More primary care doctors equals longer lives

By Beth Duff-Brown

ew research shows us just how important primary care physicians are in prolonging our lives.

Every 10 additional primary care physicians per 100,000 people in the United States was associated with a 51.5-day increase in life expectancy during the decade from 2005 to 2015, according to a study led by researchers at the Stanford School of Medicine and Harvard Medical School.

By comparison, the researchers found that an increase of 10 specialists per 100,000 corresponded to only a 19.2-day increase.

"Greater primary care physician supply was associated with improved population mortality, suggesting that observed decreases in PCP supply may have important consequences for population health," the study said.

Nationwide, the researchers found that the number of primary care physicians has increased. However, disproportionate losses of primary care physicians in rural areas and overall population growth has led to a decrease in the density of PCPs per 100,000 people from 46.6 to 41.4 per in the same decade. Rural populations were particularly hard hit.

"Primary care physicians serve as the primary point of contact for most of the population and often perform preventive care, cancer screening and early diagnosis," said Sanjay Basu, MD, PhD, assistant professor of medicine and of health research and policy at Stanford.

The researchers' findings were published Feb. 18 in JAMA Internal Medicine. Basu, a core faculty member at Stanford Health Policy, is the lead author. The study’s findings were published Feb. 18 in JAMA Internal Medicine. Basu, a core faculty member at Stanford Health Policy, is the lead author. The study’s findings were published Feb. 18 in JAMA Internal Medicine. Basu, a core faculty member at Stanford Health Policy, is the lead author.

Dramatic shortfall in near future

The Association of American Medical Colleges estimates the United States will see a dramatic shortfall of primary care physicians by 2030.

"Many believe that a well-functioning health care system requires a solid foundation of primary care," the study said. "Yet, persistent payment disparities between primary care and procedural specialties continue to erode the U.S. PCP workforce."

The researchers say that a lack of health care policies aimed at increasing primary care physician supply, compounded by market forces, have reduced the number of primary care physicians relative to higher-income specialties, such as cardiology and orthopedic surgery.

"There are few incentives to go into primary care among U.S. medical school graduates," Basu said. "Pay tends to be lower, burnout rates higher and prestige lower."

The researchers set out to identify the extent to which the number of primary care physicians might impact mortality — and to encourage policymakers to consider the importance of encouraging more medical students to become primary care physicians.

They defined primary care physicians as nonfederally employed physicians younger than 75 years old who are not hospital residents and whose major professional activity is outpatient care in general practice, family medicine, general internal medicine and general pediatrics in every U.S. county and the District of Columbia.

The primary care physician counts were obtained from the American Medical Association Physician Masterfile for the years 2005, 2010 and 2015, and population counts came from the U.S. Census Bureau.

Five major causes of death

The epidemic level of physicians reporting burnout dropped modestly in 2017, according to a study by researchers at the School of Medicine, the Mayo Clinic and the American Medical Association.

"Physicians remain at increased risk for burnout relative to workers in other fields, but there is some good news," said Tait Shanafelt, MD, director of Stanford's WellMD Center and a national leader in the movement to improve physician well-being. "For the first time, we’re seeing improvement in the prevalence of burnout symptoms in physicians nationally."

Burnout decreased and satisfaction with work-life integration improved between 2014 and 2017, according to the study. Still, levels of burnout remain markedly higher than in other fields.

About 44 percent of physicians reported at least one symptom of burnout, and only about 43 percent reported satisfaction with their work-life integration, which was less than in 2011.

Opioid deaths jump fourfold in 20 years; epidemic shifts to eastern states, study finds

By Beth Duff-Brown

Opioid-related deaths nationwide jumped fourfold in the last two decades, and the epidemic has made major inroads in the eastern states, according to a new study by researchers at the School of Medicine, Harvard University and the University of Toronto.

"Although opioid-related mortality has been stereotyped as a rural, low-income phenomenon concentrated among Appalachian or midwestern states, it has spread rapidly, particularly among the eastern states," the study said.

The researchers found the highest rates of opioid-related deaths occurred in eight states: Connecticut, Illinois, Indiana, Massachusetts, Maryland, Maine, New Hampshire and Ohio. Two states, Florida and Pennsylvania, had opioid-related mortality rates that were doubling every two years. The mortality rate from opioids has increased the fastest in the District of Columbia, more than tripling every year since 2013, the researchers found.

The study’s findings were published Feb. 22. See OPIOID, page 7

Modest decrease seen in burnout among physicians, researchers say

By Tracie White

The epidemic level of physicians reporting burnout dropped modestly in 2017, according to a study by researchers at the School of Medicine, the Mayo Clinic and the American Medical Association.

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About 44 percent of physicians reported at least one symptom of burnout, and only about 43 percent reported satisfaction with their work-life integration, which was less than in 2011.

The study was published online Feb. 22 in Mayo Clinic Proceedings. Shanafelt, who is also a professor of hematology and the Joanie and Stew Ritchie Professor, is the lead author. Lottie Dyrbye, MD, co-director of the Mayo Clinic physician well-being program, is the senior author. See BURNOUT, page 7
At new hospital, digital tools will augment patient experience

By Grace Hammerstrom

It’s easy to see how the new Stanford Hospital will look now that the exterior is complete; the interiors are built out, and the furniture, equipment and staff are all installed. Less visible but equally important is how the new hospital will feel to patients when it opens in the fall of 2019.

Multiple teams throughout the hospital have helped create a digitally driven patient experience that matches the majestic façade of the new structure, said Alpa Vyas, vice president of patient experience for Stanford Health Care. “The service and the culture we create inside must complement and enhance the physical environment,” she said.

From the moment patients and family members come through the doors of the new Stanford Hospital, a complementation of caregivers and staff will shepherd them through their health care journey. Digital tools developed specifically for the new space will also assist them: Teams at Stanford are designing a patient experience that will take advantage of smartphone technology to guide them through their inpatient visit.

Digital companion

Stanford’s MyHealth app will act as the digital companion for patients at the new Stanford Hospital, said Aditya Bhasin, vice president of software for Stanford Health Care. Patients can check in using MyHealth and speed up the admitting process before their scheduled surgery or inpatient stay. The app will also remind them about appointments and provide step-by-step directions on how to get from the outpatient clinic to the infusion treatment area and back again.

“Navigating a large medical campus can be confusing,” said Vyas, noting that it’s especially difficult for patients recovering from surgery or inpatient stay. The app will also remind patients to have an entertainment experience that’s closer to what they have at home.

Additionally, digital technology has been designed into every patient room, with plug-ins for electronic devices and storage for personal belongings. Patients will also be able to control the temperature of their room as well as the lighting and window blinds all without getting out of bed.

“We understand that people feel very vulnerable as patients in a hospital bed,” Vyas said.

“When designing the patient rooms, we looked at some of the small things we can put back into the hands of our patients to give them a sense of control over their environment.”

Enhanced communication

Every patient at Stanford Hospital is cared for by a team of doctors, nurses, therapists, case workers and support staff who must work together to coordinate services and manage a patient’s return to health. Improving caregivers’ ability to communicate and collaborate easily — in a way that protects patient privacy — was a priority, especially as the caregivers move into the larger space of the new hospital, Vyas said.

Stanford has implemented a secure messaging platform that allows care teams to communicate about a patient’s personal health information in a protected environment, said Troy Foster, senior manager for network infrastructure. “It provides seamless communication between all members of a treatment team via phone call or text,” he said. It also eliminates a lot of searching for team members when a question arises. The system runs on iPhones and is being used by more than 5,700 physicians and 2,000 nursing and ancillary staff. On an average day, 30,000 text messages and 6,000 calls are transmitted through the messaging platform.

“It’s a faster way for care teams to collaborate on patient care,” said Ann-Marie Yap, executive director of technology. “It really increases our efficiency.”

“From a patient experience perspective, we are looking at how technology can augment processes so team members have more time to focus on patient care,” Vyas said. Care teams and staff are currently testing and refining many of these new capabilities in the existing hospital before they are implemented in the new hospital. “We want to get people comfortable with using all the new technology before we move into the new space so they can be ready to care for our patients,” she said.

New antibiotics are desperately needed: Machine learning could help

By Hanane Armitage

As the threat of antibiotic resistance looms, microbiologists aren’t the only ones thinking up new solutions. James Zou, PhD, assistant professor of biomedical data science at Stanford, has applied machine learning to create an algorithm that generates thousands of entirely new virtual DNA sequences with the intent of one day creating antimicrobial proteins.

The algorithm, called Feedback GAN, essentially acts as a mass producer of random possibilities. By running the algorithm, these sequence attempts are somewhat random, the algorithm isn’t working blindly. It’s basing the new possible peptides, or small groups of amino acids, on previous research that lays out the DNA sequences most likely to align with antimicrobial properties.

For now, these templates, which don’t exist in nature, are theoretical, generated on a computer. But in the face of rising concerns about microbe resistance, Zou said it’s critical to think about solutions that don’t already exist.

“We chose to pursue antimicrobial protein discovery because it’s a very important, high-impact problem that’s also a relatively tractable problem for the algorithm,” Zou said. “There are existing tools that we incorporate into our system that evaluate if a new sequence is likely to have the properties of a successful antimicrobial protein.”

Feedback GAN builds on an algorithm that was published online Feb. 11 in Nature Machine Learning. Anvita Gupta, a student in computer science, is the first author; Zou is the senior author.

Gupta and Zou’s algorithm doesn’t just churn out new combinations of DNA. It also actively refines itself, learning what works and what doesn’t through a feedback loop: After the algorithm spits out a wide range of DNA sequence drafts, one that runs a trial-and-error learning process that sifts through the peptide suggestions. Based on their resemblance to other known antimicrobial peptides, the “good” ones get fed back into the algorithm to inform future DNA sequences generated from the code, and to get refined themselves.

“There’s a built-in arbitrator and, by having this feedback loop, the system learns to model newly generated sequences after those that are deemed likely to have antimicrobial properties,” Zou said. “So the idea is both individual peptide sequences and the generation of the sequences get better and better.”

Zou has also considered another core component of hypothetical proteins: protein folding. Proteins contort into very specific structures linked to their functions. An algorithm could create the perfect sequence, but unless it can fold up, it’s useless — like rows of a clock stuffed on a table. Zou can tweak the algorithm so that instead of analyzing a propensity for antimicrobial properties, it determines the likelihood of correct folding.

“We can actually do these two things in parallel where we look at antimicrobial properties of 30,000 text lines of something like likelihood of another,” said Zou. “We run both so that we’re optimizing either the antimicrobial properties or its ability to fold.”

Next, Zou hopes to merge the two variations of the algorithm to create peptide sequences that are optimized for both their microbe-killing abilities and their ability to fold into a genuine protein.
Failure to take statins leads to higher mortality rates, according to new study

By Mandy Erickson

A lot of patients with arteries clogged by cholesterol are readily identified, but a new study by researchers at the School of Medicine has found that this boosts their risk of death, the study said.

More than a third of patients with cardiovascular disease who have been prescribed statins to reduce cholesterol failed to take them daily, according to a review of VA records, the researchers said. Women and nonwhites were least likely to take their prescriptions, as were the oldest and youngest patients.

“The takeaway for clinicians is not to become complacent about stable patients with cardiovascular disease,” said Fatima Rodriguez, MD, assistant professor of medicine.

The study was published online Feb. 13 in JAMA Cardiology.

Rodriguez is the lead author. Paul Heidenreich, MD, professor of medicine, is the senior author.

The researchers examined the health records of 347,104 patients with atherosclerotic cardiovascular disease — caused by fatty deposits in their arteries — who had been prescribed statins. Statins are a group of drugs that lower cholesterol.

From the VA records, the researchers were able to ascertain how often the patients picked up their prescriptions over a span of nearly three years.

Almost a quarter of the patients died during that time, so the researchers were able to calculate patients’ risk of death based on how frequently they took their statins. They found that those who were taking them less than 70 percent of the time had a 20 percent increase in mortality compared with those taking them at least 90 percent of the time.

Even those who were pretty good — but not perfect — when it came to picking up their prescriptions showed some increased mortality, Rodriguez said. “There is definitely a benefit to pushing adherence to 100 percent,” she said.

While Rodriguez said physicians can often do more to encourage their patients to take their medications daily.

“It’s difficult to change behavior,” she said, “but there are small interventions people can do. Just bringing it up and showing the patient that it matters to you as a provider probably has some effect. … In some cases, you’ll be able to find a reason they’re not taking it. … There may be a misconception or perhaps there is a cost issue.”

He noted that most statins are available in generic form, however, so they are fairly inexpensive.

As to why patients fail to take the medication daily, Rodriguez said there appears to be a resistance to lifelong medications. “Patients are hesitant to take medications forever,” she said. “They want to take it for a short amount of time.”

She added that patients may also be reluctant because statins have gotten a lot of bad press, possibly because of controversy over whether patients with a lower risk of heart disease should take them. (Lower-risk patients were not included in the study; the researchers were looking at high-risk patients, for whom statins are not controversial, the researchers said.)

Rodriguez conjectured that women may not take statins regularly because they often underestimate their risk of heart disease. Older patients may lose track of their statins among all the other medications they are taking, and younger patients may not believe they are at risk of dying. It is unclear why nonwhites are less adherent, she said, though researchers are looking into it.

While some patients suffer side effects from statins, the researchers said they are few and don’t explain the high numbers of patients who fail to take statins regularly.

Medical residents’ attention split between computers, patients

By Amy Jeter Hansen

It’s no secret that doctors spend increasing amounts of time in front of computers rather than patients.

But what does this mean for medical trainees? That question is at the heart of a new study from Stanford researchers, who sifted through more than three years’ worth of data in electronic health records, analyzing nearly 16 million interactions to find out how internal medicine residents at one hospital were spending their time.

The study was published online Feb. 6 in PLOS ONE. The senior author is Jonathan Chen, MD, PhD, assistant professor of medicine. The lead author is former Stanford undergraduate student Jason Ku Wang.

The researchers discovered that the trainees spent an average of 5.38 hours — or nearly half of a 12-hour work day — in front of a screen. The findings come in the wake of previous studies, conducted through observations and questionnaires, have found. But because their work analyzed computer records, the Stanford researchers could drill deeper.

“We were able to pinpoint more precisely what specific actions they were taking,” Wang said, “so whether they were looking at a patient chart, or whether they were inputting new information — writing a note or ordering a lab test.”

The study found that 90 percent of the trainees’ time was spent on computer activity by all residents, followed by note entry. That meant they were spending more time looking for information than adding new information — an insight that might be helpful for vendors and educators, Wang said.

“I know a lot of effort has been put into decreasing the amount of time physicians spend writing a note,” he said, “Perhaps they could also look at improving EHR design so that information is easier to access.”

The study also identified a behavioral difference between residents based on the clock: While night workers stopped their EHR activity promptly after their shift ended at 7 a.m., trainees working days tended to continue computer work up to 9 p.m. and beyond.

The variance might reflect understandable feelings of fatigue related to night work, Chen said, but it also could indicate that day-shift residents feel a different level of ownership than their counterparts when it comes to their patients — and that today’s residents have a better means for keeping their work home.

“Doctors used to be done with work at work,” he said, “but now they need to keep logging in, checking in, filling in that note or doing this other paperwork that still requires attention.”

Not all computer time for doctors is bad, Chen said, but much work needs to be done to ensure that hours in front of the screen translate to effective care.

“Although he is a self-described ‘computer nerd,’ Chen said he still finds value in face-to-face patient interaction and even in paper charts. As a resident at a hospital without a digital-record system, Chen said he spent more time in patients’ rooms than at a computer console, and he discovered that his notes were more efficient when he had to use a pen. ‘You want to write as little as possible,’ Chen explained. ‘Just the relevant information.’

Wong, who has plans to attend medical school next fall, said he was a bit concerned by what his own research showed.

“It’s very alarming to see that almost 50 percent of your day will be spent on the computer rather than with a patient,” he said. “That’s definitely not what most of us go into medicine hoping for. But on the other hand, information, if it’s high-quality, can be very useful and very promising. Precision medicine and personalized health care are rooted in having electronic health records that can make that data available. For me right now, it’s very interesting because I think it’s unclear whether the electronic health record as it’s currently designed will prove to be more harmful or productive.”

An art exhibit in white documents recovery, vulnerability and ritual

By Susan Coppa

In November of 2017, artist and physician Matthew Wettcher, MD, was body surfing at Ocean Beach in San Francisco when a wave drove him headfirst into the ocean floor, breaking his neck and leaving him partially paralyzed. He was spotted and dragged onto the beach before drowning. A vacationing nurse helped resuscitate him.

Wettcher was transported to Zuckenberg San Francisco General Hospital, where he was the first person in the United States to receive a post-experimental treatment focused on maintaining sufficient blood flow within the spinal cord.

That accident and the ensuing months of struggle to ultimately regain movement serve as the inspiration for Wettcher’s new exhibit of paintings, Documents, now on display at the School of Medicine’s Li Ka Shing Center for Learning and Knowledge.

Wettcher, who completed a residency in emergency medicine at Stanford before the accident, created all of the works in the exhibit in the past year, and they are directly inspired by his accident and the recovery process. They are also exclusively a product of ritual. Wettcher, who still experiences loss of fine-motor coordination in his right hand, said: “I still have an important role to play in the art world.”

By Matthew Wettcher at the Li Ka Shing Center for Learning and Knowledge.

A bodysurfing accident and the ensuing months of struggle to regain movement were the inspiration for new exhibit of paintings, Documents, now on display at the School of Medicine’s Li Ka Shing Center for Learning and Knowledge.

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By Matthew Wettcher at the Li Ka Shing Center for Learning and Knowledge.
Young scientist helps design AI that measures surgical skill

By Ruthann Richter

Amy Jin loves hip-hop dance, the violin and English literature. But it’s her passion for computer science that has propelled her to supernova in the Exploding Field of artificial intelligence.

Jin has been intrigued by AI since the sixth grade, when she was in high school in San Jose, California, chose research projects that challenged them to show how they’d use computer programs to tackle real-world problems.

At Stanford for the subject was ignited when she was a high school freshman and she heard an IBM scientist describe how the Watson supercomputer could help doctors diagnose disease and improve patient care by processing the silos of digital medical information. Jin was captivated by the idea of using the technology to address everyday life problems, such as surgical safety checklists, a series of protocols in intensive care units, improving hand hygiene in hospitals, and recognising the signs of patients in intensive care units who are at risk of dying.

And so Jin took her years of experience and started working with mentors at Stanford to produce a new software program that can measure a surgeon’s technical skill. It works by “watching” a video of a surgery and tracking the movement of the tools to monitor their dexterity in the surgical field, as better surgeons tend to handle instruments more deftly, with less waste, and grasper placed just right. Another video showed a surgeon’s hands holding scissors, which are among the most dangerous instruments in the operating room because they can cause serious injuries, such as severe cuts or nerve damage.

In the program, she was paired with Serena Yeung, PhD, then an up-and-coming doctoral student, who was developing a method to assess clinicians’ manual skills in diverse clinical activities.

Jin worked on the program during her senior year at Stanford and was able to analyze tool usage patterns and movements, including the frequency and duration of movements, for each video. She used deep learning algorithms to identify and recognize instruments in videos, which is a challenging task because of the variation in how instruments are held and the difficulty in distinguishing between similar instruments.

The program was able to predict with more than 90% accuracy how the machine rated the difference in technical skill of the surgeons in the videos. The researchers were able to do this by training the machine on a large dataset of surgical videos and then testing it on a new set of videos to see how well it could generalize the results.

The researchers hope that their findings could be used to improve surgical training and to identify surgeons who may be at risk of complications.

They concluded that their work could be used to develop new surgical training programs and to identify surgeons who may be at risk of complications.

“We were able to get a good sense of how technical skill or alerting a surgeon when he or she needs a restorative,” Jopling said. “This could make a big difference when manual skills matter.”

“It was a really promising sport or music, where you have a coach saying, ‘Do this, Don’t do this.’ Exceptional teachers provide that, but not everyone does. Not everyone can explain what you are doing well or not doing well.”

Jopling was mulling the new surgery project. Amy Jin was busy adjusting to the demands of high school. The second child of Chinese immigrants, both PhDs in physics, she had long been keen on computer science and was already a whiz at math, but she had never done any programming. So as a freshman she became immersed in AI, doing internships in the field at Facebook and Google. While working for a doctorate program in engineering, she met Milstein. She became captivated by the idea of using the technology to improve medical practice.

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The general idea was that if we are able to track and recognize instruments in videos, we would be better able to analyze tool usage patterns and movements, and identify areas for improvement.

The researchers hope that their findings could be used to develop new surgical training programs and to identify surgeons who may be at risk of complications.

“With that, we could gain a sense of a surgeon’s performance overall,” Jopling said.

From the visual data and statistics, the researchers were able to gauge multiple aspects of the clinicians’ performance, including their economy of motion, as often well into the night. The three researchers were able to get a good sense of how technical skill or alerting a surgeon when he or she needs a restorative.

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The insights into how the machine rated the different surgeons correlated with the surgeons’ insights into how they rated the videos, “Jopling said.

For instance, there was a situation in which the surgeon in the program was able to identify and clip both the cystic artery, which supplies blood to the gallbladder, and the cystic duct, which drains bile out of it. When done properly, this steps bleeding and leakage of bile during and after the procedure. If the cystic duct is not identified and clipped, the patient can suffer devastating complications, including damage to the bile duct.

Amy Jin has worked with mentors at Stanford to produce a new software program that can measure a surgeon’s technical skill.

Hand-sanitizing initiative

Yeung and colleagues at CERC, the Department of Pediatrics, and the AI lab received permission to install deep learning cameras in the intensive care unit at Lucile Packard Children’s Hospital, and hand hygiene dispensers are located. They used AI to program the sensors to monitor personnel — shown only as outlines of human figures — to protect their privacy as they passed by the dispensers.

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later taking some time to pry it loose. The computer detected the discrepancy in skill levels by viewing not only the placement and the pathway of the implements, but also the elapsed time of the procedure.

With the analysis in hand, the group submitted their results to the Workshop on Machine Learning for Health, part of the conference on Neural Information Processing Systems in December 2017 in Long Beach, California. The conference is one of the biggest AI meetings in the world, involving 7,000 researchers, graduate students and industry professionals. Yeung listed Jin as the first author of the paper, an extraordinarily generous move on her part considering doctoral candidates eager for publication credits typically claim this spot themselves, Milstein said.

In the workshop, the paper was selected from more than 120 submissions as one of 10 worthy of a spotlight talk. Jin, attending her first-ever conference, presented her work to the distinguished audience, and it was then published in the conference proceedings.

When the choice of best paper was announced, Jin was casually scrolling through her laptop, barely listening since she didn’t expect she’d know the authors.

She was stunned when her name was called. "I was just kind of half there and was really surprised," she said. She immediately sent a text message to Yeung and Jopling, who said it was a surreal moment.

Jopling called Jin "an inspiration to all of us," and Yeung marveled that a high school student had both submitted a paper to the conference and won the top award.


Refining the tools

Jopling said the next step in the project is to amass as many as 1,000 videos recorded from several different surgeries. The Stanford researchers will collaborate with colleagues at the Utah-based Intermountain Healthcare, a 22-hospital system with a large surgical volume, to analyze the videos and refine the evaluation tool. The future work will take into consideration the complexity of surgical cases, as some gallbladder removals, for instance, may be quite straightforward, while others might be more challenging because of a patient’s multiple medical problems, Jopling said.

He said the technology will be particularly helpful in surgical training, noting that it’s labor-intensive for a surgeon to sit for hours and review the videotaped performance of a trainee. The automated system could do this for them, and could alert surgeons, in real time during a procedure, if they are starting to lose their edge, Milstein said.

"It’s really important for the patient’s outcome to know when those moments of fatigue and deterioration set in," he said. "Knowing when it’s time for a lead surgeon to take a break and allow the assistant to take over is analogous to a baseball coach deciding when a dip in accuracy and pitching speed indicates that a pitcher needs relief."

Milstein has shared the work with Mary Hawn, MD, professor and chair of surgery at Stanford, who was also enthusiastic about presenting the model, once it’s perfected, to the American Board of Surgery as a possible addition to current board certification exams.

However, not all surgeons are enthused about the idea of having a machine second-guess their skills, Jopling said.

"I had one surgeon tell me, ‘When that day comes, that’s the day I’m going to retire,'” he said. But, Jopling added, "There are always things you can work on and improve. It’s like having a tennis coach that watches every single swing you take over the course of your career, but without blinking or getting tired. There is always something you can improve, but in surgery, you often don’t get that feedback."

The AI technology could have broader applications in many aspects of medicine, Yeung noted. For instance, the group has been testing it to monitor the movements of patients in intensive care units — when, for example, they get in and out of bed or a chair — and to ensure that caregivers are following steps to keep patients safe. The technology is also being tested to monitor frail seniors at home, measuring their activities and mobility, and alerting others to a fall or other mishap that requires immediate attention.

"Clinicians, nurses and other health care providers are so overwhelmed now, and the problem is going to get worse as the baby boomer generation gets older," Yeung said. "I think AI has great potential to provide an unceasing, constant awareness of what is happening, which can be used to assist health care providers and prevent cognitive overload."

But the work will go on at Stanford without Jin, who is now a freshman at Harvard, following the path of her brother, also a science whiz, who is a senior there. She said it was hard to say goodbye to her Stanford coaches after two years of intensive work, but she’s excited — and a bit nervous — about what may come next. Although she has not settled on a major, it’s no surprise that she’s considering computer science. And that, Yeung said, could be a boon to the profession.

"It’s great to have people like Amy who excel in computer science," Yeung said. "It’s one of the problems AI is trying to address — that we don’t have enough women in the field and the number decreases at every stage. So we hope Amy will continue in the field and be a good role model for others."

Rockefeller’s Titia de Lange to give annual McCormick Lecture on March 8

Cell biologist and geneticist Titia de Lange, PhD, will give the 2019 Katharine D. McCormick Distinguished Lecture at 4 p.m. March 8 at the Li Ka Shing Center for Learning and Knowledge.

The title of her talk is “Telomeres and the DNA damage response.” The event is free and open to members of the Stanford community. A reception will follow. The deadline to register is March 7 at 7 p.m.

As director of the Anderson Center for Cancer Research at Rockefeller University, de Lange is also the Leon Hess Professor. At Rockefeller, de Lange has focused on telomeres and telomere protection drives genome instability in cancer.

The lectureship is named for Katharine Dexter McCormick, who left a large bequest to the Stanford School of Medicine. She earned a bachelor’s degree in biology from MIT in 1904. A suffragist and philanthropist, she is perhaps best known for funding research that led to the development of the first birth control pill.
The Stanford Biobank is rolling out new services that will enable researchers to better track, share and protect biological samples and the deidentified patient data associated with them. The biobank has launched a new biospecimen management system that tracks the locations of barcoded samples and provides online links to corresponding patient health records, clinical notes and molecular data in the university’s REDCap information systems. All linked information related to a sample can be securely viewed by individuals and shared with collaborators.

Before the project began, Rohit Gupta, the biobank’s executive director, recognized that many researchers have stories of surplus biospecimens that could be used by others for follow-on studies if there was an easy way to facilitate sharing of both samples and data. To that end, Gupta’s team developed BioCatalyst, a secure website that provides researchers with all the data associated with a given biological sample. In the second phase of this project, which will launch in 2020, BioCatalyst will provide researchers with integrated tools for managing, analyzing and visualizing molecular/-omics data.

The Stanford Biobank also provides faculty with on-site and off-site freezer storage. Labs that want to transition to this new system can use a preapproved consulting firm for help with moving the samples over. The biobank currently houses the samples and data associated with almost 200 projects, including two large flu and chronic fatigue studies, a bioprospective for the rare NGEY1 deficiency genetic defect, and patient data for the adult and pediatric transplantation program.

Gupta said the most important aspect of this new biospecimen management system is the potential for researchers worldwide to share disease and specimen data, reducing the total time and cost of collection and analysis.

One of the obstacles to sharing samples or data is obtaining patients’ permission to use them in future studies. To facilitate this sharing, Gupta is collaborating with multiple departments at Stanford to launch an electronic consent platform that includes an explana- tory video and online consent forms from which patients have the option to allow their samples to be used in future studies. The biobank’s website also houses a database of clinical trials, which enables researchers to see whether other projects have obtained patients’ permission to use their data.

The website provides researchers with data experts, other resources and advice on how to move them. The off-site storage facility, located in California’s Central Valley, offers clean-air conditions and 24/7 temperature monitoring and fast distribution of samples back and forth to Stanford. The off-site storage not only reduces the risk of sample destruction due to earthquakes, it is also helping save expensive campus lab space for more researchers and equipment.

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were considered: cardiovascular disease, cancer, infectious disease, respiratory disease and substance abuse or injury (such as death from alcohol and drug use, self-harm and interpersonal violence).

**Bottom line**

The association of PCP density with life expectancy was approximately one-fifth the magnitude of the association of poverty with life expectancy, and approximately two-thirds the magnitude of the association of smoking with life expectancy. Breaking down that effect by cause-specific mortality, the researchers found an increase of 10 PCPs per 100,000 people was associated with a 0.9 percent reduction in cardiovascular mortality, a 1 percent reduction in cancer mortality and a 1.4 percent decline in respiratory mortality. The surprising result was how much PCP supply has declined despite so much emphasis on primary care over the last decade,” Basu said. “I think the problem comes down to money. We pay less for preventive than treatment — and the former is where primary care lives.”

Basu believes another key benefit of the study is the methodology that was used. “We tried to test whether this is just an ‘association’ at the area level, or more likely to be a causal connection,” he said. “We looked at people who moved between ZIP codes and compared how their survival changed when moving to higher-PCP ZIP codes versus lower, controlling for other individual and area characteristics.”

They found that those people who moved to ZIP codes with more primary care physicians had substantially higher survival rates, as much as 114.2 days per decade for every 10 additional primary care physicians per 100,000 people.

Basu lauded that despite the clear correlation between better health and primary care, the number of primary care physicians is likely to continue to decline.

“The passionate students who care about population health really want to go into primary care,” Basu said. “But they also have serious education debts and are looking at the paychecks for fields like dermatology, ophthalmology or urology. They don’t actually find those fields compelling, but the pay disparity is often just too much for them to take a low-level primary care job instead.”

Other Harvard researchers and researchers at the University of North Carolina-Chapel Hill and the American Board of Family Medicine Center also contributed to the study.

The research was supported by the National Institutes of Health.

Stanford’s departments of Medicine and of Health Research and Policy also supported the work.

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**Burnout continued from page 1**

Shanafelt first conducted studies on physician well-being almost two decades ago. Over the years, research uncovered evidence of growing distress and cynicism among physicians due, in part, to spending more time on clerical work at the expense of time spent with patients. Increasing workloads and regulations contributed to high levels of emotional exhaustion and job dissatisfaction. Physicians were leaving their jobs, and their suicide rates were markedly higher than those of other professionals. Still, the studies told researchers that taken seriously enough, Shanafelt said. “Anytime a study came out on physicians’ burnout, people would say, ‘Well that’s true for all workers. Everybody is stressed.’”

“She was a need for an ongoing, nation-wide study that would compare physicians with other workers in the United States.”

**Third in series of national studies**

In 2011, while he was at the Mayo Clinic, Shanafelt joined forces with other researchers and the American Medical Association to publish the first of what would be an ongoing series of national studies to measure changes in burnout levels among physicians at three-year intervals. This is the third study in the series, the previous two were conducted in 2011 and 2014. The studies have found that symptoms of burnout are markedly more common in physicians than in workers in other professions, even after adjusting for work hours and other characteristics.

To conduct the current study, researchers sent surveys to a nationwide sampling of physicians and workers in other fields. Among physicians, 5,445, or about 17 percent, completed the survey. Of these, 43.9 percent reported at least one symptom of burnout in 2017, compared with 54.4 percent in 2014 and 43.8 percent in 2011. Symptoms of burnout among workers in other fields remained the same — about 28 percent.

The improvement from 2014 to 2017 in symptoms indicating burnout were not seen among physicians in all specialties, the study reported. Levels among certain specialties, including general surgery and obstetrics and gynecology, failed to show any significant reduction in 2017. Also, the screening positive for depression showed a modest but steady increase in the three studies: 38.2 percent in 2011, 39.8 percent in 2014 and 41.7 percent in 2017. The researchers could only speculate about what may have contributed to the decrease in the burnout level in 2017. One possibility is that a large number of burnout-affected physicians left the workplace, so they were no longer included in the study. Another possibility is that 2014 may have been a particularly challenging time for physicians due to consolidation of hospitals and medical groups, a number of new regulatory factors, and increased administrative burdens. But Shanafelt is hopeful that growing national efforts by government agencies, professional organizations and medical institutions to improve working conditions for physicians may be making a difference.

“Over the last couple of years, we have begun to think about the well-being of health care professionals through the lens of the system and practice environment rather than through the lens of personal resilience. There are now large-scale national efforts, as well as efforts at the institutional level in many organizations, to reduce physician burnout and promote physician well-being,” Shanafelt said. “We can’t say for certain, but it’s looking like those efforts may be starting to make a difference.”

Mickey Trockel, MD, PhD, clinical associate professor of psychiatry and behavioral sciences at Stanford, was a co-author of the study.

Funding for the study was provided by the Stanford WellMD Center, the AMA and the Mayo Clinic Department of Medicine Program on Physician Well-Being.

Stanford’s Department of Medicine also supported the work.

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**Opoid continued from page 1**

in JAMA Network Open. Mathew Kiang, ScD, a post-doctoral scholar at Stanford, is the lead author. The senior author is Monica Alexander, PhD, assistant professor of sociology and statistical sciences at the University of Toronto.

“More potent than they expected”

Synthetic opioid deaths now outnumber heroin deaths, which suggests synthetics, such as fentanyl, have contaminated the production process of other illegal drugs, like cocaine and methamphetamine, and is more potent than heroin. Kiang said.

“People aren’t aware their drugs are laced and more people would say, ‘Well that’s true for all workers. Everybody is stressed’,” he said. “So it makes sense that a large number of workers in other fields would look at this as normal.”

Kiang and colleagues with other workers in the United States.

Another Stanford co-author of the work was Sanjay Basu, MD, PhD, assistant professor of medicine and of health research and policy.

The study was supported by the National Institutes of Health.

Stanford’s departments of Medicine and of Health Research and Policy also supported the study.
Rare pulmonary defect prompts parents’ search for answers

By Stacy Rollo

Carter Johnson came into the world on Jan. 9, 2018. According to his parents, Kelly and Malcolm Johnson, he was perfect in every way. But it wasn’t long before red flags went up, and one of the couple’s happiest days became shadowed with worry and fear.

Something wasn’t quite right. Carter’s color was off and he was turning gray, prompting the care team at his local hospital in Maryland to whisk him to the neonatal intensive care unit for tests. When their efforts failed to provide answers, the family was sent to a regional hospital for further examination. That’s when they discovered there was no blood flow to Carter’s right lung. He was diagnosed with a rare condition called absent right pulmonary artery.

Time was of the essence. Typically, this condition is associated with multiple congenital heart defects, prompting additional echocardiograms, more tests and a rapid search for answers. In Carter’s case, his doctors determined that the uncommon malformation was isolated. But risks were high, as Carter’s test results revealed pulmonary hypertension, and other complications could be imminent. Carter needed help.

Searching for the best treatment

Kelly and Malcolm were told by the regional hospital that the best course of treatment for Carter’s condition was surgery but that he was not a candidate. This prompted his parents to start a nationwide search. Malcolm went into research mode and delved into pages of medical journals. He also sought second and third opinions from the nation’s leading children’s hospitals. He also sought second and third opinions from the nation’s leading children’s hospitals.

Their project is focused on Monterey County. Including academic, community, nonprofit and private partners. The location of the exhibition in the School of Medicine also becomes part of this model experience.

“The location is both an active place where we are the healer, and sometimes we need to be healed,” he said. The first time Wetschler returned to the site of his accident, he brought a canvas, but he did not start painting immediately. Instead, he drew a large circle in the sand, walked the 200-foot perimeter as a ritual, then went into the frigid ocean. He repeated this circle-walk and ocean dip 13 times, finding another 13th dip of meaning.

“The first time Wetschler returned to the site of his accident, he brought a canvas, but he did not start painting immediately. Instead, he drew a large circle in the sand, walked the 200-foot perimeter as a ritual, then went into the frigid ocean. He repeated this circle-walk and ocean dip 13 times, finding another 13th dip of meaning. This work in the exhibit titled Renty is the result.

“My accident was a manifestation of an individual encountering the chaos of world and his own reality,” he said. “At 26, I could change at any moment. In emergency medicine, we are exposed to people’s vulnerabilities. That requires a certain restraint, but it also challenges us to face every day and still remain emotionally whole. … The antidote is hope. It is a deep well of capacity we underestimate. There is a deep well of capacity we underestimate. Within us, there is still a well of vulnerability that used positioning and stress to create weakness in his hands and arms. Then he painted.”

What followed on the canvas was a direct product of that physical vulnerability in brush strokes and movement. Wetschler views the ritual itself as the art; he said it felt color would detract from the viewer’s comprehension of the piece.”

“Dr. Hanley and his team have delivered on their promise that Carter will live a normal life,” Kelly said. Dr. Hanley told Carter will be repaired and he will run, play baseball and have no restrictions. As parents, that was our greatest hope.”

Carter Johnson had two surgeries at Packard Children’s Hospital. He shook Kelly awake and told her, “I think I found it.” “I’m stubborn by nature,” he said, laughing. “I just felt there was something else for Carter.”

The next day, Kelly and Malcolm were on the phone with Jennifer Shek, a nurse practitioner in cardiothoracic surgery at Stanford Children’s Health. She told them Carter was a promising candidate for the program. The surgical team was led by Frank Hanley, MD, professor of cardiothoracic surgery and chief of pediatric cardiac surgery, and Doff McElhinney, MD, professor of cardiothoracic surgery and of pediatrics. Stanford Children’s Health has been recognized worldwide for innovative approaches to surgical management of complex pulmonary artery procedures. The team revealed that Carter did, in fact, have a pulmonary artery, but it was in the wrong place. The doctors diagnosed Carter with discontinuous pulmonary artery resulting from a ductal origin. Their unique surgical approach to Carter’s case would restore his lung without requiring any long-term treatments. Kelly and Malcolm could barely believe their ears.

Exceeding all expectations

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Exceeding all expectations

Any parent who had to watch their child be taken away for surgery will tell you it’s one of the touchiest things you can go through. But Kelly and Malcolm said the care they received at Packard Children’s helped them get through Carter’s surgery. “Everyone exceeded our expectations. We didn’t have one negative interaction,” Kelly said. “We received constant updates on Carter’s status, and we really felt empowered in how we played a role in his care.”

Carter had two repairs in all. In his first surgery, a shunt was implanted to establish blood flow to his right lung. The second surgery, which happened five months later, in November 2018, was the final artery construction in which Hanley removed the shunt and connected the grown pulmonary artery. During the five months between the two surgeries, Carter’s pulmonary artery grew to normal size, surpassing the doctors’ expectations.

Today, Carter is back home in Maryland and doing well. His hometown medical care team — from his pediatrician to his cardiologist — have communicated frequently with the Stanford team to ensure the boy’s care is fully coordinated.

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