and outcomes of medical illnesses, these patients require careful lifestyle and medication management.

In adults, ADHD is characterized by symptoms of inattention, impulsiveness, restlessness, deficits in executive functioning (self-directed actions needed to choose goals and to create, enact, and sustain actions toward those goals), and emotional dysregulation. Adults are challenged with staying on task for sustained periods, organizing activities, or prioritizing responsibilities, which can manifest as being forgetful or struggling with time management; these symptoms may be markedly obvious in their work and personal lives.<sup>10</sup> Adults with ADHD may struggle with

meeting deadlines, and inattentive symptoms can be related to driving errors, speeding, and having traffic tickets.<sup>15</sup> Some adults present with impairment only later in life when confronted with new or increasingly complex tasks that characterize adulthood and cannot be managed with their existing capacity for executive functioning. A systematic review shows that adults with ADHD had higher levels of unemployment compared with control groups and had an increased risk of accidents, trauma, and workplace injuries.<sup>16</sup> They also exhibited workplace impairment, reduced productivity, and reduced educational achievement as well as increased substance abuse rates and criminal behavior. Adults who have abused substances may have struggled with their impairment and have developed poor coping strategies, including a desire to self-medicate or seek external substances for relief.<sup>17</sup>

## DESCRIPTION OF PROGRAM

### Utility of Medication Management Program

Given that ADHD in adulthood is associated with a substantial impairment in occupational, academic, and social functioning, we have created an adult ADHD-specific program to accurately and efficiently identify potential cases of ADHD and to subsequently provide safe and effective pharmacologic management to patients with ADHD with the assistance of the pharmacist under a physician's supervision. This program was created after clinicians and administrators in the adult psychiatry clinic identified specific areas of patient care that would be amenable to such a novel design that would offer improved patient access and efficiency in patient panel management. This program is in addition to the health education and therapeutic programmatic options offered in our clinic that attempt to assist patients with some of the functional challenges associated with ADHD.

The program has several potential areas that could improve care for patients, including the following:

- a standardized protocol for assessment, referral, and follow-up
- closer monitoring and titration of controlled medications
- minimizing the potential for misuse or abuse of controlled medications through effective screening measures and use of a stimulant treatment contract to clearly communicate goals of treatment and appropriate management of controlled substances
- assessing patient response to various stimulant and nonstimulant medications

- providing safe and effective treatment by following standard-of-care interventions<sup>18</sup>
- increasing clinic efficiency.

### Program Structure and Eligibility

Figure 1 details the workflow for program operations. The design of the program was based on clinical management recommendations and clinic needs.<sup>18,19</sup> The program is designed to have 1 or 2 pharmacists assisting 13 to 14 physicians with the initiation and management of stimulant medications. Patients are referred to this program by their treating psychiatrists. Management of stimulant medications is done by the pharmacist via telephone, video, or office visits.

For eligibility, the patient must be a current Health Plan member and have an established clinician in the group practice. The exclusion criteria for the program include pregnancy or breastfeeding, long QT syndrome, uncontrolled hypertension,

history of cardiac problems (broadly defined to maximize patient safety) or family history of sudden cardiac death at a young age, bipolar disorder, psychotic illnesses, acute suicidality, acute or uncontrolled depression or anxiety, continued use of cannabis and unwillingness to stop, current substance abuse or treatment or recent history of substance abuse with less than 12 months sobriety, traumatic brain injury within the last 12 months, and patient unwillingness to sign the stimulant treatment agreement. The stimulant treatment agreement (contract) lays out specific risks of stimulant medications, stresses their appropriate management in terms of taking as prescribed and not diverting medication, allows for repeated urine drug screens if needed, and underscores that misuse of medications may result in stoppage of further prescriptions.

Exceptions to the enrollment criteria can be made under several circumstances. If the patient has a history of cardiac problems, s/he needs an electrocardiogram performed and clearance by a cardiologist. If the patient has a history of acute or uncontrolled depression or anxiety, s/he can start stimulant treatment concomitant with antidepressant medication if the supervising physician deems that the benefits outweigh the risk. Patients declining pharmacologic treatment of depression or anxiety but actively working with therapists or attending groups are considered for enrollment. If the patient is currently using cannabis and is willing to stop, that individual may be enrolled in the program but must have a negative urine drug screen before the next refill. If the urine drug screen is positive, the patient is offered nonstimulant treatment options. If the patient refuses these options, his/her care returns to the referring psychiatrist. Patients with traumatic brain injury within the last 12 months can be enrolled in the program if cleared by a neurologist.

California's prescription drug monitoring program, CURES (Controlled Substance Utilization Review and Evaluation System), is used to review dispensations of controlled substances in the state with each new controlled prescription order and to document findings (per state law). If there are discrepancies, findings are routed to the referring clinician to determine next steps before the patient is enrolled in the program.

### Program Workflow

The program workflow includes 3 phases. During the initial assessment phase (phase 1), patients must submit a urine drug screen sample, complete the Conners Continuous Performance Test, third edition (CPT 3) and computerized testing of attention and concentration (MHS Scoring Software, version 5.7.0, Multi-Health Systems Inc, Toronto, Ontario, Canada), and have an intake visit with a psychiatrist. If the physician, after clinical evaluation, makes a diagnosis of ADHD and rules out other comorbid conditions and the patient does not meet any of the exclusion criteria mentioned earlier, s/he can be referred to the pharmacist-managed ADHD Medication Management program. If the referring psychiatrist deems that the patient is at risk of substance abuse, s/he indicates that the patient is to be prescribed a nonstimulant medication only. If being treated with stimulant medication, patients are asked to sign a stimulant treatment agreement. This agreement reiterates the basic requirements of

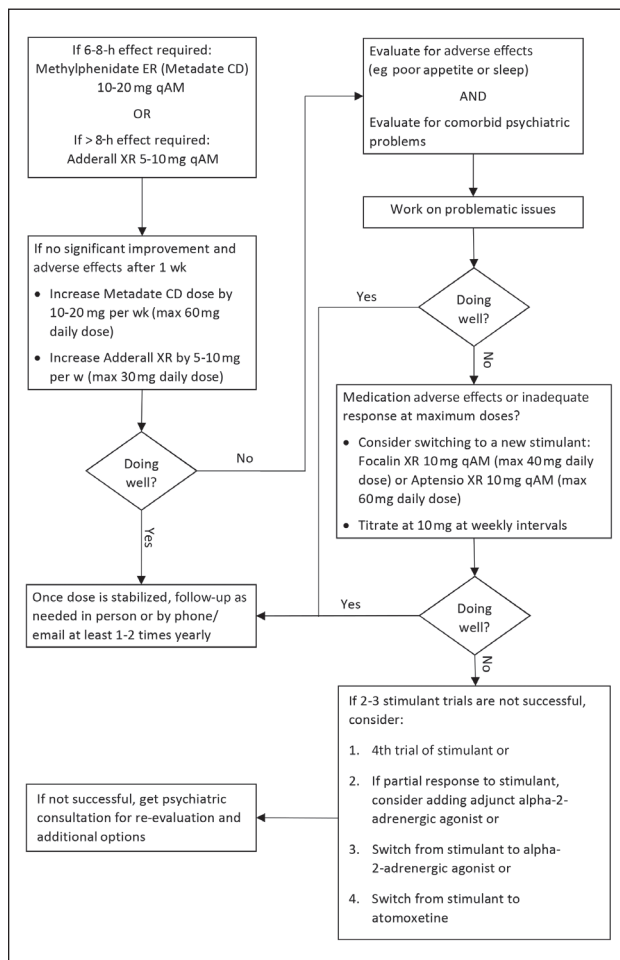


Figure 1. Medical algorithm for adult attention-deficit/hyperactivity disorder medication management program.

Adderall = brand name of amphetamine and dextroamphetamine; Aptensio = brand name of methylphenidate hydrochloride; ER = extended release; Focalin = brand name of dextmethylphenidate; qAM = every morning; XR = extended release.

continuing in the medication management program, appropriate management of a controlled substance, and reasons a patient may be discharged from the program (eg, urine drug screen positive for an illicit substance).

The initiation/titration phase (phase 2) includes a visit with the pharmacist via a telephone, video, or office visit, at which the goals of treatment are solidified. If the patient is being treated with a stimulant medication and the stimulant treatment agreement was not previously completed, the patient is asked to sign the agreement. A urine drug screen and vital signs, including weight, heart rate, and blood pressure, are obtained before the patient starts treatment with the medication. Medication regimens are started on the basis of the goals of treatment, and doses are titrated until a stable dose of medications is reached within the range of dosing approved by the US Food and Drug Administration for each medication (Figure 1). It is recommended that patients have monthly visits (phone or video, or email in exceptional circumstances) until they are receiving a stable dose of their medications.

The third phase involves treatment maintenance and monitoring. Patients are monitored on a yearly basis at a minimum by the pharmacist, who can consult with the referring psychiatrist if new symptoms arise or if a diagnosis reevaluation is needed. All patients receiving stimulants, atomoxetine, or  $\alpha_2$  agonists in the titration phase will have routine vital signs taken (blood pressure, pulse, and weight) until the dose of their medication stabilizes. After dose stabilization, patients have their vital signs checked annually. These vital signs can be completed by attending in-person appointments with their psychiatrist or the pharmacist at the outpatient clinic of the group practice, being seen at another appointment in another specialty, or blood pressure check appointments with their primary care office. A urine drug screen sample is collected before the first treatment visit and annually while the patient is in the ADHD medication treatment program. Patients may have additional urine drug screen samples collected randomly during treatment if the pharmacist believes it is clinically indicated. After the dose of medication remains stable for 6 months, the pharmacist will continue to follow-up with the patient at least once yearly.

## DISCUSSION

The goals of this medication management program include providing safe and effective care to adult patients with ADHD with the assistance of the pharmacist under supervision of a physician. Another goal is to ensure improved access and closer follow-up of adult patients with a diagnosis of ADHD.

The program has multiple benefits, including a standardized protocol for assessment, referral, and follow-up as well as closer monitoring and titration of controlled medications and minimizing the potential for abuse of controlled medications. Other benefits include assessing the responsiveness to various stimulant and nonstimulant medications for patients with ADHD; providing safe and effective treatment by following standard-of-care interventions; and increasing the efficiency of the clinic. Pharmacist management of patients in phases 2 and 3 of the program using highly efficient phone, video, and/or office visits greatly

unloads controlled substance refills from a physician's workload and provides an alternative point of contact in the clinic for these patients. Management is distributed across several psychiatrists in the clinic, which enhances the psychiatrists' ability to focus clinical efforts on higher acuity patients and more urgent patient management.

Potential limitations of this model that will require future evaluation include the interappointment intervals, patient satisfaction with the model in the long term, the frequency of need for psychiatrist consultation/intervention, and the long-term cost-effectiveness in our health care system and in other systems of care where staff funding may originate from various sources.

## CONCLUSION

ADHD is one of the most common neuropsychiatric disorders in childhood and adolescence and often persists in adults. Many studies have reported that ADHD in adults is often underdiagnosed and untreated,<sup>5</sup> with common symptoms of inattention, impulsivity, restlessness, and impairment in executive function. Given the major struggles that an adult with ADHD faces, it is imperative to have a program and workflow that adequately address the needs of this patient population. We believe that the Adult Psychiatry/Pharmacist ADHD Medication Management Program optimally standardizes the protocol for assessment, referral, and follow-up for patients with ADHD and will greatly enhance the patient care experience in multiple facets. With improved access and closer monitoring and administration of controlled medications, it should provide a safe, efficient, and effective system for identifying adult patients with undiagnosed and untreated ADHD, as well as allowing appropriate follow-up and monitoring for ongoing treatment. Patient satisfaction and other potential benefits are being evaluated and present future opportunities for study and program refinement. ♦

## Disclosure Statement

*The author(s) have no conflicts of interest to disclose.*

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## Pharmacopoeia

A uniform system of preparing, and compounding medicines, throughout the United States, would contribute much to the satisfaction of the practitioner ... . The traveler finds different preparations, under the same name, in almost every village, town, or city ... for multifarious are the names of medicines, that a name which is common to one town may be unknown in another, or what is worse, be applied to a very different medicine. Therefore, Resolved, that it is expedient that a Pharmacopoeia should be formed for the use of the United States.

— Anderson L, Higby CJ. The spirit of voluntarism: a legacy of commitment and contribution : the United States pharmacopoeia 1820-1995

# Rapid Induction Therapy for Opioid-Use Disorder Using Buprenorphine Transdermal Patch: A Case Series

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## ABSTRACT

**Introduction:** Opioid dependency is a major epidemiologic problem with profound morbidity and mortality. Despite the availability of effective treatments, there are often overwhelming barriers to those treatments.

**Case Presentations:** We present a case series involving a novel approach to the induction phase of buprenorphine or buprenorphine-naloxone therapy using transdermal buprenorphine. This approach has been demonstrated in inpatient settings but has not been widely explored in the outpatient setting. We demonstrated that a range of patients, from the highly medically complex to relatively straightforward cases, benefited from this approach.

**Discussion:** We believe that this approach can be used in a wide range of patients to transition from opioid use to buprenorphine therapy without the patient having to experience withdrawal or wait to start treatment. This should reduce the risk of lack of return for follow-up as well as decrease the dropout rate caused by patients being unable to tolerate withdrawal symptoms.

## INTRODUCTION

Opioid dependency is a serious, life-threatening, and costly problem. There are highly effective tools for treating and managing opioid dependency, but there are major barriers to getting patients to a stable regimen of treatment. One of the best approaches for many opioid-dependent individuals is buprenorphine or buprenorphine-naloxone maintenance therapy.<sup>1</sup>

Buprenorphine is a partial agonist with a high affinity at the  $\mu$  receptor. As such, if a person is currently intoxicated with opioids and ingests buprenorphine, that individual will go into precipitated withdrawal. This is a particularly acute problem in those who are using longer-acting opioids such as methadone.<sup>2</sup> Precipitated withdrawal symptoms are not only uncomfortable but also often scare the patient away from further treatment with buprenorphine-naloxone and eliminate this viable path to a greatly improved life.<sup>3</sup> There is also concern on the part of clinicians that they will have to manage precipitated withdrawal, affecting the likelihood that they will offer buprenorphine to their patients. To avoid this phenomenon, patients must be no longer taking opioids or be in substantial withdrawal before starting buprenorphine therapy.

Often, during the attempt to have the patient enter moderate opioid withdrawal to be induced with buprenorphine-naloxone therapy, the severity of opioid withdrawal symptoms leads to opioid relapse. The relapse event has a high risk of accidental overdose.<sup>4</sup> Paradoxically, the attempt to treat the condition may actually increase the mortality risk. Hence, a more reliable and safe method for induction therapy is needed.

Kornfeld and Reetz<sup>5</sup> published the idea of using a buprenorphine transdermal patch to “induce” patients in the inpatient setting to buprenorphine treatment. There is an additional case report on inpatient induction therapy with transdermal buprenorphine by Raheemullah and Lembke<sup>6</sup> in 2019. We have used variants of these protocols in a number of cases in both the inpatient and outpatient settings.

The following is a summary of 5 of those cases. Our goal in presenting these cases is to encourage the use of this approach. It is our belief that this approach to induction obviates the need to have a patient in withdrawal to start buprenorphine treatment. It also opens the possibility of starting a buprenorphine regimen at the point of intake even if the patient has used opioids in the parking lot on the way into the clinic. This approach will allow a more comfortable transition, will decrease the likelihood of patients avoiding the withdrawal process and not attempt to get on a buprenorphine-naloxone regimen, and will allow us to treat individuals who cannot emotionally or physically tolerate withdrawal. Furthermore, it will allow induction therapy to start immediately after the patient presents to the physician regardless of the patient’s withdrawal status.

The goals of the approach are as follows:

- more successful buprenorphine-naloxone induction dosing
- reduced number of failed attempts for induction therapy
- reduced precipitated withdrawal symptoms during induction therapy
- reduced risk of precipitated withdrawal relapse and accidental overdose.

This report is important because it presents this approach to buprenorphine induction therapy in both the inpatient and outpatient settings. Most inductions of buprenorphine treatment are performed in the outpatient setting.

## CASE PRESENTATIONS

### Case 1

A 63-year-old woman with spinal muscle atrophy was bed-bound, had a tracheostomy, and used a percutaneous endoscopic gastrostomy (PEG) tube for feeding. She was dealing with a bedsore and associated osteomyelitis that had not healed because of her lack of mobility. The patient was receiving hydromorphone,

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4 mg every 3 hours, via the PEG tube and fentanyl, 100 µg/d, via a patch to manage her ongoing pain. However, the palliative care team noted that she was overusing her opioids and had at times in the past had multiple practitioners supplying opioids, and the team members realized she had an opioid-use disorder. On a deeper review of the medical record, it was noted in 2003 that the patient had a history of “alcohol abuse” (term used by the patient at the time) resulting in liver damage. Also noteworthy was that in 2003 she was assaulted by her reportedly intoxicated husband while she was wheelchair bound.

The treatment team (palliative care, addiction specialists, and a standing group that reviews cases) convened and then met with the patient to offer a pain management plan that would be safer in opioid exposure and less likely to cause continuing and increasing opioid tolerance. It was clear that she had a substantial opioid-use disorder. Furthermore, in the case of a patient who

may ultimately die of respiratory failure, ongoing full-agonist opioids are not an optimal approach. The team implemented the management plan in the hospital (Table 1).

In this case we used a relatively high-dose buprenorphine patch (20 µg), beginning on day 2, because the patient was on a notably high morphine milligram equivalent at the start of the induction phase. The patient’s dose of hydromorphone was reduced on day 2 to 4 mg every 4 hours and continuously tapered every day thereafter. Sublingual buprenorphine was added to the regimen on day 4. By day 8, the patient was able to remove the buprenorphine patch and to discontinue hydromorphone therapy. The patient remained stable on a regimen of buprenorphine-naloxone sublingual film and tapered the dose from 16 mg to 12 mg at 6 months after induction.

This patient did remarkably well over the longer term. One of her home care physicians noted:

Table 1. Timeline for case 1			
Relevant medical history and interventions			
A 63-year-old woman presented with a history of alcohol- and opioid-use disorders and spinal muscle atrophy. She was bedbound with bedsores and associated osteomyelitis; tracheostomy and PEG tube feeding. She had been receiving hydromorphone, 4 mg every 3 h, via PEG tube and transdermal fentanyl, 100 µg/d.			
Date	Summaries from initial and follow-up visits	Diagnostic testing	Interventions
3/18/2018	Patient was admitted to the hospital	ALT, 11 U/L; AST, 14 U/L; ALP, 70 U/L	None
3/19/2018	Patient was seen by the addiction medicine group. Patient agreed to start buprenorphine maintenance therapy using buprenorphine transdermal patch	None	None
3/20/2018	None	None	Discontinued use of fentanyl patch; continued IV hydromorphone treatment, 4 mg every 3 h
3/21/2018	Patient reported no nausea and vomiting and was getting tube feedings. Patient asked for more pain medication	None	Started transdermal buprenorphine, 20 µg; decreased hydromorphone dosing frequency to 4 mg every 4 h IV
3/22/2018	Patient requested discharge from hospital and was discharged. Attending physician noted: “Her pain is surprisingly under control despite being off fentanyl patch and weaned [off] her Dilaudid [hydromorphone].”	None	Continued buprenorphine 20-µg transdermal; decreased hydromorphone to 4 mg every 5 h IV
3/23/2018	In outpatient setting patient had excessive saliva accumulation with sublingual buprenorphine (Subutex) pills because of underlying swallowing impairment. She was switched to a regimen of buprenorphine-naloxone (Suboxone) sublingual film, 2 mg twice daily.	None	Continued buprenorphine 20-µg transdermal patch. Decreased hydromorphone to 4 mg every 6 h IV; started buprenorphine-naloxone, 2 mg, sublingually twice daily to determine if patient could tolerate sublingual regimen
3/24/2018	None	None	Continued buprenorphine 20-µg transdermal patch. Decreased hydromorphone to 3 mg every 6 h. Once patient tolerated buprenorphine-naloxone sublingually, received 4 mg twice daily
3/25/2018	None	None	Continued buprenorphine 20-µg transdermal patch; decreased hydromorphone to 2 mg every 6 h; once patient tolerated buprenorphine-naloxone sublingually at twice daily, received 4 mg 4 times daily
3/26/2018	None	None	Continued buprenorphine 20-µg transdermal patch; continued sublingual buprenorphine-naloxone, 4 mg 4 times daily; decreased hydromorphone dose to 2 mg every 12 h
3/27/2018	None	None	Once patient tolerated new sublingual buprenorphine regimen, received 4 mg 4 times daily and removed buprenorphine 20-µg transdermal patch. Discontinued use of hydromorphone
September 2018	Patient remained stable on regimen of buprenorphine-naloxone sublingual films	None	Tapered dose of buprenorphine-naloxone sublingual films from 16 mg/d to 12 mg/d

ALP = alkaline phosphatase; ALT = alanine aminotransferase; AST = aspartate aminotransferase; IV = intravenous; PEG = percutaneous endoscopic gastrostomy.

*I am pleasantly shocked that she is doing so well. A social worker following her [up] from home health just checked in yesterday and notes a large difference in her well-being on buprenorphine-naloxone. [Another home care physician] was also equally shocked. I am so glad we did this.*

## Case 2

A 58-year-old married man with a history of alcohol addiction from his 20s to his 50s presented to our addiction medical clinic in 2012. He had an average daily intake of 20 to 23 of the hydrocodone-acetaminophen tablets (10/325 mg), which were prescribed for his foot and leg pain. We had him go through the standard withdrawal and induction protocol for buprenorphine-naloxone. He started at a daily dosage of 8 mg and 2 mg, respectively, but because he was taking carbamazepine (Tegretol) and likely was not getting enough effect from the buprenorphine-naloxone, the buprenorphine-naloxone dose was raised to 16 mg daily. He remained in remarkably stable condition for 5 years.

In late 2017, he fell off a ladder and fractured his foot. His foot required surgical repair with hardware placement, and the surgical team stopped his buprenorphine-naloxone maintenance therapy and went back to full-agonist opioid therapy. Subsequently, his physicians were unable to wean him off the morphine and oxycodone-acetaminophen for more than 6 months. The physicians managing his pain medications asked for our help. At the time the patient was taking 1 oxycodone-acetaminophen tablet (10/325 mg) daily and morphine at a dosage of 15 mg twice a day. He had been attempting to taper off the opioid regimen but was having too much pain and withdrawal.

The patient was given a buprenorphine transdermal patch (10 µg/h) on day 1. The opioid-tapering plan, which was to begin

on day 2, is shown in Table 2. However, the patient did not take the full dose of morphine on day 1 as recommended and had uncomfortable withdrawal symptoms. Specifically, the patient reported in a message to the prescriber that he had chills, low energy, and poor appetite. By later that day, however, he had taken 15 mg of morphine and was feeling better.

Ultimately the patient returned to his original buprenorphine-naloxone dosage of 8/2 mg twice daily. After the transition back to buprenorphine-naloxone, the patient reported in a scheduled phone visit that he was having “an amazing day” and later emailed.

*Just an update, the [buprenorphine-naloxone] is working great. My pain is less than when I was on the morphine and [oxycodone-acetaminophen]. It's unbelievable. My mood is better, and I can even walk better.*

The patient continued to do well on buprenorphine-naloxone maintenance therapy and returned to his baseline in compliance. He continued to have mechanical issues and some pain in his foot but was not using opioids for more than 3 months. At that time, he had to return to the hospital for further surgery and was restarted on an opioid regimen.

## Case 3

A 56-year-old man had a long history of opioid dependency. He had been in prison for 20 years and after his release returned to heroin use. He entered a methadone maintenance treatment program and was given up to 30 mg of methadone daily when he decided to try to take buprenorphine-naloxone instead. By that point he had been receiving methadone for 3 weeks. He entered our clinic about 48 hours after his last dose of methadone. On the intervening days he had been using kratom (*Mitragyna speciosa*), which has similar effects to opioids.

**Table 2. Timeline for case 2**

### Relevant medical history and interventions

A 58-year-old married man presented with a history of alcohol addiction and with average intake of hydrocodone-acetaminophen prescribed for foot and leg pain. He had previous induction and maintenance of buprenorphine-naloxone for 5 years until he injured his foot and required surgery and opioid analgesia. He was unsuccessful in weaning off morphine and oxycodone because of pain and withdrawal symptoms.

Day	Summaries from initial and follow-up visits	Diagnostic testing	Interventions
3/20/2018	Patient agreed to try using transdermal buprenorphine	None	Started use of buprenorphine 10-µg/h transdermal patch; continued morphine regimen at 15 mg twice daily; continued 1 oxycodone-acetaminophen (10/325 mg) tablet daily
3/21/2018	Patient messaged physician about pain, diarrhea, chills, low energy, and poor appetite	None	Continued transdermal buprenorphine patch; continued morphine, 15 mg twice daily; discontinued oxycodone-acetaminophen
3/22/2018	Patient reported “amazing day”; that morning took 2 mg of sublingual buprenorphine-naloxone (Suboxone) and was able to sleep. Pain was tolerable. He stated: “Best it's been since September [6 months].”	None	Continued transdermal buprenorphine patch; continued morphine, 15 mg, but once daily; started sublingual buprenorphine-naloxone, 8/2 mg twice daily
3/23/2018	None	None	Continued transdermal buprenorphine 10 µg/h patch; discontinued morphine; continued sublingual buprenorphine-naloxone, 8/2 mg twice daily
3/24/2018	Patient stated: “The Suboxone is working great. My pain is less than when I was on morphine and Percocet [oxycodone-acetaminophen]. It's unbelievable. My mood is better, and I can even walk better.”	None	Continued buprenorphine 10-µg/h transdermal patch; continued sublingual buprenorphine-naloxone, 8/2 mg twice daily
3/25/2018	None	None	Discontinued buprenorphine 10-µg/h transdermal patch; continued sublingual buprenorphine-naloxone, 8/2 mg twice daily

On examination, he was in minimal withdrawal, so we believed that a standard sublingual induction dosing might induce precipitated withdrawal. He was given a buprenorphine transdermal patch, 10 µg/h, on day 1. During the next 2 days, he continued to use both kratom and heroin but by day 3 reported that he was not having any feelings of withdrawal. Three days after applying the buprenorphine patch, we added 8 mg of oral buprenorphine-naloxone to the transdermal regimen. He reported stopping use of other opioids, which was confirmed by his urine tests (of note, we cannot test for kratom). On day 4 after starting to apply the patch (day 7 off the methadone

regimen), he removed the patch and reported no withdrawal symptoms or cravings from that point. He has successfully been maintained on a sublingual regimen of buprenorphine-naloxone, 8/2 mg daily, with no ongoing issues (Table 3). As of 1 year of treatment, regular urine toxicology results have confirmed no other drug use.

Case 4

A 34-year-old single woman with a history of ankylosing spondylitis diagnosed at age 16 years was referred to the addiction medicine recovery program from our chronic pain

Table 3. Timeline for case 3			
Relevant medical history and interventions			
A 56-year-old man presented with a long history of opioid dependence. He was in prison for 20 years and on release returned to heroin use. He entered a methadone maintenance program, tapering the dose to 30 mg/d until he decided to try buprenorphine-naloxone.			
Date	Summaries from initial and follow-up visits	Diagnostic testing	Interventions
4/24/2018	Patient was in minimal withdrawal	None	On his own, patient had stopped methadone and started taking kratom ( <i>Mitragyna speciosa</i> ) to manage symptoms of withdrawal from methadone
4/26/2018	Patient reported some insomnia but no other withdrawal symptoms. Reported that "patch works and was pretty painless"	None	Patient started using buprenorphine 10-µg/h transdermal patch. He continued kratom use until next day
4/29/2018	None	None	Started oral buprenorphine-naloxone, 8/2 mg daily
4/30/2018	None	None	Discontinued buprenorphine transdermal patch

Table 4. Timeline for case 4			
Relevant medical history and interventions			
A 34-year-old woman presented with a history of ankylosing spondylitis diagnosed at age 16 years. She was referred from chronic pain treatment program. She was prescribed opioids, and her dose had escalated over time to a maximum of fentanyl, 125 µg/d transdermally, and morphine, six 15-mg tablets daily. She was unable to follow tapering plan and was using cannabis. History revealed inhalant abuse starting at age 10, which possibly increased her risk of opioid-use disorder.			
Date	Summaries from initial and follow-up visits	Diagnostic testing	Interventions
4/9/19	Addiction medicine recovery program ordered testing on the basis of a conversation with the chronic treatment program	Liver function test results within normal limits; pregnancy test was negative	None
4/10/19	Patient presented to addiction medicine recovery program. Laboratory test results were reviewed. She was cutting fentanyl patches in half to allow daily application; actual dose was 62.5 µg/d	None	Started using transdermal buprenorphine patch, 10 µg/h; continued morphine at 7.5 mg twice daily; left on fentanyl patches (62.5 µg/d)
4/11/19	None	None	Continued transdermal buprenorphine patch, 10 µ; morphine sulfate, 7.5 mg twice daily; fentanyl patch (62.5 µg/d)
4/12/19	Patient reported "pretty fine" mood with no withdrawal symptoms reported or on examination	None	Continued transdermal buprenorphine patch 10 µg, as well as morphine sulfate at 7.5 mg twice daily. Discontinued fentanyl patch
4/13/19	None	None	Continued buprenorphine transdermal patch, 10 µg; discontinued morphine sulfate. Patient took sublingual buprenorphine-naloxone tablet (2/0.5 mg) in office and another 2/0.5-mg tablet later that evening
4/14/19	None	None	Continued buprenorphine transdermal patch, 10 µg, as well as buprenorphine-naloxone sublingual tablet, 2.0 mg - 0.5 mg twice daily
4/15/19	Patient reported "a little bit" of tremors, restlessness, and decreased appetite with some pain of upper aspect of shoulder but milder pain than last time. Anxiety was less than "mild." On examination there were no physical symptoms of opioid withdrawal (no tremors or nystagmus, and pupils measured 3 mm)	None	Continued buprenorphine transdermal patch, 10 µg; removed at bedtime. Continued buprenorphine-naloxone sublingual tablet, 2.0 mg - 0.5 mg twice daily
4/16/19	None	None	Increased buprenorphine-naloxone sublingual tablet to 2.0 mg - 0.5 mg twice daily

treatment program. She had been started on opioid treatment after her ankylosing spondylitis diagnosis and had escalated her dose over time to a maximum regimen of fentanyl, 125 µg/d, transdermally and morphine, six 15-mg tablets daily. An attempt to taper her opioid doses was started at the pain treatment program, but the patient was not able to follow the plan. What triggered her referral to the addiction program was a pattern of inconsistent reports of her level of use, behaviors such as changing the fentanyl patches sooner than needed, and the use of cannabis. This pattern, combined with the team uncovering a history of inhalant abuse starting at age 10 years, indicated that she had a possible or likely substance use disorder.

We met with the patient and decided to offer her buprenorphine. During the meeting, the patient gave a more consistent picture of her actual use at the time, which was fentanyl, 62.5 µg (the patient was cutting patches in half to allow daily application) and morphine sulfate, 7.5 mg twice a day. She had, in fact, self-tapered her dose but was also running out of medication because she had not informed her physicians of her actual use pattern.

Even though she had been receiving fentanyl, it was at a lower dose than in the first case in this series, and we believed that 10 µg/h of transdermal buprenorphine would be a sufficient starting dose. We were aware that we might need to increase the dose, but determined did not need to (Table 4).

By day 4 the patient reported that she had some limited body aches but was feeling better than expected. She noted on day 14 that she was “doing great.” On each of the subsequent appointments she noted that she was more energetic and could think more clearly than she had in a long time. To date, the patient is doing well in treatment and in her personal and professional life.

### Case 5

A 72-year-old man with chronic abdominal pain had previously been in our buprenorphine-naloxone (Suboxone)

maintenance program but decided to leave the program. He returned because he felt that he might have better pain relief from buprenorphine-naloxone. We had several discussions with the patient that we did not expect the buprenorphine-naloxone to relieve his abdominal pain unless it was caused by withdrawal. During his time away from our program, the patient was getting an opioid from an Internet supplier. We believe that the name and dose of the opioid was “tapentadol 100 mg.” However, given its unregulated path to the patient, it is not clear what he was, in fact, taking. We discussed with the patient that the interaction between an unknown opioid and buprenorphine-naloxone would be hard to predict. It was our suspicion that, if this was actually tapentadol, it would have opioid properties and, when mixed with sublingual buprenorphine-naloxone, could result in precipitated withdrawal. The protocol we used is described in Table 5.

The patient continued to have abdominal discomfort, which was treated with ondansetron. He was able to discontinue his opioid use.

### DISCUSSION

The common theme of these cases is that we avoided weaning the patients off their opioids until they were comfortably on a buprenorphine regimen. This could be accomplished by slowly introducing buprenorphine during the course of 24 to 48 hours via a buprenorphine transdermal patch. This approach is not novel, but this is the first known published report in which the technique is proposed as a general method independent of setting and medical complexity. The patch eliminates the risk of precipitated withdrawal because it essentially internally cross-tapers the patient from an opioid to the buprenorphine. Mechanistically this is most likely because of the higher affinity of the buprenorphine and the slow entry into the patient’s body. As the buprenorphine diffuses through the skin, subdermal fat, into the bloodstream,

**Table 5. Timeline for case 5**

#### Relevant medical history and interventions

A 72-year-old man who presented with chronic abdominal pain, had left a buprenorphine-naloxone (Suboxone) maintenance program in the past. He returned to treatment, thinking he would have better pain relief from buprenorphine-naloxone. The patient was getting opioids from an Internet supplier—“tapentadol 100 mg”—but the treatment team was uncertain if that was the actual medication and dose.

Date	Summaries from initial and follow-up visits	Diagnostic testing	Interventions
6/3/19	Patient had already taken his morning dose of “tapentadol.” Before administration of transdermal buprenorphine patch, there were no subjective reports of withdrawal or physical symptoms of withdrawal	None	Started use of buprenorphine transdermal patch, 10 µg/h. At night took dose of “tapentadol”
6/4/19	None	None	Continued transdermal buprenorphine patch, 10 µg/h; reduced “tapentadol” dose by half
6/5/19	Patient noticed that transdermal buprenorphine patch fell off and taped it back on. Patient reported “good” mood and denied any withdrawal symptoms; physical examination findings revealed no physical symptoms of withdrawal	None	Continued buprenorphine transdermal patch, 10 µg/h; discontinued “tapentadol”
6/6/19	None	None	Continued transdermal buprenorphine patch 10 µg/h; started buprenorphine-naloxone, 8/2 mg, sublingually
6/7/19	Patient continued to have abdominal discomfort that was treated with ondansetron (Zofran), but his opioid use stabilized	None	Removed transdermal buprenorphine patch; continued sublingual buprenorphine-naloxone, 8/2 mg daily

into cerebrospinal fluid, and ultimately to the  $\mu$  receptors, it slowly displaces the other opioids, occupies the receptor, and blocks further access to other opioids. By the time we taper the patient's hydromorphone, hydrocodone, and oxycodone doses, there is a limited number of receptors for the full-agonist agents to bind to.

The lethality of opioid-use disorders need not be stated. Opioid replacement therapies greatly reduce that mortality. However, the first weeks of trying to get on a buprenorphine regimen are notably at-risk times for death.<sup>7</sup>

In the future, the use of transdermal buprenorphine to transition people from full-agonist opioids to buprenorphine or buprenorphine-naloxone may open the door to multiple applications that were previously very challenging or off-limits. The most common use would be in the buprenorphine-naïve, opioid-dependent patient who presents with too high a blood level of opioid to perform an induction at the time of presentation. For many of these patients we postpone the induction phase and hope that they will return in withdrawal so that we can perform an induction. For patients who have received buprenorphine in the past, we sometimes send them home to self-induce when they get into enough withdrawal. This approach often fails because patients are not always a good judge of when to self-induce or they simply change their minds in the face of the early discomfort of withdrawal. The potential exists to simply apply the buprenorphine patch in the office and then follow-up in the next 24 to 48 hours to initiate sublingual treatment with buprenorphine or buprenorphine-naloxone. Even if the patient continues to use opioids on those first and second days, the buprenorphine will gradually enter the body and displace the full agonists. Not only is this potentially more humane, but it also should reduce the lack of return for follow-up, which is a major issue.

Certain groups of patients in particular can benefit from this approach. Patients with chronic pain who experience terrible pain flares when they are no longer taking opioids also do not need to go through withdrawal to transition to buprenorphine treatment. This population is particularly sensitive to withdrawal and rebound hyperalgesia.

Future applications could also include opioid-dependent pregnant women who, to date, have typically been sent to a methadone clinic. Buprenorphine has been shown to be as good or better than methadone for the mother and newborn.<sup>8,9</sup> However, the withdrawal experience in pregnant women is considered a risk for fetal distress. Although we found nothing in the literature about this to date, it is logical that transdermal buprenorphine could be used to transition from full-agonist opioids because this approach does not require a withdrawal phase. This could be a radically improved approach and would limit the risk of the transition of the patient to a methadone clinic. Often methadone is administered at a self-standing

outside clinic so there is the risk of patients not presenting for follow-up. Starting buprenorphine in the clinic at the point of diagnosis would clearly improve compliance and reduce barriers to treatment.

## CONCLUSION

The use of transdermal buprenorphine is not novel. We present an expanded approach to its use in a wide range of settings and with patients who range in medical complexity. Our cases demonstrate that the approach is generalizable to many different clinical situations. It is our hope that the approach described will lower barriers and increase access to a potentially life-saving and quality-of-life-improving treatment. ♦

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# Drug-Induced Lupus, a One-time Hit or a Harbinger of Future Autoimmunity: A Case Report

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## ABSTRACT

**Introduction:** Drug-induced lupus (DIL) can comprise up to 10% of new lupus cases annually, and the list of medications associated with DIL is increasing. However, it can be difficult to recognize the connection between symptoms and a medication-induced autoimmune syndrome, which can lead to an invasive, costly workup. Given that the prognosis is usually good if therapy with the offending agent is stopped, it is important to identify this clinical entity promptly.

**Case Presentation:** A healthy, 44-year-old man with hypertension was seen initially because of shoulder pain and again after development of fevers and chest pain. He underwent a thorough infectious workup and then oncologic workup, with his clinical course complicated by a *Histoplasma* infection. After evaluation by subspecialists, the patient was thought to have an autoimmune condition related to DIL. His symptoms improved after he discontinued the offending drug therapy and received a course of corticosteroids.

**Discussion:** Our case highlights how DIL should be on the differential when seemingly disparate symptoms develop in a patient receiving DIL-associated medications. Lupus is one of the “great imitators,” in which symptoms can be ascribed to many different underlying causes. Although this patient’s presentation may have been confounded by concomitant histoplasmosis, his improvement with cessation of hydralazine treatment argues in favor of DIL. His continued atypical serologic test results could be residual from his DIL and should normalize with time. However, it raises the question whether this bout of DIL has unmasked a previously quiescent autoimmune condition, requiring continued observation.

## INTRODUCTION

Drug-induced lupus (DIL) is a condition that many physicians learn about during medical school then tend to forget. Nevertheless, several studies indicate that DIL can comprise up to 10% of new lupus cases every year, and the list of medications associated with DIL is increasing.<sup>1-3</sup> However, even when the level of suspicion for DIL is relatively high, it can be difficult to recognize the connection between symptoms and a medication-induced autoimmune syndrome. Without proper recognition of its symptoms, DIL may lead to an extensive, costly workup. Given that the prognosis is usually good if therapy with the offending agent is stopped, it is important to identify this clinical entity as soon as possible. We present a case of DIL diagnosed after an extensive workup.

## CASE PRESENTATION

### Presenting Concerns

A 44-year-old man presented to his primary care physician on July 11, 2018, for evaluation of acute-onset, right shoulder pain without any preceding trauma. The patient was vegetarian, regularly did aerobic exercise, and had no history of smoking or alcohol use. His medical history was notable only for hypertension, for which he received hydrochlorothiazide, hydralazine, and losartan. His shoulder pain was thought to be benign.

### Therapeutic Intervention and Treatment

Initially, the patient underwent a course of nonsteroidal anti-inflammatory drugs and physical therapy. His pain subsequently resolved.

### Follow-up and Outcomes

Three weeks after the right shoulder pain resolved, new intermittent pain developed in the left shoulder. Because of the severity of the pain, he had decreased range of motion and was waking up during the night. He denied any frank swelling or warmth of the joints but had noted periodic pain in the wrists (right more than left) and in his hand (distal interphalangeal joints) with range of motion. He was seen by his primary care physician and then by an orthopedic physician, who thought the hands and wrists were fine but that he may have had bilateral rotator cuff syndrome. He was offered a magnetic resonance image to evaluate for a partial tendon tear as well as a corticosteroid injection into the subacromial space, but he declined both at the time.

Given multiple joint involvement, including his hands and wrists, serologic laboratory tests were performed. The results included a normal rheumatoid factor, negative anticyclic citrullinated peptide antibody (anti-CCP), and a slightly elevated erythrocyte sedimentation rate to 39 mm/h. Bilateral shoulder impingement syndrome was diagnosed, and conservative treatment with nonsteroidal anti-inflammatory drugs, shoulder exercises, activity modification, and physical therapy was recommended. However, given the elevated erythrocyte sedimentation rate, there was a suggestion of inflammatory arthritis. A 15-day

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course of 15 mg of prednisone daily was empirically trialed, with complete resolution of the joint and muscle pain.

Shortly after having completed his corticosteroid course, the patient started experiencing periodic fevers, chest pain, and cough. An upper respiratory tract infection was diagnosed. However, because of persistent symptoms, he visited the Emergency Department. At that point, a full battery of laboratory tests was performed, and results demonstrated normal C3/C4 levels, normal aldolase level, normal rheumatoid factor, negative anti-CCP, and positive antinuclear antibodies (ANA), particularly antidouble-stranded (ds) DNA (17 IU/mL) and anti-Scl-70 (1.1 antibody index). Concurrently, procaltitonin and lactate levels were elevated to 0.17 ng/mL and 3.5 mmol/L, respectively. It was thought that he had a postviral cough, but a computed tomography (CT) scan of the chest showed esophagitis and mediastinitis. This was thought to be secondary to excessive coughing. He had a fluoroscopic esophagram, for which the results were normal. No esophagogastroduodenoscopy was done at that time, but results of an infectious disease workup were notable for a positive urine *Histoplasma* antigen. Therefore, the patient was given a trial of itraconazole therapy. He continued to have some intermittent symptoms.

A month later he also tested positive for *Coxiella* immunoglobulin M antibody, but it was unclear whether this was clinically significant. A repeated chest CT scan 1 month after the first CT showed improvement in esophagitis and mediastinitis but demonstrated small bilateral pleural effusions with normal complement levels. Additionally, a maculopapular rash developed, particularly pronounced over the dorsal aspects of the feet. It was thought to be a drug-related rash, so the patient's regimen of hydrochlorothiazide, which he took for blood pressure control, was discontinued.

Because of the patient's persistent lymphadenopathy and other systemic symptoms, an oncologic workup was also undertaken. A peripheral blood test result showed microcytic anemia. A bone marrow biopsy and positron emission tomography scan were performed. The scan showed mildly hypermetabolic sub-centimeter nodes above and below the level of the diaphragm, which the radiologist thought could be reactive. This finding was thought to be supportive of the clinical diagnosis of granulomatous infection and less likely a possible lymphoproliferative process. His flow cytometry results and bone marrow biopsy specimen were both normal.

On looking at the overall presentation along with the patient's medication list, there was concern that the symptoms could be related to DIL. An antihistone antibody was checked on October 25, 2018, and came back positive. At this point, 3.5 months after his initial presentation, the patient was presumed to have either DIL related to hydralazine use or native systemic lupus erythematosus (SLE). His hydralazine treatment was stopped, and he was started on a course of prednisone and hydroxychloroquine. His symptoms resolved. His antihypertensive medications were also switched to clonidine and chlorthalidone.

The patient had a follow-up 3 months later in the rheumatology clinic and was still feeling well. Interestingly, on March 29, 2019, the patient tested positive for lupus anticoagulant.

Although the level of his antihistone antibody was lower than before, it was still positive, as were anti-dsDNA and anti-Scl 70 antibodies. Continued follow-up with a rheumatologist is planned. The patient gave informed consent to allow publication of his case. Table 1 provides a timeline of the case.

## DISCUSSION

SLE is one of the most common autoimmune diseases. It occurs in 15,000 to 30,000 cases per year, of which approximately 10% can be related to drugs.<sup>1,3</sup> According to Xiao et al<sup>1</sup>, DIL "is the most common form of an iatrogenic autoimmune disease." Hydralazine is an antihypertensive medication that has been associated with DIL as well as antineutrophil cytoplasmic antibody vasculitis.<sup>4</sup> Iyer and colleagues<sup>5</sup> state: "Hydralazine-induced lupus syndrome was first reported in 1953. The syndrome occurs in 5–10% of patients taking hydralazine, and clinical manifestations include arthralgia, myalgia, fever, and serositis." Musculoskeletal symptoms are the most common clinical manifestations. It rarely manifests as pericardial effusion, cardiac tamponade, pleural effusion, or pulmonary edema. Iyer et al additionally note<sup>5</sup>:

*After the publication of the African-American Heart Failure trial [in 2004], there was a significant increase in the amount of hydralazine prescribed to patients with heart failure. ... Risk factors that have been linked to hydralazine-induced lupus include high daily doses (> 200 mg/d), slow acetylator status, HLA-DRw4 phenotypes, therapy longer than 3 months, female sex, and a family history of autoimmune disease.*

In about 95% of patients with DIL, the serum is positive for ANA; however, ANA-negative DIL, although rare, has been described.<sup>5</sup>

Both DIL and SLE are ANA positive. Although antihistone antibodies are classically associated with DIL, they have poor specificity because they can occur in up to 50% of patients with SLE as well as in other rheumatic diseases such as scleroderma or rheumatoid arthritis.<sup>2,6</sup> Surprisingly, not all forms of DIL are created equal, as antihistone antibodies have been detected in 32%, 42%, and less than 50% of DIL associated with minocycline, propylthiouracil, and statins, respectively.<sup>2</sup> According to Araújo-Fernández et al<sup>2</sup>:

*The presence of anti-Smith antibodies is almost exclusively found in idiopathic SLE [but is rarely found in DIL]. ... Antiphospholipid antibodies and lupus anticoagulant have been described in some cases of DIL. ... Curiously, serologic abnormalities, especially antihistone antibodies, may persist much longer than the symptoms of DIL, which resolve over days or weeks after drug discontinuation.*

There are multiple theories as to how hydralazine induces DIL. Per Kumar et al<sup>4</sup>:

*[it] is known that hydralazine tends to accumulate in the intracytoplasmic neutrophilic granules. This accumulation leads to binding to myeloperoxidase, which leads to release of cytotoxic products and cell death. Once the neutrophils have undergone cell death, antigens that are normally sequestered are exposed, enabling uptake by antigen-presenting cells and production of antineutrophil cytoplasmic antibodies.*

Other hypotheses that have been proposed regarding how hydralazine can cause an autoimmune response include "increased expression of neutrophil autoantigens through the reversal of

**Table 1. Timeline of the case**

Date	Summaries from initial and follow-up visits	Diagnostic testing	Interventions
7/11/18	Patient saw PCP because of right shoulder joint pain for past wk	Physical examination	Diagnosed with shoulder impingement syndrome; pain resolved with PT
7/23/18	Patient had left hand and left shoulder pain	Hand radiographs, serum ESR, RF, and anti-CCP	Diagnosed with de Quervain tenosynovitis of left hand. Advised to continue PT and take naproxen
7/24/18	ESR elevated at 39 mm/h, thought to be caused by inflammatory reaction to shoulder impingement. Normal RF and anti-CCP levels. Results of hand radiographs were normal	Physical examination	Advised to continue PT and to follow-up with orthopedic physician, who thought he had rotator cuff syndrome
8/6/18	Continued to have bilateral shoulder, hand, and knee pain. No frank joint swelling. Declined subacromial cortisone injections. Rheumatologist believed that elevated ESR and multiple joint pains were suggestive but not diagnostic of inflammatory arthritis. Patient was also having fatigue	Results of radiographs of shoulders were unremarkable Physical examination showed skin mottling on palms	Referred to rheumatologist Advised continued NSAIDs, PT, and activity modification. Also recommended evaluation for OSA
8/10/18	Polysomnogram completed and OSA diagnosed	None	Provided CPAP machine
8/16/18	After 6 wk of body aches, he was now having right-sided chest wall pain and bilateral thigh pain	Creatine kinase level elevated. ANA panel positive for antidouble-stranded DNA and anti-Scl 70	Continued observation
8/20/18	Saw PCP because of cough, diagnosed as postviral	Physical examination	Follow-up as needed
8/22/18	Continued to have bilateral shoulder and thigh pain. Ordered 15-d course of prednisone, 15 mg daily	Physical examination	Patient's pain completely resolved after 3 d, and he stopped taking prednisone
8/29/18	Patient admitted to hospital for treatment of sepsis after 2 wk of cough and 1 day of chest pain. Recent travel to western Canada. Started treatment with ampicillin-sulbactam (Unasyn)	CT angiogram of chest to rule out pulmonary embolism revealed esophagitis/mediastinitis	Continued antibiotics. Infectious disease specialist checked serologic test results for <i>Coccidioides</i> , HIV, C3, C4, and aldolase, and urine <i>Histoplasma</i> antigen
8/30/18	Patient had normal C3, C4, and aldolase levels. Procalcitonin level was elevated	Physical examination	Continued treatment of presumed bacterial infection
9/7/18	Seen by infectious disease specialist because of low-grade fevers, persistent cough, and red nodular rash on feet. Urine <i>histoplasma</i> antigen was positive	Extensive fungal laboratory tests, including testing for <i>Aspergillus</i> and <i>Histoplasma</i> culture, ordered	Started on short course of itraconazole
9/24/18	Follow-up CT scan of chest consistent with granulomatous mediastinitis	Physical examination	Advised having PET scan to further characterize abnormality
9/28/18	PET scan showed interval decrease in mediastinitis but showed large lymph nodes above and below the diaphragm	Physical examination	Referred to oncologist
10/2/18	Oncologist evaluated patient for lymphadenopathy (thought possibly caused by lymphoma vs histoplasmosis)	Diagnostic bone marrow biopsy performed	Follow-up with PCP
10/15/18	Bone marrow negative for malignancy. Patient was having night sweats with cough. Serum protein electrophoresis showed MGUS. Violaceous macular rash developed on chest and back	Physical examination	Referred to pulmonologist
10/16/18	Pulmonologist evaluated patient. Patient had been receiving hydrochlorothiazide, hydralazine, and losartan for > 10 y	PFT results normal	Continue benzonatate (Tessalon Perles) for relief of cough. Antihistone antibody checked
10/25/18	Antihistone antibody positive. Possibly had drug-induced lupus. Hydrochlorothiazide and hydralazine regimen stopped. If no improvement, he would get long course of histoplasmosis treatment	Physical examination	Follow-up with PCP
11/2/18	For BP control, he was started on clonidine patch and chlorthalidone regimen. Still was having right wrist pain	Physical examination	Follow-up with rheumatologist
12/17/18	Rheumatologist recommended trial of hydroxychloroquine (Plaquenil) and prednisone taper for treatment of drug-induced lupus	Physical examination	Most symptoms resolved with prednisone dose taper. Follow-up with rheumatologist
3/29/19	Came in for follow-up with rheumatologist. Found to test positive for lupus anticoagulant	Repeated ANA panel and antihistone antibody	Antidouble-stranded DNA and anti-Scl 70 still elevated. Antihistone antibody still elevated but lower. Routine rheumatology follow-up advised

ANA = antinuclear antibody; anti-CCP = anticyclic citrullinated peptide; BP = blood pressure; CPAP = continuous positive airway pressure; CT = computed tomography; ESR = erythrocyte sedimentation rate; MGUS = monoclonal gammopathy of uncertain significance; NSAIDs = nonsteroidal anti-inflammatory drugs; OSA = obstructive sleep apnea; PCP = primary care physician; PET = positron emission tomography; PFT = pulmonary function test; PT = physical therapy; RF = rheumatoid factor.

epigenetic silencing of the *MPO* (myeloperoxidase) and *PR3* (proteinase-3) proteins encoded by the genes and “breakdown of central tolerance by drug metabolites in slow acetylators of hydralazine.”<sup>4</sup>

Because DIL is less likely to have extensive internal organ involvement, examination findings such as hepatosplenomegaly, renal problems, or neurologic findings are less common.<sup>6</sup> However, serositis can be seen. Our patient’s presentation was a little muddled because the serositis in DIL manifests as pleuritis or pericarditis, with peritonitis being less common. Mediastinitis, as our patient experienced, is unusual. However, granulomatous mediastinitis can be seen in chronic infections such as histoplasmosis or tuberculosis. Therefore, this patient’s presentation may have been confounded by *Histoplasma* infection. Typical laboratory findings in DIL include anemia, leukopenia, thrombocytopenia, elevated erythrocyte sedimentation rate, positive ANA, and positive antihistone antibodies.<sup>5</sup>

This case highlights the inherent challenge in diagnosing DIL, as with many rheumatologic conditions that generally require a pattern of signs and symptoms to evolve over time before the diagnosis becomes clear. Sosenko et al<sup>7</sup> noted that DIL diagnosis is further complicated by the fact that although there are “established criteria for the diagnosis of SLE, no formal or universal diagnostic criteria for DIL have been established. The syndrome of DIL results in symptoms” and “laboratory findings consistent with SLE,” but “these findings should be related to drug exposure.” This topic is important not only for rheumatologists but also for primary care practitioners practicing in the community, because many of the triggers of DIL are commonly prescribed. DIL can be difficult to recognize in clinical practice for a multitude of reasons: “Delayed insidious association between drug exposure and symptom onset, rapid introduction of new drugs developed with limitations in predicting their long-term effect during treatment, and lack of understanding the pathophysiologic mechanisms in DIL.”<sup>8</sup> It is interesting that the patient had chest imaging (CT) findings consistent with mediastinitis, when mediastinitis is not typically associated with autoimmune disease.

This case serves as a reminder for physicians in the outpatient clinic that rheumatologic conditions tend to declare themselves over time, as opposed to immediately displaying all the classic clinical manifestations of the disease. It will become ever more important to recognize medication-induced lupus syndromes given the expanding list of medications (some of them very commonly used) associated with DIL. Furthermore, biologics that antagonize tumor necrosis factor (TNF)- $\alpha$  have also been implicated in DIL but are being increasingly used since they were first introduced in 1998 to treat chronic inflammatory conditions such as rheumatoid arthritis and Crohn disease.<sup>1</sup> There is an inherent difficulty in distinguishing true drug-induced autoimmunity from exacerbation of preexisting autoimmunity or unmasking of a second autoimmune disease.<sup>1</sup>

Per Araújo-Fernández et al,<sup>2</sup> TNF- $\alpha$  antagonist-induced lupus syndrome (TAILS) has most commonly been associated with infliximab “because it is the most immunogenic, based on its chimeric structure and its ability to reach high tissue

concentrations.” Authors of several prospective studies have shown that ANAs develop in patients receiving treatment with anti-TNF $\alpha$  drugs.<sup>2</sup> These lupuslike syndromes develop in approximately 2 per 1000 patients receiving TNF $\alpha$  antagonists.<sup>2</sup> There are several theories why TAILS may occur. Anti-TNF $\alpha$  drugs might induce cell apoptosis, prompting release of antigenic particles as nucleosomes that may lead to formation of autoantibodies.<sup>2</sup> Alternatively, these medications may induce immunosuppression, leading to increased risk of infection and a higher bacterial DNA load that can stimulate polyclonal B-lymphocytes and induce anti-dsDNA antibodies.<sup>2</sup> Last, anti-TNF $\alpha$  medications can suppress the T-helper cell 1 immune response and favor a T-helper 2 response.<sup>2</sup> Araújo-Fernández et al<sup>2</sup> also note, “Although the development of ANAs and anti-dsDNA antibodies is higher in patients receiving anti-TNF treatment, the incidence of TAILS is low, estimated to be between 0.5 and 1.0%.” Anti-TNF $\alpha$ -induced DIL shows no important differences compared with the other drugs, so the most common symptoms still include arthritis, myositis, and serositis.<sup>2</sup>

More recently, another mechanism of autoimmunity has been proposed, called NETosis. This is a unique mechanism of neutrophil cell death that has been described in DIL. Per Vaglio et al<sup>3</sup>:

*[It is] characterized by the extrusion of a meshwork of intracellular granular proteins bound to chromatin. This process plays a primary role in the host defense against pathogens; however, enhanced formation of neutrophil extracellular traps (NETs) and delayed NET clearance has been associated with various autoimmune diseases. ... Peptidylarginine deiminase 4 (PAD4) is a calcium-dependent enzyme that mediates chromatin decondensation in neutrophils, a critical process in NET formation. In fact, hydralazine has been shown to promote NET formation via increasing intracellular calcium flux in vitro, [which activates PAD4 and triggers NET formation].*

Even after discontinuation of the offending hydralazine therapy and receiving both corticosteroids and hydroxychloroquine, the patient’s anti-dsDNA antibodies remained elevated. In some case studies there were reports of serologic samples remaining positive for up to 1 year. However, in DIL, normally antihistone antibodies are positive (although this is also dependent on the offending drug), but anti-dsDNA antibodies tend to be negative, unlike in SLE. Also, our patient not only had anti-dsDNA antibodies, which is atypical for DIL, but also recently tested positive for lupus anticoagulant. Lupus anticoagulant (a misnomer because it is actually a procoagulant but in the past interfered with coagulation-measuring assays) is one of the antiphospholipid antibodies that can be found even in healthy individuals. However, lupus anticoagulant can be positive in idiopathic SLE or can develop as a result of certain drug exposures. Although ANAs and antihistone antibodies are commonly associated with DIL, antiphospholipid antibodies are relatively rare in hydralazine-induced lupus.<sup>9</sup> Our patient’s symptoms were ascribed to hydralazine-induced lupus syndrome, but perhaps the hydralazine served to unmask undiagnosed idiopathic SLE in this patient because the anti-dsDNA antibodies and presence of lupus anticoagulant are atypical in DIL.<sup>10-12</sup> Possibly, once a patient has had a diagnosis of DIL, s/he has demonstrated a

higher propensity for autoimmunity. These patients with DIL may benefit from future monitoring for development of SLE or other autoimmune conditions.

## CONCLUSION

Rheumatic diseases are usually evolving and tend to declare themselves with time. Our patient's case highlights how DIL should be on the differential diagnosis when seemingly disparate symptoms develop in a patient receiving DIL-associated medications. The list of medications associated with lupuslike syndromes is growing, including the now popular class of anti-TNF $\alpha$  drugs. Lupus is one of the "great imitators," in which symptoms can be ascribed to many different conditions. Perhaps such a costly workup (in terms of time, cost, and invasive testing) could have been avoided or truncated had DIL been considered earlier. However, in clinical practice many mimickers of the patient's symptoms would need to be ruled out first, making a narrowed diagnostic approach even more challenging.

Although this patient's presentation may have been confounded by concomitant *Histoplasma* infection, his improvement with cessation of hydralazine therapy argues in favor of DIL. This patient's continued atypical serologic test results could be residual from his bout of DIL and should normalize with time. However, it also raises the question whether this episode of DIL has unmasked a previously quiescent autoimmune condition that would require continued observation. ❖

## Disclosure Statement

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## Remedy

All who drink of this remedy recover in a short time, except those whom it does not help, who all die. Therefore, it is obvious that it fails only in incurable cases.

— Galen of Pergamon, 130 AD-210 AD, prominent Greek physician, surgeon, and philosopher in the Roman Empire

# The Doctor's Day Off: An Encounter with Homelessness and Drug Addiction

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This graphic submission is the dramatization of a true incident. It is intended to show the shock, surprise, sadness, guilt, futility, and resignation I and many physicians feel in the face of the opioid crisis. ❖

## How to Cite this Article

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Keywords: drug addiction, homelessness, medical-industrial complex, opioid addiction, sexual assault



# Addressing the Health Needs of the Uninsured: One Community's Solution

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## ABSTRACT

**Introduction:** Providing high-quality health care to poor and uninsured individuals has been a challenge to the US health care system for decades. Often, patients do not seek care until they are in a crisis, or they seek care at a health care system while not addressing their primary care needs.

**Objective:** To report on a community that has sought to change this dynamic with the development of an all-volunteer practitioner-run clinic model.

**Methods:** Perspective on a successful volunteer-run safety-net clinic.

**Results:** Volunteers in Medicine on Hilton Head Island, SC, provides free health care, with more than 28,000 eligible patient visits annually, for the underserved population. This clinic is self-funded through donations and charity events and accepts no federal money. The patients are not asked to pay a fee for service. Most medical specialties are represented at the clinic, and many partnerships are in place for referrals for more advanced procedures such as surgery. All health care clinicians are volunteers, including physicians, nurses, dentists, and mental health professionals.

**Discussion:** The quality of care meets or exceeds national recommendations on many measurements, including mammography and Papanicolaou test screening rates.

**Conclusion:** Safety-net clinics such as Volunteers in Medicine are a needed and viable option to the provision of health care to the vulnerable, often unseen members of society.

## INTRODUCTION

Hidden among the beauty and affluence of the resort beach community of Hilton Head Island, located just off the southeast coast of South Carolina in the US, is the subpopulation of service workers who provide the labor to maintain the quality of life and vacation experience that people have come to expect. Although the average income of residents on Hilton Head Island is \$72,509, approximately 10.9% of the population lives at or below the poverty level.<sup>1</sup> The

uninsured population is estimated to be 1:5 persons.<sup>2</sup> This high rate of poverty and uninsured status has created a health care equity and access problem.

## HISTORY OF VOLUNTEERS IN MEDICINE

A chance encounter in 1993 between Jack McConnell, MD, and a hitchhiker created the knowledge of the health access gaps and sparked the vision for the establishment of a volunteer-run clinic on Hilton Head Island, SC.<sup>3</sup> The original Volunteers in Medicine (VIM) Clinic building was built on land the town of Hilton Head Island leased to VIM for \$1 per year. The initial clinic consisted of 5 paid staff members, 48 retired physicians, 74 retired nurses, and 3 dentists. The focus was primary health care. Since 1993, the clinic has experienced tremendous growth. There are now 22 full-time equivalent employees who operate the clinic with the help of 650 retired and professional volunteers. As a team, the staff and volunteers serve in excess of 3500 individual patients annually, providing more than 22,000 medical visits and 6000 dental visits. This equates to \$13 million in health care provided. VIM conservatively saves the local hospitals

more than \$2.5 million in uncompensated Emergency Department visits.<sup>3</sup>

## MISSION AND QUALITY MEASURES

The primary mission of VIM at this location is “to understand and serve the health and wellness needs of the medically underserved population and their households who live or work on Hilton Head and Daufuskie Islands.”<sup>4p1</sup> The focus is on maintaining the health of these individuals, so they remain productive members of the community. The clinic is funded through generous community donors and volunteers. The clinic does not accept any government funding. The clinic has been awarded 4-star status through Charity Navigator 5 years in a row, with 91.87% of funds going directly to patient care.<sup>5</sup> The clinic is committed to providing high-quality health care to those it serves.

## Improve the Patient Experience

The clinic is open 5 days a week with scheduled and walk-in appointments available. The care provided is holistic. Services available include primary care, dental care, vision care, and the specialties of general surgery, otolaryngology, neurology, orthopedics, endocrinology, urology, infectious diseases, gynecology, cardiology, chiropractic medicine, dermatology, gastroenterology, pediatrics, podiatry, psychiatry, mental health, pulmonology, rheumatology, imaging (radiology/ultrasonography), occupational therapy, and physical therapy. Laboratory services are available on-site and include point-of-care testing for streptococcal infection, influenza, hemoglobin A<sub>1C</sub>, international normalized ratio, urinalysis, electrocardiography, and pregnancy testing. The newest service to be provided is telepsychiatry in cooperation with the Medical University of South Carolina in Charleston (unpublished data).

Patients consistently share their gratefulness for the clinic. Some of the comments include the following<sup>6</sup>:

*Editor's note: Please also see: Let's Care for Those in Need—Today: Collaborating to Solve the Uninsured Crisis in America, by Lee Jacobs, MD (page 106); and Fostering Partnerships with the Safety Net: An Evaluation of Kaiser Permanente's Community Ambassador Program in the Mid-Atlantic States, by Lorella Palazzo, PhD; Juno Matthys; Craig Sewald, MPA; et al. (page 31)*

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Keywords: patient access, quality, safety-net clinic, volunteer health care workers

- “They really demonstrate a level of caring that goes above what you would expect from anybody.”
- “The doctors who are volunteers really took an interest in my son and his case and came up with a diagnosis.”
- “Volunteers in Medicine makes a meaningful difference in people’s lives. Without VIM’s surgical program, I probably would have been in a wheelchair for the rest of my life.”

VIM continuously gathers patient satisfaction data through focus groups and patient satisfaction survey cards.

### Improve the Health of Populations

VIM is committed to improving the health of populations as well as individuals. Intake screening questions include food security, domestic abuse and safety screening, and smoking status. Resources are available to address positive answers to

these questions, including an on-site food pantry, on-site counseling and social work services, and information about smoking cessation. VIM also strives to improve the health of populations through disease management clinics. The Wellness Program focuses on healthy lifestyle choices by offering weight management programs, free group exercise programs, cooking classes, and access to health monitoring devices such as the Fitbit (Fitbit Inc, San Francisco, CA). Other clinics include Diabetes, Hypertension, Pulmonary (sleep apnea), and Women’s Wellness. There are also a variety of complementary services such as physical therapy, chiropractic care, exercise programs, healthy eating classes, and stress management classes. With a recent upgrade to the electronic health record, implementation of a voice recording documentation system, and the employment of a full-time medical records

manager, the clinic has begun collecting data on key clinical indicators to demonstrate the quality of care being provided (see Sidebar: Proposed Key Clinical Indicators, 2019, with Benchmark Sources).

VIM provides full-service immunizations for children and has a robust influenza vaccination program. Through a partnership with Walgreens, VIM provided influenza vaccines to the adult population of the clinic. In addition, through a community partnership grant with Access Health Lowcountry in Beaufort, SC, VIM is able to provide fecal immunochemical testing to adults for colon cancer screening.<sup>7</sup> Additionally, more than 700 screening mammograms were provided, free of charge, within the Women’s Health program in 2017.

### Reduce per Capita Cost of Health care

By using a volunteer provider model of care, VIM provides more than \$13 million in health care on a \$2.3 million budget. This is accomplished in many ways. The on-site pharmacy receives discounted medications from Nashville, TN-headquartered Dispensary of Hope and other donors at a cost of approximately \$40,000, with a value of \$6.7 million in pharmaceuticals dispensed.<sup>8</sup> The Surgical Donation program, through partnership with local hospitals, has provided care to more than 200 patients, with a value exceeding \$800,000, at a cost to VIM of \$74,000, resulting in a 10-fold cost-saving factor (Table 1).

### Improve the Work Life of Clinicians and Staff

Often, the focus in health care is on the patient experience, but more recently the literature cites an additional focus toward “Improving the work life of clinicians and staff.”<sup>9</sup> This is an inherent part of the VIM philosophy. Everyone who works or volunteers at this clinic does so out of a desire to serve others. The clinic strives to provide the clinicians with support to provide high-quality care. Support includes subscriptions to UpToDate for online access to the most recent health care guidelines, on-site technical support for the electronic health record, daily team huddles to keep everyone informed of policy and care changes, interpreters to

#### Proposed Key Clinical Indicators, 2019, with Benchmark Sources

- **Blood pressure control:** Percentage of patients with hypertension who had a BP documented within the past year  $\leq 140/90$  mmHg (American Heart Association<sup>1</sup> goal: 70% control)
- **Diabetes control:** Percentage of patients with diabetes whose most recent HbA<sub>1c</sub> was  $< 8\%$  (national average = 35%)<sup>2</sup>
- **Weight control:** Percentage of patients who have had BMI screening within the past year showing BMI  $> 28$  kg/m<sup>2</sup>
- **Lipid screening:** Percentage of patients whose lipid panel indicates low LDL-C ( $< 100$  mg/dL) and high HDL-C ( $> 50$  mg/dL) (American Heart Association<sup>1</sup> benchmark)
- **Mammography screening:** Percentage of women who had a mammogram during the past 2 years for whom a screening is recommended according to the NCI<sup>3</sup> guidelines (national average = 67%)
- **Colorectal cancer screening:** Percentage of adult patients who had an appropriate screening for colon cancer (CDC Chartbook<sup>2</sup>: 60%)
- **Dental caries:** Percentage of patients with untreated dental caries (CDC Chartbook<sup>2</sup>: 41.5%)
- **Prescription utilization:** Annual number of prescriptions filled in the clinic and their dollar value (CDC,<sup>2</sup> best estimate: 60%)
- **Emergency Department utilization:** Avoidance of Emergency Department use by instead utilizing clinic as indicated by patient questionnaire and data derived from financial metric evaluations (CDC Chartbook<sup>2</sup>: 20%)
- **Patient visits:** Annual number of total patient visits and annual number of active individuals using clinic over past 3 years
- **Food security and domestic abuse:** Screening at each patient intake

<sup>1</sup> Whelton PK, Carey RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/ NMA/PCNA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: Executive summary: A report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Hypertension* 2018;71:1269-1324. DOI: 10.1161/HYP.0000000000000066.

<sup>2</sup> Health, United States, 2016 [Internet]. Washington, DC: US Department of Health and Human Services; 2017 [cited 2019 May 20]. Available from: [www.cdc.gov/nchs/data/abus/abus16.pdf](http://www.cdc.gov/nchs/data/abus/abus16.pdf).

<sup>3</sup> NCI adopts new mammography screening guidelines for women. *JNCI* 1997 Apr;89(8):538-40.

BMI = body mass index; BP = blood pressure; CDC = Centers for Disease Control and Prevention; HbA<sub>1c</sub> = hemoglobin A<sub>1c</sub>; HDL-C = high-density lipoprotein cholesterol; LDL-C = low-density lipoprotein cholesterol; NCI = National Cancer Institute.

facilitate conversations with non-English-speaking patients, and support staff who are always ready and able to provide assistance. The daily huddle ends with the medical director issuing a call to action: "Have some fun, do some good." That one statement describes the atmosphere of the clinic. Volunteers have described working at the clinic in the following ways: "It's a support group. It's like family"; "I volunteer to not let years of learning and practicing go to waste and to interact with a talented group of peers"; and "This is my happy place. Everyone wants to be here; the patients, the staff, the volunteers. It brings joy back to work." There are many long-term volunteers at VIM, with greater than 200 having volunteered for more than 10 years (unpublished data). The Volunteer Satisfaction Survey of 214 volunteers reports that 98.1% of respondents would

definitely recommend VIM to friends and others as a great place to volunteer.<sup>10</sup> The volunteer program has seen a growth in younger volunteers, many of whom are students or are still working, which aids in the sustainability of the volunteer workforce.

### CONTINUOUS QUALITY IMPROVEMENT PROCESSES

Although the care is free, the quality is not subpar. The clinic is continuously monitoring quality health outcomes such as percentage of eligible patients receiving mammograms (80%),<sup>3</sup> the number of patients with diabetes screened with hemoglobin A<sub>1c</sub> and a vision test, or the percentage of charts in which the medication list was reconciled at the time of service. There is an effort to streamline the documentation process to ensure that medication lists are up to date, documentation of

immunizations in the state health department system occurs, and patients are contacted with abnormal laboratory results. There is a documentation scribe program in development to assist clinicians in the use of the electronic health record as well as the use of a voice recognition dictation system. These are all patient care activities one would expect in state-of-the-art health care systems, yet they are being offered in this free clinic.

### FUNDING

It is no small endeavor to keep a clinic such as the VIM Clinic Hilton Head Island in operation. Unlike many businesses, growth at VIM costs money. It costs \$9000 each day to operate the clinic, which is more than \$2.3 million per year. This budget is accomplished through 52,000 volunteer clinician hours<sup>10</sup>; donated pharmaceuticals; health care community donations; and donated maintenance, construction, landscape, and technology support. The Development Office, with a combination of paid and volunteer staff, works year-round to solicit funds to keep the clinic operating. Activities such as an annual gala, letter fundraising appeal, food festivals, silent auctions, community grant applications, and the Vehicle Donation Program are just a few examples of the fund-raising efforts.<sup>11</sup> The financial report for the fiscal year ending June 2018 can be found on the VIM Clinic Hilton Head Island Web site.<sup>12</sup> We must not forget our patients, who volunteer to clean the clinic, perform maintenance, and hold fundraising activities for the clinic. Patients are eligible for care at the clinic if the household income is less than 200% of the Federal Poverty Guidelines and they are not eligible for other medical insurance.<sup>4p3,4</sup> The patients do not pay a fee for service; the care is free.

Many ask why the Affordable Care Act (ACA)<sup>13</sup> does not solve our patients' health care needs. As a safety-net clinic, VIM plays an important role in the health care of the working poor people on Hilton Head Island. South Carolina did not participate in the Medicaid Expansion offered through the ACA, making many of our patients ineligible for insurance. Even with subsidies, insurance premiums and out-of-pocket costs are expensive, and out

**Table 1. Key financial performance indicators, July 1, 2017, to June 30, 2018<sup>a</sup>**

Indicator	Number	US Dollars
<b>Value of services</b>		
Value of medical/dental care provided <sup>b</sup>	—	4,515,101
Program costs and in-kind goods and outside services <sup>b</sup>	—	1,537,475
Total value of services provided	—	6,052,576
Value of care provided per patient (per visit)	—	1679 (220)
SC hospital ED visits per 1000 population <sup>1</sup>	397	—
Population of Bluffton and Hilton Head Island (BH) <sup>2</sup>	55,416	—
Uninsured population of BH <sup>2</sup>	14,020	—
Potential hospital ED visits of BH uninsured	—	5666
Median cost per ED visit <sup>3</sup>	—	1233
Hospital costs avoided, total (per patient)	—	6,862,925 (1904)
<b>Impact of medical services provided</b>		
Total value	—	6,062,576
VIM investment (annual expenses excluding volunteer time) <sup>c</sup>	—	2,305,303
Impact per dollar invested, %	263	—
<b>Impact of hospital costs avoided</b>		
Total cost avoided	—	6,862,925
VIM investment (annual expenses excluding volunteer time) <sup>c</sup>	—	2,305,303
Impact per dollar invested, %	298	—

<sup>a</sup> Final data as of October 26, 2018.

<sup>b</sup> Data from VIM relative value unit tracking report, fiscal year 2018.

<sup>c</sup> Data from VIM fiscal year 2018 financial statements.

<sup>1</sup> Hospital emergency room visits per 1,000 population by ownership type [Internet]. San Francisco, CA: Kaiser Family Foundation; 2016 [cited 2019 May 20]. Available from: [www.kff.org/other/state-indicator/emergency-room-visits-by-ownership/?currentTimeframe=1&selectedRows=%7B%22states%22:%7B%22south-carolina%22:%7B%7D%7D%7D&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D](http://www.kff.org/other/state-indicator/emergency-room-visits-by-ownership/?currentTimeframe=1&selectedRows=%7B%22states%22:%7B%22south-carolina%22:%7B%7D%7D%7D&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D).

<sup>2</sup> QuickFacts: Bluffton town, South Carolina; Hilton Head Island town, South Carolina [Internet]. Suitland, MD: US Census Bureau, 2016 [cited 2019 May 20]. Available from: [www.census.gov/quickfacts/fact/table/blufftontownsouthcarolina,hiltonheadislandtownsouthcarolina/PST045218](http://www.census.gov/quickfacts/fact/table/blufftontownsouthcarolina,hiltonheadislandtownsouthcarolina/PST045218).

<sup>3</sup> Caldwell N, Srebotnjak T, Wang T, Hsia R. 'How much will I get charged for this?' Patient charges for top ten diagnoses in the Emergency Department. *PLoS* 2013;8(2):e55491 (table 3). DOI: <https://doi.org/10.1371/journal.pone.0055491>.

ED = Emergency Department; SC = South Carolina; VIM = Volunteers in Medicine.

of reach for many of our patients. In addition, there is a health care clinician shortage in Beaufort County, SC, meaning there are not enough physicians and dentists to serve the population, making access an issue. Furthermore, there is only 1 insurance company offering an ACA health insurance plan in South Carolina.<sup>14</sup>

The hotel and hospitality industry has direct benefit from this clinic by means of keeping its workforce healthy. A partnership is in development between the University of South Carolina Beaufort and VIM Clinic Hilton Head Island to create a comprehensive communication plan that will demonstrate the value provided by the clinic to this industry.<sup>15</sup> The goal is to obtain some financial support from the organizations that directly benefit from the services provided at the clinic.

## FACILITATING THE VOLUNTEER PROCESS

Volunteering in a free health care clinic is a rewarding service. To make the volunteer role attractive, the VIM organization has created a streamlined onboarding process. All volunteers must<sup>16</sup>:

- attend an orientation offered monthly
- provide a curriculum vitae, driver's license, social security card, and any medical/professional license
- receive an annual tuberculosis test provided by VIM
- sign and complete a confidentiality statement and code of conduct agreement.

Retired volunteers can work under a special license established for physicians volunteering in not-for-profit clinics (legislation passed by request from VIM Clinic Hilton Head Island in 1993).<sup>17</sup> All health care clinicians receive full malpractice coverage from the South Carolina Joint Underwriting Association.<sup>18</sup>

There is no minimum number of volunteer hours required. Some volunteers are seasonal (snowbirds), and others volunteer on a weekly basis.

## CONCLUSION

Safety-net clinics, such as VIM Clinic Hilton Head Island, are a feasible way to provide access to high-quality, cost-efficient health care to those in need. While serving the mission of VIM, the volunteer health care clinicians also experience

a renewed satisfaction in their chosen professions. Bridging the gap between provision of care and joy in work is accomplished at VIM. Other communities can use VIM Clinic Hilton Head Island as an example to develop their own unique models of health care. More information is available through the national VIM Web site (<http://volunteersinmedicine.org>). The national office, which developed from the original clinic on Hilton Head Island, is dedicated to assisting individuals, groups, and local communities who want to develop a free health care clinic for people without access to health care. The organization provides direction, inspiration, and support in the process of developing a clinic through training, resource materials, and consulting services. Volunteerism is alive and well in the health care community, as demonstrated by the 88 VIM Alliance member clinics, the 20 clinics under development, the 343,00 patient visits in 2017, and the 10,400 volunteers working to improve the health of those in need.<sup>19</sup> What are you waiting for? ♦

## Conflict of Interest Statement

*The author(s) have no conflicts of interest to disclose.*

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# Let's Care for Those in Need—Today: Collaborating to Solve the Uninsured Crisis in America

Lee Jacobs, MD<sup>1</sup>

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## ABSTRACT

This editorial is a call to action for medical communities across the country to address the uninsured crisis in their communities. Thirty million Americans without insurance need access to affordable, high-quality care. An insurance solution may be years away, so we must start today.

## INTRODUCTION

What can be done to provide high-quality, affordable, and accessible care to those without health care insurance? There has been a lot of talk, scores of strongly held diverse opinions, posturing, and campaign slogans, but none of this helps the people in need of medical care today. What can be done now?

In this issue of *The Permanente Journal*, there are 2 articles that detail strategies for providing care to those in need (page 35 and page 102).<sup>1,2</sup> Given a choice of standing on the sidelines and listening and watching, these people chose to act. They chose to deal with today's realities—and to care for the uninsured population. They are the heroes, and there are many others across the country also taking action, as I will mention here.

This is a crisis that must be addressed now. We need a country-wide safety-net movement driven by the crisis, led by the health care community, and fueled by collaboration and compassion.

## PEOPLE—NOT STATISTICS

After working for many years in a homeless clinic and for the last several years as medical director for a safety-net clinic, I have experienced firsthand the plight of those with no capability to pay for badly needed health care. I know them as people, not as a statistic. I know them as people with basic health needs but with limited options. I know them as very frustrated people asking for help and as people with a major sense of relief and appreciation when a caring person steps forward to help them.

I am not an expert on public health policy. I am not an economist. However, as a physician who deals daily with the medical needs of individuals without insurance, I have to ask: Why can't

the approach illustrated in the real-life examples of the articles in this issue be reproduced countrywide?

## DEFINING THE PROBLEM: IT'S ABOUT THE "UNCARED FOR"

We all know what the problem is. More than 30 million Americans are without health insurance, limiting their access to affordable, high-quality care.<sup>3</sup> However, the number of uninsured persons will not answer the most relevant question: What percentage of uninsured Americans need care today in each of our respective communities?

The problem with filling headlines with large national estimates is that it discourages interventions that could be undertaken today, thereby reinforcing the cop-out that "it is just too much for us to deal with." So rather than be overwhelmed and discouraged by the numbers, it is helpful to remember: The objective is to fast-track care initiatives that will help the uninsured members of our communities who need care. Although providing health insurance is the essential long-term solution, the essence of a community solution today is not about insurance, but rather it is about how medical practitioners can provide the much needed clinical care.

## A PROVEN CARE MODEL: THE SAFETY-NET CLINIC

There are heroes today in safety-net health care organizations throughout the country providing a variety of services to individuals in need of medical care. The National Association of Free and Charitable Clinics (NAFC) Web site<sup>4</sup> provides the location and other information for these clinics, as well as a primer on how to start a clinic if there is not one in your area. According to the NAFC, in 2018 there were 1400 free and charitable clinics in the US, caring for 2 million patients and 6.3 million patient visits, and staffed by 203,000 volunteers, including 111,000 medical volunteers.<sup>4</sup> Impressive numbers, and yet when the Affordable Care Act<sup>5</sup> was being developed, the NAFC leaders were excluded from the dialogue,<sup>6</sup> when the conversation shifted away from care solutions to insurance reform. As expected, there continues to be a major role for these clinics since the Affordable Care Act was signed into law,<sup>7</sup> not surprising because this model has been shown to be effective in addressing the primary care needs of patients with low income.<sup>8</sup>

Recognition of the value of the safety-net clinic as a quickly implementable model to care for the uninsured population dates to 1991 when Kelleher<sup>9</sup> wrote "Free Clinics: A Solution That Can Work ... Now!" Since Kelleher's article was published, the number of safety-net clinics has grown from 200 in 1991 to the present estimate of 1400. Good growth reflects the commitment of many individuals to serve in their communities, but there still are insufficient numbers to meet the demands. I wonder how

*Editor's note: Please also see: Addressing the Health Needs of the Uninsured: One Community's Solution, by Lynne M Hutchison, DNP, FNP-BC, and Raymond L Cox, MD, MBA (page 102); and Fostering Partnerships with the Safety Net: An Evaluation of Kaiser Permanente's Community Ambassador Program in the Mid-Atlantic States, by Lorella Palazzo, PhD; Juno Matthys; Craig Sewald, MPA; et al (page 31).*

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different the health care landscape might be today if Kelleher's 1991 solution had been implemented more extensively in more communities across the country.

Although there are several variations to the safety-net clinic model, most have in common that they are primary care focused and are staffed by a predominantly volunteer staff, and all exist to care for a patient population with limited options for care. Depending on the amount of time that practitioners volunteer, some clinics are able to function like any other primary care office, where patients see the same practitioner on follow-up visits. Many are free clinics, whereas others operate on a sliding scale with charges depending on the ability to pay. The article on page 102 of this issue describes a free clinic in South Carolina that offers a broad array of specialty and ancillary support without using government money.<sup>1</sup> Heroes. Can you imagine the impact of this model if it were implemented around the country?

### A CRITICAL SUCCESS FACTOR: COMMUNITY COLLABORATION

My intent with this editorial is not to add to the debate; I'll leave that to the debaters. Rather, my intent is to encourage action for us—the medical community—to take a leadership role and develop local solutions so that care for those in need can be provided for now. I hope that we have not become so insulated in our practices, and protective of our cost structures, that we don't believe we can solve this crisis. As a medical community, do we really believe that the government will provide the solution any time soon as to how we should care for patients without insurance? I do not believe that helping those individuals in need of care today through a safety-net model would in any way derail or delay a national insurance solution. The objective of the medical community is to provide care now and not wait!

### Physician Volunteers

Collaboration starts with you. Please consider how you might be part of the solution to this crisis. Here are a few self-assessment questions:

- Do you believe that this is, in fact, a health care crisis?
- How responsible do you feel for helping the uninsured patients in your community in need of medical care today?
- If you have cared for those in need previously—the poor, the uninsured, the homeless individuals—did you feel it was a meaningful experience?
- Rather than planning to watch from the sidelines hoping there might eventually be a solution, do you want to help provide care now?

If you answered yes to any of these questions, here are some specific steps you can consider:

- Visiting a clinic. Learn about their ministry; especially hear their passion. Hear about the experiences of volunteers, especially their patient stories.
- Volunteering, even just 2 or 3 hours a month. I can guarantee you that most of the safety-net clinics need volunteers and administrative support, and all need financial support. Retired clinicians and their spouses can use their skills and experience to make major contributions.

- Starting a safety-net clinic in your location, if there is not one already.
- Advocating for the uninsured and medically underserved persons in your community. Discuss the need with your colleagues and friends.

This volunteerism may well be a remedy for physician burnout. In recent years much has been written on the topic of physician burnout,<sup>10</sup> with estimates from surveys of more than 40%.<sup>11</sup> I have found over the years that volunteerism has given me an overwhelming sense of appreciation for what I have, and it rejuvenates me professionally. I have found that helping people in need provides a perspective for me that is therapeutic. It has been well documented in the literature that volunteerism is an effective remedy for the situations that contribute to physician burnout.<sup>12-14</sup>

### Other Key Collaborators

Obviously, fast-tracking any solution will take extensive community collaboration. I believe these collaborative efforts will primarily be driven by our compassion and not solely by our concern for our business future. However, the solution cannot rely on the compassion of a few heroes; we must mobilize and encourage several sectors in our communities to be involved, including medical groups, hospitals, community leaders, churches and synagogues, retailers, public communications, and many others. If strong, collaborative networks can be developed, I believe communities will have the resources to solve this crisis.

### Hospitals

Obviously, hospitals are essential community collaborators and most already provide large amounts of uncompensated care. Hospitals have a major financial incentive to encourage care for uninsured patients in settings other than their Emergency Departments. By having access to primary care clinics, there will be fewer uninsured people using the Emergency Department for ambulatory care,<sup>15</sup> and hospitals will have options for discharge appointments to decrease readmissions. It is imperative for hospitals to be strong partners in the community solution because, more than other sectors, they face major financial infrastructure changes if a government solution is initiated in the future.<sup>16</sup>

### Pharmaceutical Companies

Other key collaborators to finding a solution for the uninsured patients are the pharmaceutical companies. Because these companies are such an important component of an affordable solution, I would like to clarify what I believe is a misconception that is prevalent in the chatter among nonmedical "authorities" as drug companies are labeled with derogatory terms such as *Big Pharma*.

Why do the pharmaceutical companies have such a poor public image? I believe physicians contribute to this image by prescribing new brand medications that generally do not offer any major advantages over older, time-proven medications. Sure, pharmaceutical companies aggressively market new expensive medications, but it is still the physician who writes the prescription! This problem is illustrated in the list of the top 10 Medicare medications prescribed in 2016, which made

up \$145 billion (17%) of Part D expenses.<sup>17</sup> A primary care physician could practice for a long time and rarely prescribe any medication on this list. This problem is underscored by a major study in which researchers determined that the expensive newer insulins offered no advantage over older insulins in the treatment of type 2 diabetes.<sup>18</sup>

Clinician volunteers in safety-net clinics can attest to the fact that generic medicines for chronic conditions are generally available at affordable prices in the community. Although expensive medicines are not commonly prescribed in our safety-net clinic, when needed, these medications can be requested at no cost from pharmaceutical companies through patient assistance programs. For these reasons, I have not found medication availability for patients in financial need to be a major barrier, and certainly at no time do we compromise quality because of medication cost. We do need pharmaceutical companies to be part of the collaborative solution and would most certainly welcome any additional assistance, such as free, generic medication for those patients who qualify.

#### Specialty Support

Although the patients' primary care needs are generally basic and not expensive, a limited number of patients in safety-net clinics need specialty care. In my experience, one of the greatest challenges for a safety-net clinic is obtaining subspecialty support, including mental health and dental care. Specialists are an integral part of the solution!

To obtain subspecialty consultations, there are several interventions that could be considered for communities. For example, it would be incredibly helpful if each subspecialist in a community would commit to accept a limited number of uninsured patient referrals per month. Committing to just 1 or 2 referrals would make a major difference to the clinics, while reassuring the consultant that by accepting a patient the floodgates of referrals would not open. Additionally, it would be supportive if specialists would agree to participate in videoconferencing, which is a high-quality, cost-effective approach for obtaining specialty opinions.<sup>19,20</sup> An additional solution is linked to hospital privileges. If a specialist consults on a patient in the inpatient setting or sees a patient in the Emergency Department, s/he would commit to seeing the patient on follow-up in his/her office after discharge, regardless of insurance coverage or ability to pay. I believe that not to provide such follow-up care in these settings would actually be an ethical, not an insurance, issue.

#### Effective Collaboration Takes Mutual Commitment and Trust

Two recently published articles stressed the importance of a high level of trust among community collaborators, including a strong mutual commitment to the objective of caring for the uninsured population and, as in any successful partnership, clarity of roles.<sup>20,21</sup> An additional important point is made; the level of the motivation of various sectors to be involved may be related to how well they can maintain their financial health while they collaborate to provide care.

Community collaboration is a critical success factor in caring for uninsured community members. So, convene your community collaborators to study, to implement, and then to celebrate!

## HIGH-QUALITY, AFFORDABLE, AND ACCESSIBLE CARE, NOT SECOND-CLASS CARE

Implementation of a safety-net clinic strategy will help communities make major strides in addressing health disparities. However, to be a viable option for the care of uninsured patients, community safety-net clinics must provide high-quality, affordable, and accessible care.

#### Quality

First and foremost, the safety-net strategy must provide high-quality care. Volunteer physicians and associate practitioners need to feel that their time and skills are being used to provide high-quality and meaningful care. I have learned in my years as a clinician and as an administrative leader that high-quality care does not have to be expensive care. More magnetic resonance imaging and more brand medications do not necessarily equate to better care.

An excellent framework for establishing and tracking quality metrics is found at the HealthConnection Clinic, a Canadian primary care center that serves vulnerable patients.<sup>23</sup>

This center demonstrates what is possible when a highly engaged leadership shares a common vision and purpose, along with the importance of sustained and meaningful community engagement—an important aspiration for all safety-net clinics.

#### Affordability

There are various financial structures for safety-net clinics ranging from free clinics to clinics with sliding fee scales based on ability to pay. However, what they all have in common is they limit their overhead by having a predominately volunteer staff and solid financial support from partners in their communities. They all also have in common that, regardless of their financial model, no patient is turned away for lack of money.

#### Accessibility

In many communities, transportation is a major challenge for an uninsured person with limited financial resources, especially if there is no public transportation in the area. I have had patients walk several miles to see us in the office. Clinic location, the hours of operation, and tolerance of late patients are important access considerations for safety-net clinics.

## THE TIME TO ACT IS NOW!

There is a crisis today in each of our communities. A large number of people have important medical problems that must be addressed. There has been a lot of talking and political posturing, but what we need now is action—action by those who are best able to organize and to provide the needed care. That's us!

I am not arguing that safety-net clinics may be the long-term solution, but I do not believe that there is a more viable solution to provide care to the uninsured and underserved patients who are badly in need of health care today.

I told my daughter when she graduated from medical school, *"You have earned a special gift—use it freely [to serve others]."*<sup>24</sup> Yes, all of us have special gifts, and most certainly we have an opportunity to serve others today. If we can rally now to address

this crisis, community by community across the US, medical experts can continue to manage health care, and uninsured persons would have high-quality care options while the national dialogue continues in the future.

What we cannot do is go on with business as usual. ❖

### Disclosure Statement

*The author(s) have no conflicts of interest to disclose.*

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## Expensive Kind of Care

Uninsured people don't just slink off into a corner and die. They seek treatment, but usually when it is an emergency, and this will be the most expensive kind of care available.

— Kurt Eichenwald, b 1961, American journalist



**Shades of Purple and Yellow at Sunset**  
photograph

**Michael House, LCSW**

Mr House states, "This macro rose photograph was taken in my SW Portland, OR, rose garden."

Mr House retired from the East Interstate Medical Office in Portland, OR, in 2014.  
He has received awards from the American Rose Society for his macro photography.

# MD Aware: A Mindful Medical Practice Course Guide

Written by Stephen Liben and Tom A Hutchinson

Patricia Lynn Dobkin, PhD<sup>1</sup>

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Medical education has been evolving in the way physicians are “raised.” Where didactic expert lecturers once dominated pedagogy, problem-focused learning, small group experiences, and mentoring are becoming accepted methods. Within this context, recognition of relatively high rates of medical students’ psychological distress and the need to promote resilience have been included when considering curriculum.

Mindful Medical Practice (MMP) has been steadily finding its way into medical education as outlined in *Mindful Medical Practitioners: A Guide for Clinicians and Educators*.<sup>1</sup> *MD Aware: A Mindful Medical Practice Guide*<sup>2</sup> builds upon this trend. It describes a course rolled out in 2015 that aims to reinforce positive qualities inherent in medical students that will help them maintain their enthusiasm for medicine and provide them with the means to hold onto their humanity.

Two voices are harmonized across the 12 concise chapters. Although they were written separately (except the Introduction), the authors’ intentions are clearly in sync. The MMP course is divided into seven 3-hour classes, each described in depth. Interestingly, the authors share the underlying processes that led to the teaching methods described. Although core content and a template for each class are provided, what is most appealing is the way the authors show the reader what it feels like to be with 20 second-year medical students on the threshold of clerkship—an anxiety-provoking transition for many.

Classes 1 through 7 are theme-based covering the following topics: 1) Attention and Awareness, 2) Congruent Communication, 3) Awareness and Decision Making, 4) Clinical Congruence, 5) Building Resilience, 6) Responding to Suffering, and 7) Mindful Congruent Practice in Clerkship and Beyond. These subjects build upon one another and are integrated so that at the end of the MMP course students ideally have the means to become good physicians who know how to approach complex medical issues. Clinical examples are used throughout the course to allow students to see the relevance of what is being taught. Contemplative practices are seamlessly integrated into each class highlighting experiential learning as a method that “sticks” because it evokes emotions. Narrative medicine exercises, deep listening exchanges, and safe space sharing enrich the course.

Liben, in Chapter 2, reaches out to aspiring MMP teachers—just what does it take to lead a class? A whole person who is self-aware and comfortable leading guided awareness practices in an authentic manner. Showing, not telling, is emphasized. “Great faith, great doubt, and great effort”<sup>2</sup> are prerequisites for teaching MMP. Then, logistics are described.

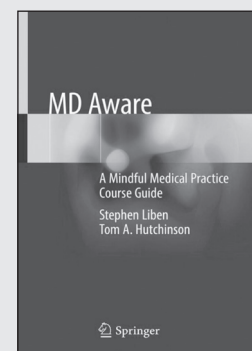
Chapters 3 through 9 take the reader into the classroom experience. Each exercise is explained, guided contemplation transcripts are provided, and a one-page class template is offered so that a teacher can take it to class as a guide. Computers and other

devices, including smartphones, are left out on purpose. Distractions are avoided. Elements of Mindfulness-Based Stress Reduction courses are maintained (eg, Triangle of Attention, S T O P exercise) as are Satir’s communication stances<sup>3</sup> that promote whole person care and healing. How MMP methods differ from standard medical training is underscored.

Hutchinson, in Chapter 10, invites the reader directly into his sixth class (Responding to Suffering) via an audio transcript. This level of vulnerability is unprecedented. We glimpse not only the inner workings of a gifted teacher, but also students’ responses to his way of being. We are privileged to be privy to a “master class”—one whereby a lifetime of clinical work and pedagogy meld together effortlessly.

Liben, in Chapter 11, tackles the nuts and bolts of what can and cannot be done when creating an MMP course elsewhere. For example, which parts of the course can be or should not be altered is mentioned. He justifies the format of the course, class size, consecutive weekly classes, and explains how to create a safe space for teaching and learning in this unique way. How to select and train MMP teachers is outlined. Critical in medical training, how to evaluate student learning is also addressed.

Finally, medical students’ views are shared via their essays pertaining to the MMP course. It seems the experiment was a success as they relate how they feel ready to face the challenges awaiting them during clerkship and beyond. ❖



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## Transition at TPJ

Stephen Tarnoff, MD, Editor in chief (interim)

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Since its inception in 1997, *The Permanente Journal* has occupied a distinct and important niche in health care literature. And perhaps more than anyone else, founding editor in chief, Tom Janisse, MD, has played a critical role in carving out that niche and demonstrating its importance for patient care.

Under Dr. Janisse's 23 years of inspired leadership, *The Permanente Journal* has helped advance the fields of quality improvement, care delivery, and implementation science through the publication of cutting-edge clinical research. The Journal has also shone a light on the intersection between complex clinical care and the social determinants of health -- even as it boldly created space for the arts and humanities in our increasingly technology-driven profession.

As a long-time reader and admirer of *The Permanente Journal*, I was honored to be invited to serve as interim editor during this period. Having recently stepped down from my role as President and Executive Medical Director of Washington Permanente Medical Group, I am deeply aware of the vital service

that this publication provides to the health care community. I look forward to working with the editors and editorial board to strengthen this valued Permanente Medicine asset and plan for a dynamic future.

Over the months ahead, we will be carefully evaluating *The Permanente Journal's* future goals and considering the best ways to enhance the journal's value for readers and the broader health care community.

Some significant changes are already in the works, including a shift to online-only publication that will take effect with our next issue. Other changes will likely follow as we work to ensure the Journal is positioned for a successful future. *The Permanente Journal* has long been a valued resource for medical professionals across the globe, and we are well positioned for continued success. I am grateful for the support of our readers and the Kaiser Permanente and Permanente Medicine communities as we navigate this period of change and chart a course for new growth. ♦

CME

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- Novel use of Apple Watch 4 to Obtain 3-lead Electrocardiogram and Detect Cardiac Ischemia

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