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JOURNAL REPORTS: HEALTH CARE

How Apps Can Help Manage Chronic Diseases

Hospitals and doctors have identified digital tools that can assist patients in dealing with ailments such as diabetes, heart disease and lung disease. The early results are promising.



Digital medicine—including remote monitoring and behavior modification—can improve outcomes in such costly and tough-to-manage categories as diabetes, heart disease and lung disease. ILLUSTRATION: ANASTASIA VASILAKIS FOR THE WALL STREET JOURNAL

By *Laura Landro*

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Technology is offering a new fix for one of the most confounding health-care challenges: getting patients with chronic disease to take better care of themselves.

About half of all adults suffer from one or more chronic diseases, which account for seven of 10 deaths and 86% of U.S. health-care costs. But preventing and treating such ailments requires time that doctors don't have in brief office visits, and a degree of daily self-management that many patients have been unable to handle. They often become overwhelmed by the demands of their daily regimens, slip back into poor health habits, fail to take their medications correctly—and end up in the emergency room.

While there has been something of a national obsession with health apps like fitness trackers, most are aimed at exercise and lifestyle buffs and aren't designed to link patients to health-care providers. There is generally no evidence to back their use in improving health outcomes for those who have chronic disease unless the patients' own doctors are involved.

New studies, however, show that the emerging field of digital medicine—a combination of remote monitoring, behavior modification and personalized intervention overseen by the patients' own doctors—can improve outcomes in some of the most costly and tough-to-manage categories such as diabetes, heart disease and lung disease. As a result, a growing number of hospitals and health systems are adopting digital programs that have been studied in clinical trials and can be delivered on a broad scale at low cost with the use of smartphones, wireless devices and sensors.

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In addition to raising patients' confidence that they can manage their health—and providing some hand-holding and nudging when they don't—experts say the innovations allow doctors to gather data about patient behavior and symptoms, and intervene when patients aren't following their regimens or have a flare-up in their disease. They also enable care teams to deliver continuing and consistent support to change behavior, such as losing weight, taking medications as prescribed and exercising. “Digital medicine allows us to get into your life in a personal way, deliver interventions continuously and inspire you to be

healthy in a way an office-based practice can't," says Joseph Kvedar, a physician and researcher who is vice president, connected health, at Partners HealthCare, which includes Brigham and Women's Hospital and Massachusetts General Hospital in Boston.

Partners has tested such approaches as remote blood-pressure monitoring for hypertension patients, text messaging to motivate diabetes patients to exercise daily, and remotely monitored electronic pillboxes that alert congestive-heart-failure patients to take their medications. Such technology, if widely adopted, could deliver behavioral interventions to whole populations and engage patients in ways that were unimaginable in the past, Dr. Kvedar says.

The push for digital medicine comes as reimbursement for medical care is shifting from fee-for-service arrangements to a focus on delivering quality outcomes at reasonable cost. The Centers for Medicare and Medicaid Services currently covers some telehealth services, such as seeing a doctor over a video connection, and is now contemplating changes that might cover the use of digital services such as apps as well. The explosion in digital medicine has spurred researchers to develop apps for studies of diabetes, asthma and heart disease, and myriad technology startups are pitching disease-management apps to health-care providers.

But Amir Lerman, an interventional cardiologist and professor of Medicine at the Mayo Clinic in Rochester, Minn., cautions, "You can't just build an app in your garage and think it is going to change medical care. You need to have a treatment plan behind it, and a health system to care for the patient."

That, in turn, has spurred the health-care industry to study which technologies are best. Two dozen health systems including Rush University Medical Center in Chicago and the University of Virginia Health System have joined a network run by Avia, a company that helps vet and test digital approaches to patient care. And the American Medical Association recently announced a collaboration called Xcertia with the American Heart Association, the Healthcare Information and Management Systems Society and others, which is developing guidelines for evaluating mobile health applications. "Physicians recognize the tremendous potential in digital health tools," says James Madara, the American Medical Association's chief executive, "but without a framework to evaluate them, there could actually be harmful effects."

"We have to figure out how to prioritize these thousands of ideas that come at us every week," says Mike Dandorph, president of Rush. "When we try innovative ideas, we must ask, does it advance outcomes, provide a good patient experience and change the overall cost of care?"

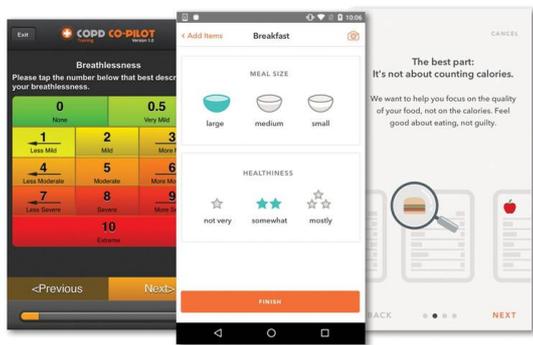
Here are some approaches backed by evidence that are gaining traction in digital medicine.

Diabetes: Keeping the condition at bay

Prediabetes—higher-than-normal blood sugar—increases the risk of stroke and heart attack. According to the Centers for Disease Control and Prevention, prediabetes affects 86 million adults, or more than one in three, and as many as 30% of them will develop diabetes within five years unless they lose weight through a healthy diet and exercise.

While many health plans and insurers offer diabetes-prevention plans, the lifestyle changes to ward off diabetes can require daily hand-holding, so more are looking for ways to deliver such programs digitally. In collaboration with the American Medical Association, Salt Lake City-based Intermountain Healthcare, with 22 hospitals and 185 clinics, is pilot-testing an online program provided by San Francisco-based Omada Health for patients at risk for diabetes. The yearlong program starts with a core 16-week online course on better lifestyle habits, and assigns patients to a personal health coach and private online support forum with moderated discussions.

Participants receive a pedometer and a cellular scale that transmits their weight readings to their Omada profile, and are visible to the coach. They log their daily activity and food either online or with a mobile app; if they have a connected device such as an Apple Watch, they can link it with the program to transmit activity automatically. Their results are displayed on a personal dashboard. After the initial sessions, Omada provides a 36-week sustaining curriculum focusing on weight maintenance. "You can't just send someone a scale and a step tracker and pray for results," says Omada Chief Executive



Temple Lung Center's COPD app (left) and two nutrition screens from Omada Health's diabetes-prevention program.
PHOTO: THE APPS

Sean Duffy. “You have to combine these instruments with high-touch intervention” that includes social support and personalization.

Coaches usually reach out once or twice a week to check on whether participants have completed their lesson, answer questions and congratulate the patient on tracking activity or meals. Patients can also communicate as often as they like with coaches, who are required to respond within a day of any outreach. Omada sends Intermountain aggregate patient reports to show how an overall population is doing, but can also send individual patient reports for follow-up. Coaches can also encourage patients struggling in the program to reach out to their Intermountain doctors.

Research has shown that Omada participants are able to maintain weight loss and lower average blood-sugar levels two years after starting. In one study of 501 Humana Medicare Advantage beneficiaries, published in the *Journal of Aging and Health*, participants lost 7.5% of their initial weight after 12 months, improved blood-sugar levels, and lowered cholesterol. In addition to reducing their risk of diabetes, participants also reported improvements in self-care, diet and exercise, and lower feelings of depression and isolation.

“The new reality is that patients want to seek care in their own environment and on their own schedule online, as opposed to going to the office and waiting for a provider,” says Mark Greenwood, an Intermountain physician and one of the initiative's program leads. “The future of primary care is to be both physician and navigator, hooking up patients with technology to help them manage their conditions.”

Omada estimates health plans and insurers it contracts with recoup their investment in the program within two years, with a predicted net savings of more than \$2,000 per participant over five years. Dr. Greenwood says payment for the program will be based on outcomes. But he also says savings will come from preventing progression to full-blown diabetes, which can cost \$8,000 a year to manage per patient.

One Intermountain participant, Michael Astle, 64, enrolled after he learned his blood sugar was in the high range. “I knew that my health was at risk, and I wanted to lose weight,” he says, but he kept putting off doing anything about it. He liked using the cellular scale to track his weight and the app on his phone to record activity and diet, and though he never met the other online participants, he says the forum helped “form a bond if someone was struggling or feeling bad and needed encouragement.”

Within 16 weeks he was down to 190 pounds from 227, and continues to lose weight toward his goal of 180. Mr. Astle says it is motivating to know that every time he steps off the scale, it sends his weight to his coach, “and I can't let it go back up.”

Pulmonary disease: Holding back the symptoms

Chronic obstructive pulmonary disease, or COPD, affects an estimated 30 million Americans and encompasses emphysema and chronic bronchitis. Commonly associated with smoking, it causes increasing difficulty with breathing, and exacerbations can lead to repeated trips to the ER and hospitalizations if not treated in a timely manner with medication. Patients may fail to recognize that symptoms are getting into the danger zone, leading to delays in treatment.

Temple University's Temple Lung Center in Philadelphia has developed a health application called COPD Co-Pilot. Once daily, patients use a smartphone to report symptoms including breathlessness, cough, wheeze and sore throat on eight easy-to-

read screens, and use hand-held meters to measure the air flowing in and out of their lungs. Those who don't report in by noon get a reminder from the system.

The Value of Patient Involvement

The percentage of surveyed health-care executives and clinicians citing these as the top general benefits of using technology for patient engagement

- Support patients** in efforts to be healthy **67%**
- Provide input** to providers on how patients are doing when not in clinic **60%**
- Create ecosystem** that allows for better predictive analytics around patient health and more timely intervention **51%**
- Augment** current capabilities of brick-and-mortar health system **47%**
- Give patients** extra motivation since they know clinician will see data **29%**

Note: Multiple responses allowed

Best Tech to Achieve It

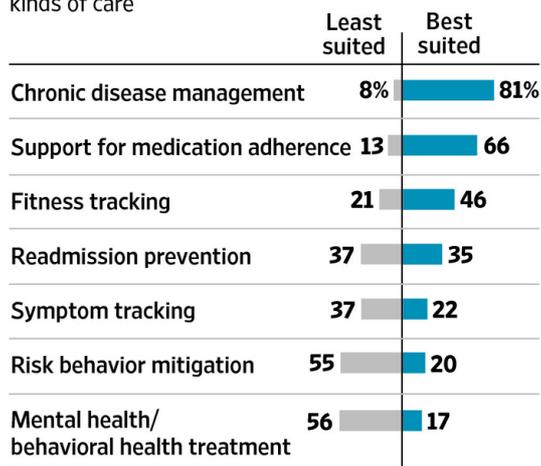
The percentage of those surveyed who said these technologies were effective in engaging patients in their own care



*Such as wireless scales or glucometers.

Where to Apply It

The share of respondents saying patient-engagement technology tools are least or best suited for these kinds of care



Source: NEJM Catalyst 2016 survey of 595 members of its Insights Council of health-care executives and clinicians

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A computer algorithm helps measure how serious the symptoms are compared with the patient's baseline data; nurses review the scores and refer patients who appear to need immediate treatment to doctors who can prescribe same-day therapy. There are different treatment plans for less urgent scenarios, which nurses can recommend after review with a doctor, and communicate via text or email back to patients who can respond that they will comply or that they may need something else.

A 2015 study in the journal Telemedicine and e-Health found that patients who used the app to report daily symptoms and received same-day treatment experienced fewer and less severe exacerbation symptoms, leading to improved symptom control, lung function and activity status.

“By linking the provider directly to the patient, we can get therapy to them sooner rather than later and prevent things from getting worse,” says Gerard Criner, director of the Temple Lung Center and principal investigator on the study. (The technology used in the study has been adapted by a Temple spinoff company, HGE Health Care Solutions, founded by Dr. Criner.)

Ronny Neal, 58, a Temple COPD patient, has been using the app for about a year. His condition sometimes makes it difficult to walk or breathe and once landed him in the hospital for several days. Mr. Neal was skeptical at first, when his team at Temple suggested the program,

wondering, “Are they going to follow me every step I take?”

But he says it has helped motivate him to stay on top of his symptoms much better than in the past, and get attention and medication quickly when they get worse. On the few occasions he forgets to enter his information, he gets a text nudging him to check in. “It’s a tough disease with no cure, but you don’t want it to get any worse and you don’t want to be going in and out of the hospital,” he says. “It’s now part of my routine—get up, brush my teeth, take my medicine and check in.”

Dr. Criner says the program aims to help patients better control their COPD, while staying connected to the Temple Lung Center team on a daily basis.

Blood pressure: Monitoring medicine

Patients too often fail to take their medications as prescribed, a particularly dangerous problem for chronic-disease patients. One study showed that new prescriptions for diabetes, high cholesterol and hypertension, known as high blood pressure, weren't even filled 22% of the time. Because high blood pressure and high cholesterol don't have apparent symptoms, patients may skip doses or figure they don't really need the drugs.

To improve patients' compliance with blood-pressure medication, Rush University Medical Center is working with Proteus Digital Health, of Redwood City, Calif., to prescribe its Proteus Discover system, which encapsulates medications in a single pill with an ingestible sensor the size of a grain of sand, made of trace amounts of minerals. Once swallowed by a patient, the sensor communicates with a wearable patch worn on the torso, which records the time the medication was taken as well as data such as heart rate, steps and rest.

The patch transmits the information wirelessly to an app on a mobile device, such as a smartphone or iPad, for the patient to monitor and share with a health-care provider, and sends an alert if a dose is missed. If the patient forgets to take a pill, they can be alerted by a notification to their mobile device.

A study published last year in the Journal of the American College of Cardiology found that the use of Proteus Discover led to greater reductions in blood pressure and cholesterol in patients with uncontrolled hypertension and diabetes than usual care.

"We know there is a mismatch between the prescriptions we write and the prescriptions that get taken by patients," says Anthony Perry, vice president for population health and ambulatory services at Rush. "This is a tool that provides data back to the patients and provides a feedback loop to help build strong habits that support taking medications consistently."

Heart disease: Helping patients take charge

Heart disease causes one-third of deaths in the U.S., but many of them are due to preventable risk factors like poor diet, smoking and lack of exercise. After angioplasty, a procedure to reopen coronary arteries following a heart attack, patients can avoid a repeat event by undergoing a cardiac rehabilitation program. But patients may not do all the follow-up necessary, and programs are often limited in the personal attention and time patients get from rehab teams.

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In a study at the Mayo Clinic in Rochester Minn., published earlier this year in the journal Clinical Investigations, researchers tested a health program available online or through a smartphone app that provided information about healthy lifestyles and asked patients undergoing cardiac rehab to report dietary and exercise habits. Compared with a group of patients that had usual care, those using the digital program lost more weight and improved lifestyle habits and had fewer cardio-related ER visits and

rehospitalizations.

Steve Ommen, a cardiologist at Mayo and medical director of its Center for Connected Care, says Mayo is incorporating apps, wearable monitoring devices and other digital technology into programs for patients with chronic diseases.

Mayo's aim, Dr. Ommen says, is not to find an app for each disease, but to find solutions that can be broadly used in managing all complex diseases, particularly since so many patients are struggling with multiple conditions. Ideally, he says, patients could have a period of intense monitoring to get them on the right track and then "graduate to self-care and self-monitoring."

"Whenever we introduce a new technology to help them, patients are very open to trying it," he says. "This will definitely change the relationship between patients and care teams, but we see it as being more connected and really extending and enhancing our relationship."

Ms. Landro, a former Wall Street Journal assistant managing editor, is the author of "Survivor: Taking Control of Your Fight Against Cancer." She can be reached at reports@wsj.com.

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