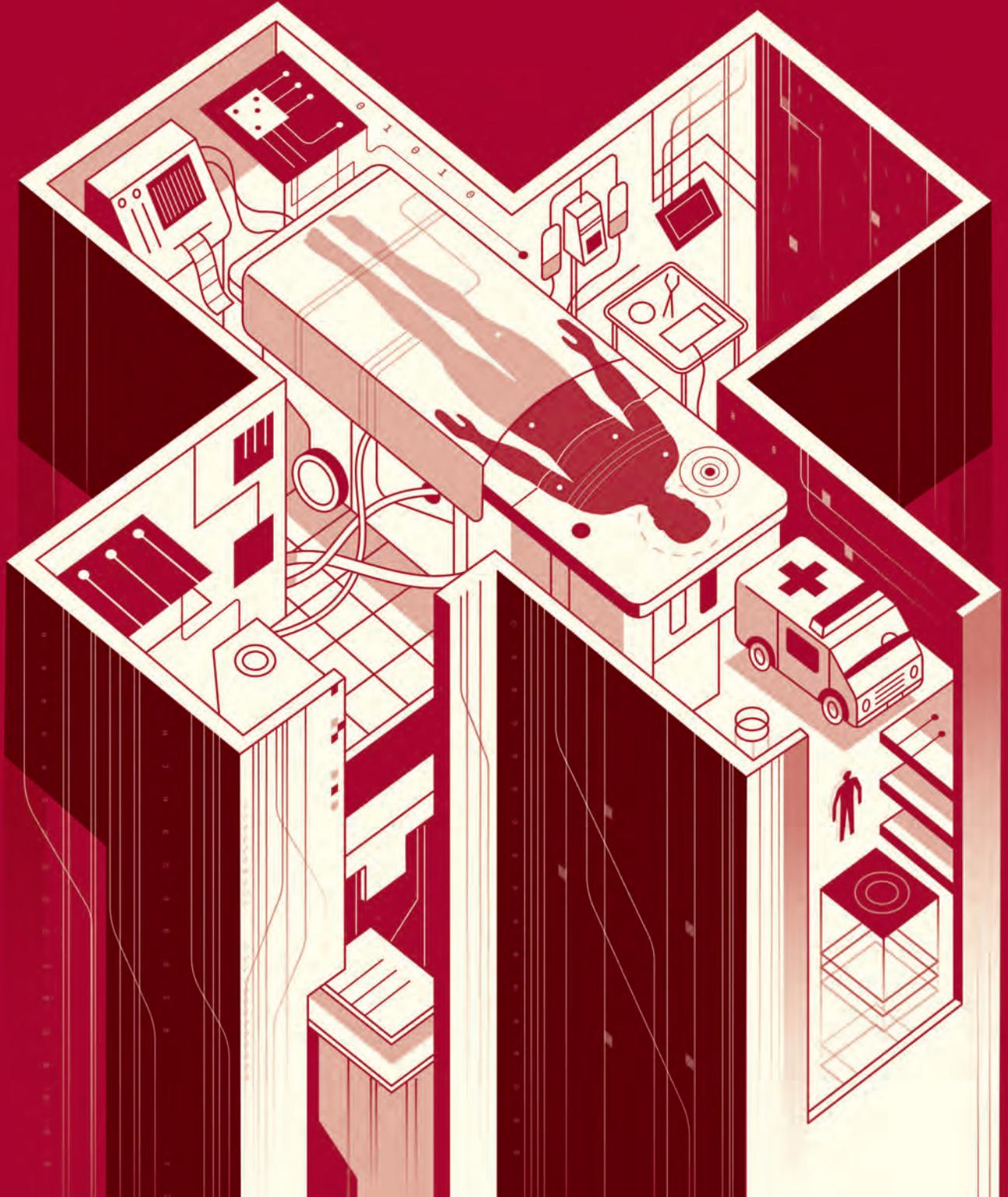


EMED

STANFORD DEPARTMENT OF EMERGENCY MEDICINE



LETTER FROM THE CHAIR

The Emergency Department is the front door of every hospital, and that has never been more true than during the COVID-19 pandemic. Stanford experienced unprecedented patient volumes and care needs that transcended anything we had witnessed in the past. A sprint to meet the pandemic challenges turned into a marathon, and then an ultra-marathon, and now we transition (we hope) into an endemic existence.

I am proud to say that the Stanford Department of Emergency Medicine has not only survived, but thrived, using opportunities born out of necessity to create a new approach to patient care: Precision Emergency Medicine.

Precision Emergency Medicine is a new paradigm that utilizes information and technology to deliver acute care effectively, efficiently, and authentically to our patients and their communities in five key areas.

This publication is part annual report, part instruction manual, and part invitation to learn more about how all practitioners can factor in patient differences in environment, lifestyle, and genetics to truly individualize and optimize care.

In the following pages, you will learn about new technologies, approaches, and learning modalities that harness innovation and inclusion to advance Precision Emergency Medicine.

The ultimate goal of Precision Emergency Medicine is to continuously improve the efficacy of targeted diagnostic and management strategies that result in better care for patients. Because Precision Emergency Medicine is a strategy for continuous improvement, there is no endpoint - just unlimited opportunities.

We now sit at a crossroads. Emergency Medicine is no longer simply acute care to treat any patient, any time, anywhere. We can drive innovation that impacts the entire care continuum. We see more diversity in patients and conditions than in any other field, which affords us an invaluable vantage point from which to transform health care.

I am so proud of what our department has achieved, but I am even more excited about what our specialty can do in the years to come.

In collaboration and the spirit of innovation,

Andra Blomkalns, MD, MBA

REDLICH FAMILY PROFESSOR AND CHAIR, EMERGENCY MEDICINE
STANFORD UNIVERSITY SCHOOL OF MEDICINE



DEFINING THE FUTURE OF EMERGENCY MEDICINE

Stanford Department of Emergency Medicine has developed a new approach to acute care delivery that utilizes information and technology to effectively, efficiently, and authentically care for our individual patients and our communities: precision emergency medicine.

Precision Emergency Medicine takes into account differences in the environment, lifestyle, and genes, and through data science and technology enables health care providers to increase the variables that factor into care pathways and treatment decisions.

This information is utilized in decision-making specific for each patient. Emergency medicine researchers can use the same data to assess entire patient populations and develop approaches that impact whole communities.

Precision Emergency Medicine is not based on one technology, but on many incremental advancements in five key areas.

Provide deliberate access to care – optimize clinical settings and expand access through digital health.

Capitalize on technology and digital tools – incorporate technology generating individual-specific data and utilize novel diagnostics to personalize treatment.

Leverage human data – use big data and AI to incorporate all available information into care decisions with a greater attention to the social determinants of health.

Advance population health – strengthen health systems and inform community resources.

Reimagine provider education and role – train and support providers in interpreting and utilizing data.

STRATEGIC PLAN: A ROADMAP FOR THE FUTURE

Under the leadership of Vice-chair of Strategy Matthew Strehlow, MD, the Stanford Department of Emergency Medicine is midway through an ambitious five-year strategic plan to help define the future of the specialty through Precision Emergency Medicine. Task forces composed of physicians and administrative staff focus on innovation in key areas:

HUMAN-CENTERED DIGITAL HEALTH

Drive telehealth and AI implementation, training, and use within emergency medicine.

HIGH-IMPACT EMERGENCY MEDICINE RESEARCH

Catalyze Precision Emergency Medicine research and grow multidisciplinary research programs.

PRECISION HEALTH EDUCATION

Redesign education to teach precision health and implement predictive learning analytics.

OPTIMIZED CLINICAL ENVIRONMENT

Incorporate Precision Emergency Medicine into clinical practice.

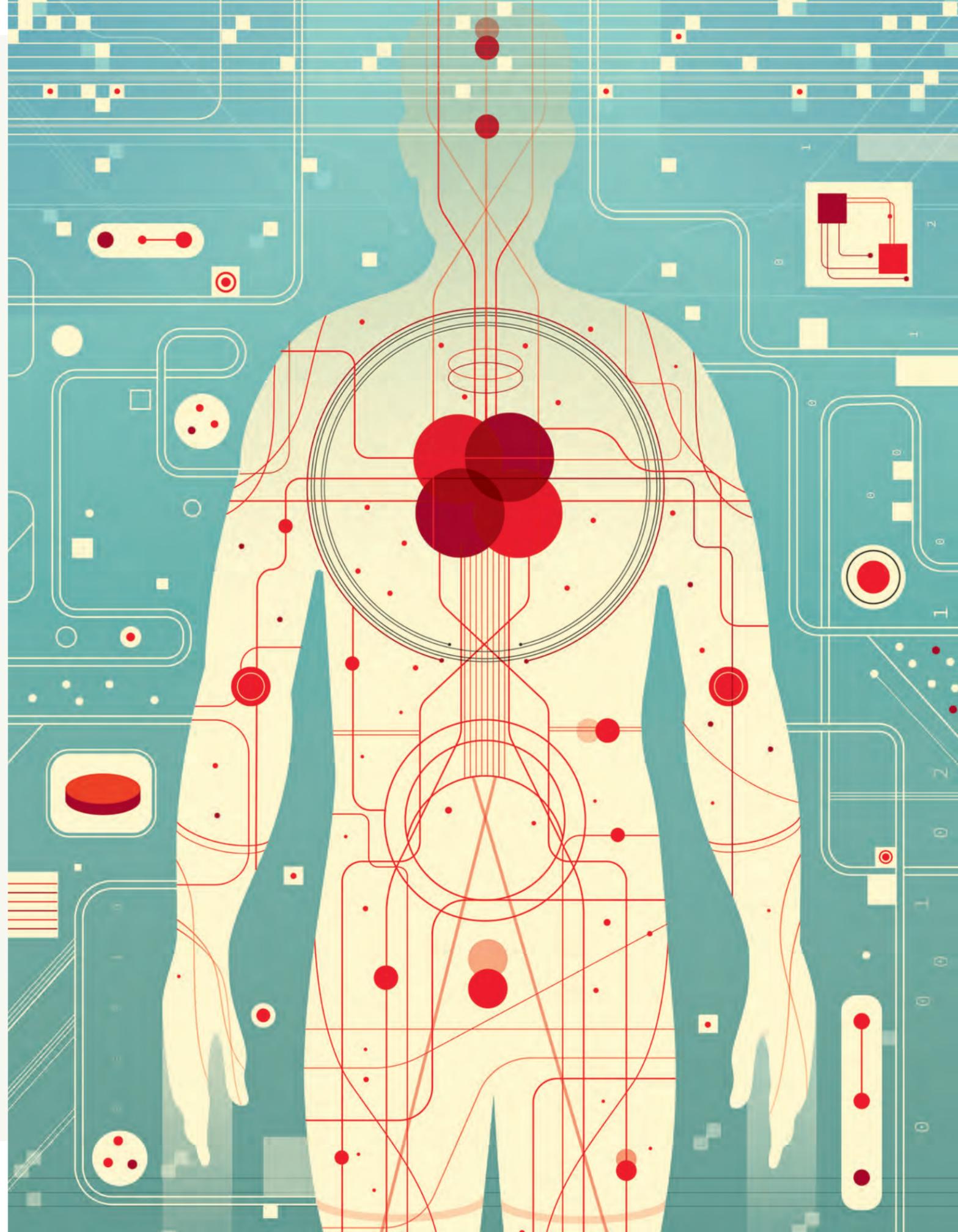
FOSTERING HUMAN POTENTIAL

Promote excellence and inclusion and implement career development and wellness programs.

COLLABORATION

Build impactful collaborations across Stanford University and with industry.

HARRY CAMPBELL



DIVERSITY AND INCLUSION

Diversity and inclusion are fundamental department values. Our faculty, trainees, and staff prioritize translating these values into action to ensure our patient care, research, and providers reflect and respect all members of our community.

THE STANFORD DEPARTMENT OF EMERGENCY MEDICINE WOMEN IN EM GROUP MEETS MONTHLY FOR PRESENTATIONS ON PROFESSIONAL DEVELOPMENT.



- Nearly 60% of leadership positions are held by women, including the department chair, and 44% of faculty are female, compared to 38% nationally.
- In 2021, 10% of emergency medicine faculty were from underrepresented in medicine (URiM) groups, more than double the percentage from two years prior.
- In 2021, faculty published more than 30 studies and commentaries on diversity, equity, and inclusion (DEI) issues. (See all studies online at emed.stanford.edu).
- The department DEI Committee, led by Eli Carrillo, MD, meets monthly to share ideas, promote discussion, and report recommendations to department leadership.
- Al'ai Alvarez, MD, department diversity officer collaborates with the Stanford Office of Faculty Development and Diversity, and Italo Brown, MD serves as Social Justice and Health Equity Lead for Stanford MD training (see p. 20).
- Emergency medicine residents receive training via health equity rounds and upstander training several times a year.
- The department DEI Residency Recruitment Taskforce employs a ho-



IN 2021, FACULTY PUBLISHED MORE THAN 30 STUDIES AND COMMENTARIES ON DIVERSITY, EQUITY, AND INCLUSION TOPICS.



listic review in screening, interviews, ranking, and selection, resulting in an increase in recruitment of URiM candidates.

- One hundred percent of faculty have been trained in unconscious bias/microaggressions and on the treatment of LGBTQ+ patients (see below). 100% of staff have completed training in recognizing bias and upstander training.
- In 2021, the department welcomed two students as part of a new intern initiative to instruct and mentor URiM students in research best practices.
- The department actively participates in Stanford's Leadership Education in Advancing Diversity (LEAD) program and the Stanford Clinical Opportunity for Residency Experience Program (SCORE) program to ensure current URiM students have a clear path to emergency medicine.
- In 2021, following a months-long gender equity assessment, department faculty crafted and launched in-depth training and discussions for all attendings, residents, and staff on unconscious bias, microaggressions, and reporting processes.
- The Women in EM group holds monthly meetings for female attendings, fellows, and residents to connect, learn, and share experiences on career development and advancement.

TEACHING INCLUSIVE LGBTQ+ HEALTH

MICHAEL GISONDI, MD, vice chair of education for Stanford Department of Emergency Medicine co-led the development of a groundbreaking interactive online course in 2021, "Teaching LGBTQ+ Health" to ensure members of every community receive optimal care.



Through case studies of bisexual, gay, and non-binary gender patients, learners explore the best approaches to physical exams and health assessments for the LGBTQ+ population, how to make clinical settings more welcoming, and how to use appropriate LGBTQ+ health vocabulary.

PARITY IN ACADEMIC AND EMERGENCY MEDICINE: "WE DIDN'T KNOW IT WAS THIS BAD."

Numbers tell a story and Christopher Bennett, MD, is determined to share that story. Dr. Bennett and collaborators have published seven studies focused on parity and inclusion - or the lack thereof - in academic medicine and emergency medicine.



Among their findings

- The proportion of emergency medicine residents who identify as Black did not increase significantly from 2007-2008 (4.84%) to 2017-2018 (4.43%).
- The proportion of U.S. medical school faculty who identify as Black or African American increased only minimally in the past 30 years, with just 5% of faculty identifying as Black in 14 specialties in 2020. No specialty had proportions comparable with U.S. population estimates.
- Only 28% of clinically active U.S. emergency physicians are women and only 38.8% of academic emergency medicine faculty are women, despite comprising 50.8% of the current U.S. population.

Bennett hopes that by recognizing the lack of progress, institutions can implement more impactful changes to increase and accelerate parity. "It is critical that our physician population mirrors the diversity of the patient populations we serve," he says.

A RACE TO RESEARCH

STANFORD EMERGENCY DEPARTMENT COVID-19 BIOBANK AND COVID RESEARCH

Steve Jobs famously got his start building computers in his garage. The Stanford Department of Emergency Medicine COVID-19 research got its start under a pink tent in a parking lot behind a Palo Alto office building.

Andra Blomkalns, MD, MBA, Chair of Stanford School of Medicine Department of Emergency Medicine shares how rapid efforts to overcome hurdles in the first weeks of the pandemic led to the creation of one of the first COVID-19 biobanks in the country at an academic institution.



Hurdle One: Move quickly

To launch a research effort, it can take eight weeks or more to develop a protocol and receive approval from Stanford's Institutional Review Board (IRB). The pandemic presented immediate and emergent needs with no time for delay.

BLOMKALNS: "Sam Yang [associate professor of emergency medicine] put together a research protocol for a broad section of samples for the COVID Biobank and IRB thoroughly reviewed and approved over a weekend, which is impossible! We were able to expedite the effort because there was only a research protocol to review. We didn't have a grant or a sponsor; the Department of Emergency Medicine paid for it at the outset. We saw it as an urgent obligation to humanity."

Hurdle Two: How and where to collect samples for COVID research trials

Stanford was one of the first institutions to develop a test for COVID and establish drive-thru testing. However, patients who tested positive but did not require immediate medical care were not permitted back on campus. This presented a challenge: how to collect additional saliva and blood samples?

BLOMKALNS: "My thinking was, we don't have a choice. This is a global crisis. I was ready to invite people to my house if

we needed a location for research. Fortunately, our director of finance and administration, Stephanie Edelman, found a pink tent for us to use to collect samples in the parking lot behind our administrative office, which wasn't on campus.

"We would call patients who tested positive and ask if they'd be willing to drive back to our tent to provide samples. So many did because they knew they were contributing to science and helping others."

"It was a renegade frontier kind of thing. Prasha Govindarajan [associate professor of emergency medicine] and I put together test kits in my office late at night, and overnight Prasha went from researching stroke to collecting samples in the rain in a parking lot."

Hurdle Three: Find resources

During the first month, Blomkalns faced seemingly insurmountable roadblocks in securing supplies such as collection tubes, swabs, and PPE.

BLOMKALNS: "It was extremely difficult! I ended up leaning on my relationship with a company I worked with when I had a basic science research lab in Cincinnati to scrounge up swabs, blood collection tubes, and personal protective equipment (PPE), and my contact basically went in the warehouse herself and filled up a big box and sent it. We were also getting PPE donated from outside sources, and I was purchasing supplies such as pulse oximeters, a tabletop centrifuge, and gallons of hand sanitizer with my own credit card off Amazon.

"Many of these precious samples have been processed and live in the Stanford biobank repository. The hardest part was setting up a process to secure and appropriately process the samples because different investigators are going to use all the different components of blood samples and each of these components requires different handling. That's where collaborators like Catherine Blish [associate dean for basic and translational research] and Ruth O'Hara [senior associate dean for research] have been instrumental and very, very supportive. Bonnie Maldonado [professor of pediatrics and of epidemiology and population health] connected us with other resources and trials to participate in even more research."

Hurdle Four: Evolve

Stanford Emergency Medicine and partners started the collection process in April 2020 for the COVID Biobank, well in advance of similar institutions around the country.

BLOMKALNS: "Around the same time, outpatient investigators and inpatient critical care staff at Stanford realized that they needed samples for clinical trials, so we kept adding investigators and groups onto the research protocol and expanding sampling.

"This led to the creation of the COVID Biobank Leadership Committee, which continues to meet regularly to make sure we have a repository of COVID samples that can be used across Stanford, and nationally. The samples span the entire duration of the pandemic and include all types of patients ranging from those who didn't even know they were sick, to those who were

dying. This breadth is important; the patients who go home and recover quickly are just as important to our research.

"To date, we have samples from over 700 patients in the ED COVID Biobank. That data is driving a lot of important research. And the NIH has funded Stanford Medicine to serve as a co-site for a consortium of 40 institutions across the country to explore post-acute sequelae of COVID. Part of this work will utilize existing samples from the COVID ED Biobank, as well as data from additional tests."



DR. PRASANTHI GOVINDARAJAN COLLECTS COVID-19 SWABBED SAMPLES DURING THE EARLY DAYS OF THE PANDEMIC.

ADDRESSING THE COVID-19 INFODEMIC

In 2021, the Department of Emergency Medicine partnered with the Stanford Ethics, Society, and Technology Hub to sponsor "INFODEMIC: A Stanford Conference on Social Media and COVID-19 Misinformation," convening experts from around the world in social media, cyber policy, ethics, public health, and medicine.

Over 500 participants from 71 countries heard speakers from Pfizer, the World Health Organization, and the Council on Foreign Relations (among others) discuss vaccine hesitancy, confidence, equity, and ethics. Representatives from Google, Facebook, and Twitter, and online physician influencers discussed efforts to communicate accurate COVID-19 vaccine information online.

INFODEMIC presentations are available on the Stanford Department of Emergency Medicine YouTube channel.

HARNESSING DATA TO IMPROVE EMERGENCY CARE

The Emergency Department Data Analytics Committee (EDAC) is employing informatics to improve care delivery through research, quality monitoring, and machine learning.

Comprised of emergency medicine physicians with informatics expertise, a clinical data architect, and a data analyst, the team guides emergency medicine clinical operations and researchers in utilizing patient data in innovative ways.

The goal is to use informatics to drive the right care for patients starting the moment they arrive in the emergency department lobby, and to guide the physician in providing evidence-based care.



DRS. IAN BROWN AND MAAME YAA YIADOM ARE ADVANCING INNOVATIVE USE OF PATIENT DATA TO IMPACT CARE AND GUIDE PHYSICIAN DECISION-MAKING.

Committee member **Maame Yaa Yiadom, MD** explains: “In cases of heart attack, according to medical literature, if you only use chest pain as a determinant to order an EKG, you’re going to miss 20 to 30% of cases. Women have different risks and symptoms than men. Non-English speakers communicate their experience differently. People who haven’t had access to primary care will present differently. This all adds up to differential risk for an emergency condition.

“When this is not accounted for, we see differences in how well patients do. Yet physicians have a finite capacity to secure and utilize data points. We should use the power of computing to apply our understanding of known risk diversity to support early diagnosis more precisely.”

According to Yiadom, interim vice-chair of research for Stanford’s Department of Emergency Medicine, there are two primary ways to utilize artificial intelligence:

- the system can make a decision; OR
- the system can present information that the physician can layer on top of decision-making.

For example, based on data points, the system might determine a patient has a 93% risk of fall in the next 24 hours. The physician would use this information to evaluate if they should order physical therapy, or advise the patient do a home safety check for items that they might trip over.

Yiadom is also exploring how to replicate physician decision-making when a physician isn’t present.

“The first person a patient talks to is often a clerk entering their information in the computer. That may not be the best person to identify risk. However, 75% of our patients have been seen within the Stanford system before. We can expose that data to artificial intelligence built into the system to have a computer identify early on which patients need tests.”

Ian Brown, MD, clinical associate professor, was the first Stanford emergency medicine physician to be board certified in clinical informatics, and in 2008, when the hospital was getting ready to go live with EPIC EHR, he spent hundreds of hours running clinical scenarios and redesigning workflows to create a more efficient system. He is now utilizing informatics to identify variances in care delivery.

Brown says, “I spend my days taking care of one patient at a time, and that’s what I wanted to do, to help people in greatest need. But with informatics, there’s such an opportunity to make a macroscopic improvement in our whole health care system.”

According to Brown, Stanford is one of the top five hospitals in the country for interconnections with other health information systems, and the emergency department has more health information exchanges than any other part of Stanford Medicine. As a result, when patient data is entered, on the backend there can be 2,000 other similar patient cases.

With the ability to examine every step that a doctor takes in every order, the system, according to Brown, can determine if providers stray from evidence-based medicine. Brown and colleagues can then help to guide changes for the provider as well as examine if the changes in the EHR system reduce variations of care and impact cost.

EM INFORMATICS FELLOWSHIP

Stanford’s two-year EM Clinical Informatics Fellowship offers fellows the opportunity to develop projects in multiple arenas such as artificial intelligence (AI) and digital health quality improvement. Throughout the program, fellows work closely with both clinicians and technical experts, often bringing these two enterprises together to impact patient care.

Fellow **Dev Dash, MD** has developed an AI system that can review cardiac echocardiograms to assess the quality of cardiac output and determine if the images are adequate. Dash is also developing dashboards that will enable emergency medicine physicians to review practice variation and resource utilization.

“Emergency medicine stands to benefit the most from having machine intelligence assist patient care,” says Dash. “We have access to an overwhelming amount of past data, with very limited time to parse through all of it.”



VIRTUAL CARE

TELEHEALTH & REMOTE EMERGENCY SERVICES

As health systems work to provide a range of virtual services from prevention to primary care, Stanford's long-term vision is to extend this continuum to include virtual emergency care, including assessment, diagnostics, treatment, and follow-up.

The challenges of the COVID-19 pandemic presented opportunities for Stanford's Department of Emergency Medicine to make major strides toward this vision with three foundational programs.



Step One: When a parking garage is more than a parking garage

One of Stanford's first steps toward virtual emergency care was to establish a drive-through alternative care site for COVID-19 testing in 2020, supported by a remote emergency medicine physician. Patients drove into the garage adjacent to Stanford's Marc and Laura Andreessen Adult Emergency Department (ED) and registered for their visit through their phones. ED nurses in personal protective equipment measured their temperature, oxygen saturation, and pulse, and swabbed them for COVID-19. A laboratory runner retrieved specimens from the drive-through site every 15 minutes.

A telemedicine platform on wheels was then positioned near the patient's car and an emergency medicine physician stationed in the hospital initiated a remote assessment and discussion with the patient via video. The physicians utilized streamlined charting tools that enabled them to see as many as 100 patients in a single shift while minimizing exposure to COVID-19.

Nearly 5,500 patients received safe, expedited care in the drive-through area.



DR. SAM SHEN HELPED LAUNCH REMOTE PHYSICIAN CONSULTATIONS AT A PARKING GARAGE COVID-19 TESTING SITE. THE SUCCESS OF THE PROGRAM LED TO THE DEVELOPMENT OF TELEHEALTH CONSULTATIONS FOR LOW-ACUITY PATIENTS AND OTHER INNOVATIONS.

Step Two: Utilizing iPads to increase interactions with patients in isolation

Through 120 iPads mounted at eye-level in ED patient rooms, physicians and nurses can now provide supplemental, virtual care by calling in to patient rooms to gather history, provide updates, and conduct physical assessments. Specialists, interpreters, and some consultants use the system to meet with patients remotely, and the iPads have been used to allow patients to meet virtually with family, view informational videos, and consent to participate in clinical research.

The innovation was developed and implemented in just eight days in the early stages of the COVID-19 pandemic when personal protective equipment was in short supply.

Step Three: Telehealth

Patients in the Stanford ED who meet specific, low-acuity criteria may now choose to be treated by a remote, board-certified telehealth emergency medicine physician.

Patients are taken to a designated telehealth room in the ED where they connect by video with the emergency medicine physician to discuss their concerns and symptoms. An on-site technician and nurse are guided by the physician and can conduct basic physical examinations while the physician observes on a monitor. Physicians use the interaction, observations, and certain test results as needed to evaluate, diagnose, and determine best next steps for care.

Since the program was implemented in early 2021, the number of patients served each day by the telehealth physician has increased by over 300% percent. The off-site physician provides support to both the adult and pediatric emergency departments, which experience unexpected patient surges at different times.

The program enables Stanford's Department of Emergency Medicine to test and evaluate remote emergency care, with an eye toward scaling to other locations in the future. Stanford will also track wait time, patient satisfaction, length of stay, and other metrics to optimize the quality of care and patient experience.

Scheduling virtual follow-up visits

Patients can now be seen virtually by an emergency medicine physician for follow-up within 72 hours of an ED encounter. Based on the discharge condition, the physician can schedule the appointment for the patient to be evaluated from their home through the MyHealth app.

The program was developed in part to increase access to a continuum of care for patients who may face transportation, scheduling, or mobility challenges.

Looking Ahead

Tele-EMS support: Currently, emergency medicine physicians provide support by phone to help local EMS groups in the field assess patients and determine immediate care needs. Telehealth can supplement the process, with cameras installed in emergency vehicles offering opportunity for physicians to evaluate conditions and guide hands-on care.

Tele-triage: Emergency physicians will be able to remotely support the triage of patients who call into Stanford Health Care to determine if they need further immediate care in the ED, an alternative setting, or an outpatient clinic.



DR. RYAN RIBEIRA DEMONSTRATES THE USE OF IPADS MOUNTED AT EYE-LEVEL TO INCREASE CONNECTION WITH PATIENTS IN ISOLATION.



INNOVATORS AT A GLANCE



PREDICTING MYOCARDIAL INJURY FASTER, WITH FEWER DIAGNOSTICS

Chest pain accounts for seven to nine million emergency department visits each year in the U.S. and typically triggers serial laboratory studies and prolonged monitoring for acute coronary syndrome (ACS). Current risk-stratification methods, often requiring serial biomarker assays, are costly and inefficient.

DAVID KIM, MD PHD, assistant professor of emergency medicine, and colleagues have developed and validated a predictive model for myocardial injury using continuous lead-II ECG signal data from bedside monitoring early in a patient's presentation to predict myocardial injury.

The predictions of the best-performing models, using only non-invasive monitoring and basic patient information, demonstrated an excellent negative predictive value for myocardial injury among patients with chest pain or shortness of breath. Results were available significantly sooner than dispositive laboratory results. The model also showed better classification accuracy than ED physicians.

Kim and colleagues are also looking at increasing the yield of CT scans for pulmonary embolism, a very common diagnostic dilemma in the ED. They are developing a model to learn which patients should be prioritized for testing based on their cardiac electrophysiology and respiratory dynamics. And they are looking to develop a system for real-time guidance for resuscitation in shock.



CREATING NEW TECHNOLOGY TO RAPIDLY DIAGNOSE AND TREAT SEPSIS

Every year, nearly 1.7 million Americans develop sepsis. Standard diagnosis of sepsis relies on a blood test that typically takes at least 24 hours. **SAMUEL YANG, MD** is working to change this.

Yang, an associate professor of emergency medicine, has received two grants from the National Institutes of Health totaling \$7.4 million to develop a rapid sepsis test with high accuracy. Preliminary data from his research suggests it is possible to accelerate antimicrobial susceptibility testing, with results available within as little as 15 minutes.

Yang's approach is to analyze bacteria at a single-cell level versus an entire population of cells. To work at such a minute scale, he is using advances in microfluidic technologies to miniaturize a full-scale laboratory into a disposable, cartridge-size device operable by a bench-top instrument.

The test first captures live bacteria directly from whole blood, then probes the genetic sequences within each bacterium individually for species identification, before tracking phenotypic features of individual live bacterium – size, shape, metabolism, and growth rate – to determine the response to antibiotics.

While incorporating complex technologies, Yang is determined to create a product that is automated and easy to operate, particularly within the timeframe of emergency care.

IMPROVING HEALTH CARE DELIVERY FOR AT-RISK POPULATIONS

JODY VOGEL, MD, vice chair for academic affairs for Stanford's Department of Emergency Medicine, is investigating interventions to reduce health care costs and improve the quality of care for frequent emergency department visitors with complex needs, thanks to a five-year Career Development Grant Award from the Agency for Healthcare Research and Quality.

Frequent emergency department visitors are an at-risk population with substantial psychosocial and medical vulnerabilities who often have multiple chronic health conditions, significant use of primary and specialty care services, and high mortality.

Vogel's focus is on developing an evidence-based framework to effectively address health and psychosocial concerns and successfully mobilize resources for these patients.

Vogel is overseeing investigations employing both quantitative and qualitative methods. The research affords Vogel opportunities to collaborate with Internal Medicine, Psychiatry, Behavioral Health, Addiction Medicine, and Social Work among others.



INNOVATORS AT A GLANCE



USING DIGITAL DEVICES TO EXPAND CARE BEYOND THE EMERGENCY DEPARTMENT

BRIAN SUFFOLETTO, MD, associate professor of emergency medicine, is designing and testing digital behavioral interventions (DBIs) across a range of conditions. His work centers on improving the health of older adolescents and young adults, given their increased relative risks for certain health issues (e.g. alcohol and mental health issues) and the ubiquity of smartphone ownership, as well as their use of the emergency department as a surrogate for primary care.

Suffoletto is leading multisite clinical trials testing the use of DBIs with young adults to:

- improve seatbelt use, lower distracted driving, and reduce drinking and driving.
- determine optimal strategies to reduce hazardous alcohol consumption.
- improve mental health care for depression and mental health self-management in the transition to college.

His work centers on human-computer interaction (HCI) and context-aware computing and is informed by psychological theories of behavior change.

A PRECISION MEDICINE APPROACH TO TREATING TRAUMATIC BRAIN INJURY

ANGELA LUMBA-BROWN, MD is defining new best practices for diagnosing and treating traumatic brain injury (TBI), including concussion, using phenotyping.

TBIs are complex and heterogeneous; not every person will exhibit the same signs or symptoms nor respond to treatments in the same way. Lumba-Brown, associate vice-chair for Stanford's Department of Emergency Medicine and co-director of the Stanford Brain Performance Center, leverages advances in data science to drive personalized care for TBI.

"Phenotypes can fast-track precision diagnostics and tailor therapeutics," says Lumba-Brown. Depending on the phenotype, a patient may benefit from oculomotor therapy, cognitive behavioral therapy, escalated migraine medication, vestibular rehabilitation, sleep modifications, and/or exercise therapies.

Lumba-Brown's research has also pioneered work supporting the concept that anxiety and mood disruption may occur early on following head injury and throughout recovery, impacting how physicians approach mental health following traumatic brain injury.

GUIDING PUBLIC POLICY

JENNY WILSON, MD, MS, clinical associate professor of emergency medicine, is principal investigator at Stanford for the Centers for Disease Prevention and Control Influenza and Other Viruses in the Acutely Ill (IVY) network comprised of 21 large hospitals in the U.S.

As the only IVY site in Northern California, Stanford provides public health surveillance data on hospitalizations, variant prevalence, and vaccine effectiveness in the region. Wilson and Stanford Medicine colleagues ensure COVID-19 data is rapidly and accurately captured to provide near real-time feedback to guide national policy.

Additionally, Wilson has co-led a trial of antithrombotic therapies in patients hospitalized for COVID-19. "There is the risk of big blood clots," she notes. "But also concern that small clots caused by inflammation and endothelial dysfunction contribute to the organ failure we see in critically ill patients with COVID-19."

This concern led physicians to treat all COVID-19 ICU patients with therapeutic anticoagulation. Based on the work done by Wilson's research group, we now know that this strategy does not improve outcomes in the critically ill – though it may provide benefit in patients with less severe disease. Ongoing studies are evaluating the safety and efficacy of antiplatelet agents and other antithrombotic therapies in patients with COVID-19.



FUTURE-FORWARD TRAINING IN EMERGENCY MEDICINE INNOVATION

In 2021, Stanford's Department of Emergency Medicine welcomed John Dayton, MD as the first emergency medicine innovation fellow.



The innovation fellowship comprises digital health projects; MBA coursework focused on health care, innovation, and entrepreneurship; and teaching shifts in Stanford's Marc and Laura Andreessen Emergency Department. Dayton will also complete the Biodesign course at the Stanford School of Design to learn to apply the principles of design thinking in health care settings.

As an entrepreneur-in-residence, Dayton works with venture capital firms and health tech startups to learn how the innovation ecosystem works with hospitals like Stanford to bring the next generation of medical technology to the market. He is also part of the Stanford Innovation Partnership Evaluation Committee that builds collaboration between the Department of Emergency Medicine and health care companies and explores innovative digital tools to improve health care.

ONLINE COVID-19 TRAINING FOR HEALTH CARE PROVIDERS AROUND THE GLOBE

MORE THAN 120,000 HAVE ACCESSED THE MULTI-LINGUAL COURSE

“Emergency medicine is a community-based specialty, and we live in a global community. That was never more obvious than when the pandemic struck.”
- MATTHEW STREHLOW, MD



Stanford’s Department of Emergency Medicine has launched a 15-module online course to train health care workers in low-to middle-income countries (LMICs) and rural and remote areas on recognizing and treating COVID-19.

In LMICs, where health care systems are more likely to be under-resourced and overwhelmed, non-physician health care workers constitute most health care providers.

“Our LMIC partners were asking us where they could get ventilators and people to manage them,” explains Matthew Strehlow, MD, director of Stanford Emergency Medicine International. “But even with skilled technicians, most patients on ventilators died. It seemed clear we could have a bigger impact if we trained health care workers in identifying, evaluating, and treating COVID symptoms before they reached the ventilator stage.”

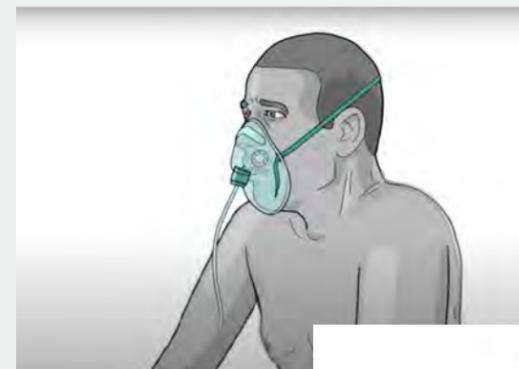
COVID-19 Training for Health Care Providers was developed in just 14 weeks and to date, more than 120,000 learners around the globe have enrolled in the course that is now

available in Spanish, Hindi, French, and Portuguese.

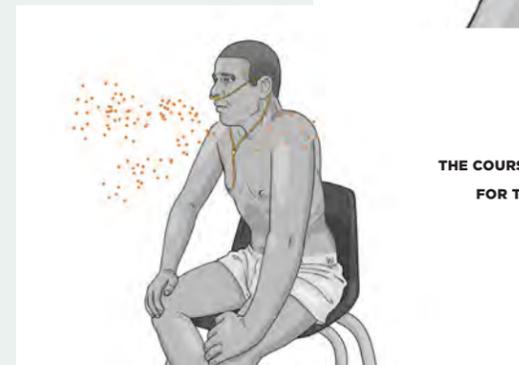
The African Forum for Research and Education in Health (AFREhealth) has partnered with Stanford University to promote and disseminate the course throughout Africa. AFREHealth is an interdisciplinary group of leaders from more than 60 medical and nursing schools in Africa.

The Pakistani government and Educast, a Pakistani-Saudi virtual health platform, utilized Stanford’s online course to train more than 400 Pakistani women physicians in caring for COVID-19 patients remotely. Stanford emergency medicine physicians then held webinars to answer questions and review challenging cases.

THE 15-MODULE ONLINE COVID-19 PROGRAM WAS CREATED BY STANFORD EMERGENCY PHYSICIANS SPECIFICALLY FOR HEALTH CARE WORKERS IN LOW- TO MIDDLE-INCOME COUNTRIES WITH LIMITED RESOURCES.



THE COURSE COVERS SYMPTOMS AND SIGNS IN PATIENTS WITH COVID-19, EARLY STABILIZATION OF PATIENTS, PREVENTING THE NEED FOR INTUBATION, AND VENTILATOR MANAGEMENT OF PATIENTS.



THE COURSE HAS ALSO BEEN ADAPTED FOR TARGETED USE THROUGHOUT AFRICA AND PAKISTAN.



EXPANDING THE LOCAL COMMUNITY CRISIS SUPPORT NETWORK

As the COVID-19 pandemic lockdown intensified, Jennifer Newberry, MD, assistant professor of emergency medicine, grew concerned that uninsured and underinsured community members were not receiving adequate information about COVID-19. She also worried that the lockdown would increase incidents of intimate partner violence (IPV) due to forced proximity and added stress.

In partnership with Next Door Solutions to Domestic Violence, Newberry and her team created a video series in English and Spanish to teach promotoras (lay Hispanic/Latino community members with specialized training in health education) and community members about COVID, as well as how to recognize intimate partner violence, and how to partner with physicians for support.

Newberry notes, “These are not providers. They are educators and facilitators with a different level of health literacy. What we are trying to do is equip them with knowledge and tools to help their communities understand COVID, access health care, and recognize the connection between health and IPV.”

STANFORD EMS IN THE COMMUNITY

The Stanford Department of Emergency Medicine's Emergency Medical Services (EMS) section is closely integrated with surrounding communities stretching from San Francisco to Gilroy. Partnerships span all aspects of pre-hospital care and training for fire departments, law enforcement agencies, and even the National Park Service.



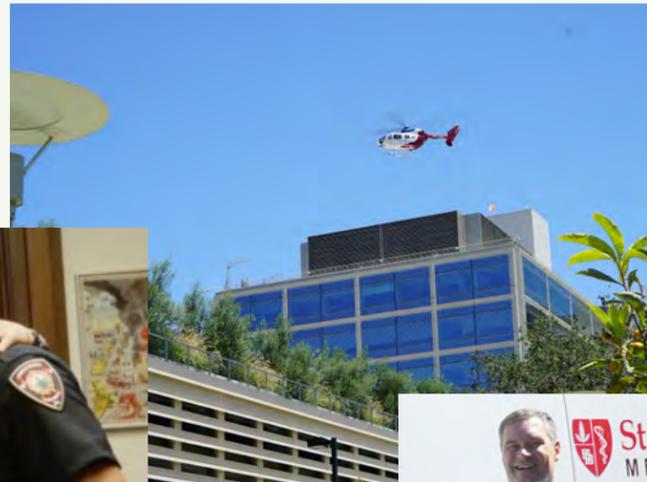
TRAINING LOCAL PARTNERS

Stanford emergency medicine physicians serve as medical directors for 10 local fire agencies, providing crucial hands-on training on the latest protocols for health emergencies, and advanced EMS. During the COVID-19 pandemic, much of this training focused on airways, including improving intubation success rates using video laryngoscopy.

Physicians also provide support to local law enforcement in managing COVID risk and, in cooperation with Stanford Health Care, offered a first responder testing program at no cost to financially strained local governments. And EMS faculty train national park service paramedics on-site in Yosemite four times a year on advanced airway management, ECG interpretation, and trauma management.

COVID-19 TESTING FOR FIRE DEPARTMENTS

Stanford EMS physicians enlisted colleague Jennifer Newberry, MD to serve as principal investigator on a six-week assessment of the impact of COVID on fire departments throughout Santa Clara County. In partnership with the California Firefighters Association, Stanford acquired nasal pharyngeal swabs and blood draws from firefighters at 40 sites, enrolling nearly 1,000 participants.



IN 2021, EMS SECTION DIRECTOR MARC GAUTREAU, MD (ABOVE) WAS APPOINTED BY THE GOVERNOR TO THE STATE EMS COMMISSION, AND CLINICAL ASSISTANT PROFESSOR WILLIAM MULKERIN, MD (FAR LEFT) RECEIVED THE DISTINGUISHED SERVICE MEDAL FROM THE CALIFORNIA EMS AUTHORITY FOR EXTRAORDINARY CONTRIBUTIONS TO EMS.

EMS GUIDANCE AND SUPPORT

EMS faculty develop protocols, procedures, and scope of practices for pre-hospital care for the state, and advocate on policies and legislation. And as the EMS base station for San Mateo County, Stanford emergency department serves as a resource for local EMS providers. Providers in the field call into the emergency department and speak with a physician who answers questions about care or protocols on incoming patients.

LIFE FLIGHT

Stanford Life Flight is the oldest flight program in California and the state's only academic hospital-based flight program. Alfredo Urdaneta, MD, clinical assistant professor serves as medical director for Stanford Life Flight, providing support on ride-alongs and training Life Flight nurses. Urdaneta also reviews all treatment protocols and offers remote medical oversight via telecommunication day or night.

IMPROVING OUTCOMES FOR STROKE PATIENTS

Prasanthi Govindarajan, MD is using a multi-year Research Project grant from the Department of Health and Human Services Agency for Healthcare Research and Quality to study the effect of state- and county-level stroke center bypass policies on patient outcomes.

In a best-case scenario, pre-hospital providers quickly recognize stroke en route, and the patient is taken to a facility such as a primary stroke center that can rapidly administer the optimal treatment for that patient, even if it means bypassing a closer facility.

During 2006-2014, only 896 counties in the United States had a stroke center bypass policy; twice as many did not. And among those with policies, there was wide variation in the process, implementation, and scope.



Working with partners, Govindarajan, an associate professor of emergency medicine, is using a mixed-methods approach to determine:

- if a bypass policy leads to an increase in intravenous alteplase and better stroke patient outcomes (lower 30-day mortality and greater short- and long-term functional independence); and
- if county factors (e.g., variation in policy components, urban/suburban/rural counties) are associated with differential effects on outcomes.

Govindarajan was recently invited by the Centers for Disease Control and Prevention's Division for Heart Disease and Stroke Prevention to serve on a national panel of experts developing guidelines for stroke systems of care.

RESIDENCY

OPTIMIZING EMERGENCY MEDICINE TRAINING

Stanford's emergency medicine residency program innovations ensure inclusion and in-depth career development for residents.

HOLISTIC RESIDENCY RECRUITMENT

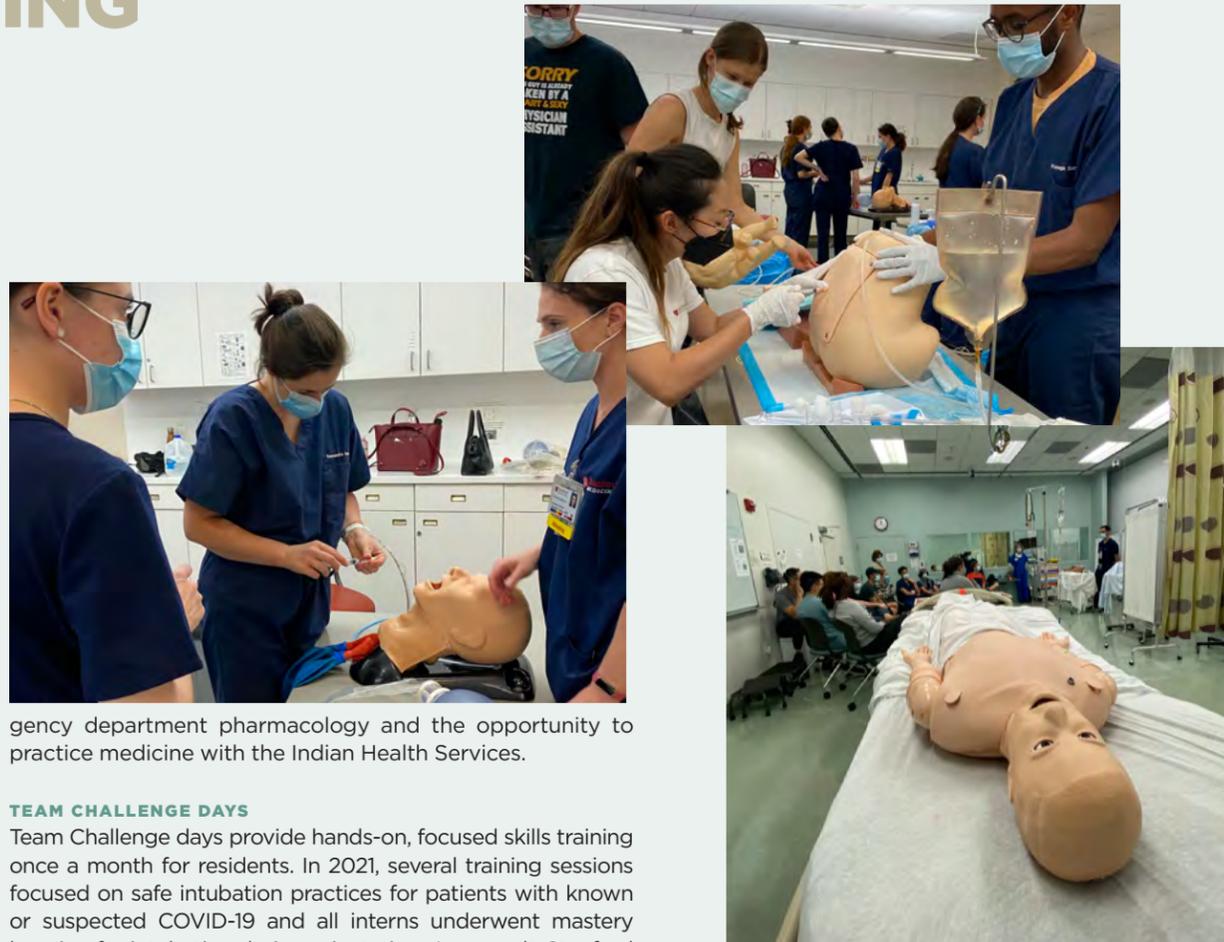
Stanford was one of the first emergency medicine residency programs to blind U.S. Medical Licensing Examination scores in reviewing candidates, as studies indicate scores reflect a racial bias. For several years, Stanford Emergency Medicine has redacted candidate pictures for the initial candidate screening. The program recently added a second review of Underrepresented in Medicine (URiM) students by the DEI Residency Recruitment Taskforce. These efforts helped increase URiM representation in the intern class to nearly 25%.

ADVANCED CLINICAL AND CAREER ENRICHMENT LINE (ACCEL) PROGRAM

Beginning in their intern year, emergency medicine residents are provided significant time to explore subspecialties of emergency medicine through more than 75 electives in three lines:

- Emergency Medicine Without Walls (EM WOW)
 - Medical Education
 - Advanced In-Hospital Medical Care and Clinical Operations
- Residents attend discussions, participate in projects, and are provided longitudinal mentorship with faculty leaders in specific tracks within each line.

The program is designed to continuously evolve and last year a Sports Medicine Track was created based on resident input. Additionally, two new electives were added for emer-



gency department pharmacology and the opportunity to practice medicine with the Indian Health Services.

TEAM CHALLENGE DAYS

Team Challenge days provide hands-on, focused skills training once a month for residents. In 2021, several training sessions focused on safe intubation practices for patients with known or suspected COVID-19 and all interns underwent mastery learning for intubation during orientation. As a result, Stanford emergency medicine residents maintained their ability to perform all intubations in the emergency department during the pandemic. And emergency medicine residents, in partnership with Internal Medicine residents, comprised an integral part of ICU staffing during a six-month COVID-19 surge.

ALPHA CHIEF

The Alpha Chief role provides residents with the chance to oversee up to 29 beds, attend all codes and traumas, balance ambulance- and walk-in patients, and manage the entire flow of the high-acuity section in what could be considered a junior faculty role. In addition to allowing greater responsibility and autonomy for fourth-year residents, the structure frees attendings to have more time to teach, oversee procedures, and work one-on-one with interns or medical students.

A New Paradigm

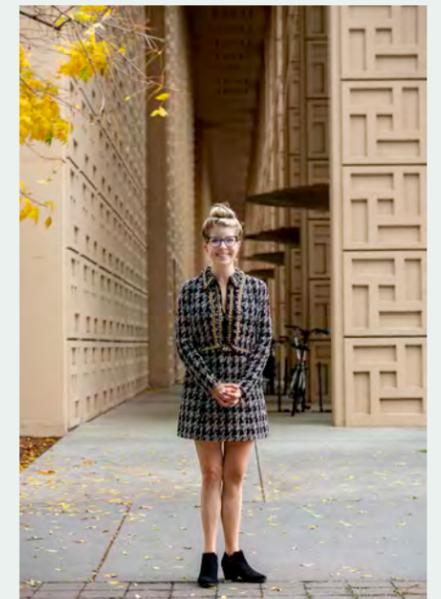
"When you don't fit in someone else's box, build your own box." – Dr. Holly Caretta-Weyer

In 2016, Holly Caretta-Weyer, MD was the youngest participant in the Association of American Medical Colleges (AAMC) Core Entrustable Professional Activities for Entering Residency pilot where she helped create a pilot to define 13 skills medical students are expected to master before graduation. Five years later, these EPAs are being variably implemented at nearly every AAMC member school.

Now, Caretta-Weyer is translating this work into national standards for emergency medicine residency training to ensure residents have the data, resources, coaching, and individualized feedback to build their own box, so to speak.

Caretta-Weyer, a clinical assistant professor of emergency medicine, and the Emergency Medicine Residency Program Evaluation and Assessment Consortium are utilizing a five-year \$1.25 million grant from the American Medical Association (AMA) to develop an ecosystem of assessment and predictive learning analytics as part of a shift to competency-based medical education.

An entrustable professional activity (EPA) is an "everyday physician activity," ranging from repairing a simple laceration to resuscitating a victim of multisystem trauma. Caretta-Weyer's project develops specific, measurable outcomes of EPA's and helps move emergency medicine toward training that is data-oriented and facilitated by new technology. The goal is to create individualized or precision training for each trainee at any given point in their education.



THROUGH ADVANCED ELECTIVES, TEAM CHALLENGE DAYS, AND THE ALPHA CHIEF ROLE, RESIDENTS REFINE CAREER GOALS AND SKILLS.



RESIDENCY PROGRAM DIRECTOR SARA KRZYZANIAK, MD WITH GRADUATE BRYN EIFELDER, MD

TRAINING FUTURE PHYSICIANS ON HEALTH EQUITY AND SOCIAL JUSTICE

Q&A WITH ITALO BROWN, MD, CLINICAL ASSISTANT PROFESSOR OF EMERGENCY MEDICINE

YOU HAVE BEEN DESIGNATED THE SOCIAL JUSTICE AND HEALTH EQUITY LEAD FOR THE STANFORD MD TRAINING PROGRAM. WHAT IS THE PRIMARY GOAL OF THE GROUP?

Medical students need to develop a health equity lens and a compass for social justice, and the responsibility is on us as a community to make sure this is fully integrated into their curriculum.

I spend a lot of time convening other folks for brainstorming sessions about what can work and what can't. I try to identify training gaps and connect the resources to address them.

For example, we know the use of race-based algorithms in assessing a patient's Estimated Glomerular Filtration Rate (eGFR) has been one of the most cited topics when we talk about the racialization of medicine, but students weren't hearing about this. I met with the course director and now we have a panel discussion of nephrology experts discussing the issue.

WHAT ADDITIONAL PROGRESS HAS BEEN MADE?

We recently inserted health equity content into medical school pre-clerkship courses to explore how social determinants affect health outcomes for people who are typically marginalized. And we've integrated health equity rounds to general surgery, family medicine, and emergency medicine core clerkships.

We have case-based dialogue around how underlying health equity issues affect health outcomes. For example, we talk about cystic fibrosis, which is typically associated with white individuals, and sickle cell diseases, which predominantly impacts people of color, and we look at differences in times for admission, or times to receiving pain medication, and the implicit bias that comes along with these two diseases.

HOW DID YOU BECOME INTERESTED IN THIS WORK?

I studied under the late Dr. Bill Jenkins who was key in raising awareness and getting the government to acknowledge wrongdoing on the Tuskegee experiments. He is a major force in why we understand Black medical distrust and why we are aware of experimentation on black bodies. He made an investment in me as a teacher when I was 20 years old. My way of paying it back and showing a return on his investment in me is to do this work.

HOW DOES YOUR WORK WITH BARBERSHOPS INFORM YOUR WORK ON THE COMMITTEE?

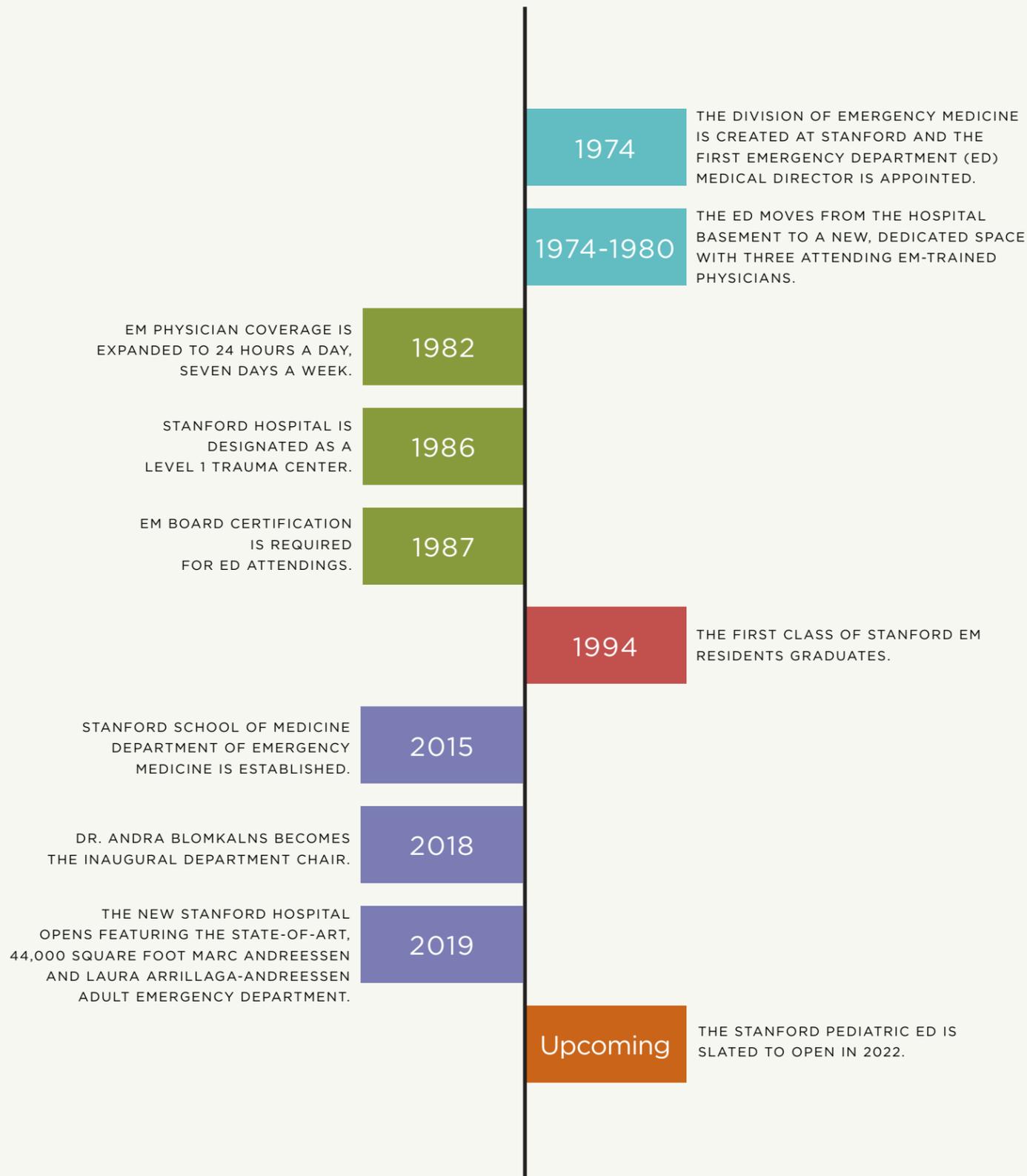
I was fortunate to become involved in TRAP medicine, which utilizes barbershops as a venue for conversations about men's health care. I think barbershop-based health initiatives have a clear place in health care and medical training because they address topics that have often been in the blind spots of institutions. During COVID, we shifted to social media and screening sites to get the messages out to the Black community. It's important that medical students understand the different venues for these conversations.

WHY IS EMERGENCY MEDICINE AN IMPORTANT LEADER IN THIS SPACE?

In emergency medicine, we are already connectors. Every day we interact with other services in the hospital and speak their languages, and so that ability to communicate, translate, and integrate material across different disciplines allows us to be a strong voice for issues of health equity.

ITALO BROWN, MD





4,000

In 2021, 4,000 ED patients were treated using telehealth video visits with a shorter length of stay than non-video visits.

245

Stanford Emergency Medicine faculty, fellows, and residents wrote or contributed to 245 peer-reviewed publications in 2021.

265

On average, 200 patients visited the Stanford adult ED in 2021. On average, 65 patients a day visited the pediatric ED.

48%

On average, 48% of hospital patients admits arrived via the ED.

1,000,000+

Stanford ED's Pegasus project uses SMS messaging to keep patients informed at every step of their visit. In 2021, the system sent more than 1 million text messages in English and Spanish.

101

Stanford Department of Emergency Medicine has 101 full- and part-time faculty, 60 residents and 17 fellows.

TO READ MORE ABOUT THE STORIES FEATURED IN THIS MAGAZINE PLEASE VISIT [EMED.STANFORD.EDU/PRECISION.HTML](https://emed.stanford.edu/precision.html)





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