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Mobile Health: Apps for Every Age and Ouch

Explore how the recent explosion in mobile health and medical apps can impact every stage of a person's life — and potentially, our health care system.

“Wherever there’s a mobile signal, there’s a potential for better health care,” says Eric Topol, author of the book, “The Patient Will See You Now.”

Topol uses a Gutenberg printing press analogy to explain how smartphones are forever changing health and medicine. Just as the printing press made information available to the common man, the smartphone is creating “democratized, bottom-up medicine” for all of us. No longer are we dependent solely on health care providers to manage our health.

More of us are using smartphones than ever — almost two-thirds of American adults now own one. That means more of us have access to this “democratized” version of the health care system that Topol envisions.

This interactive, online journalism project explores how mobile health and medical apps affect us at every age and life stage. Users scroll through the site to see characters travel through a lifetime, each character using a different app for a particular health ailment or situations.

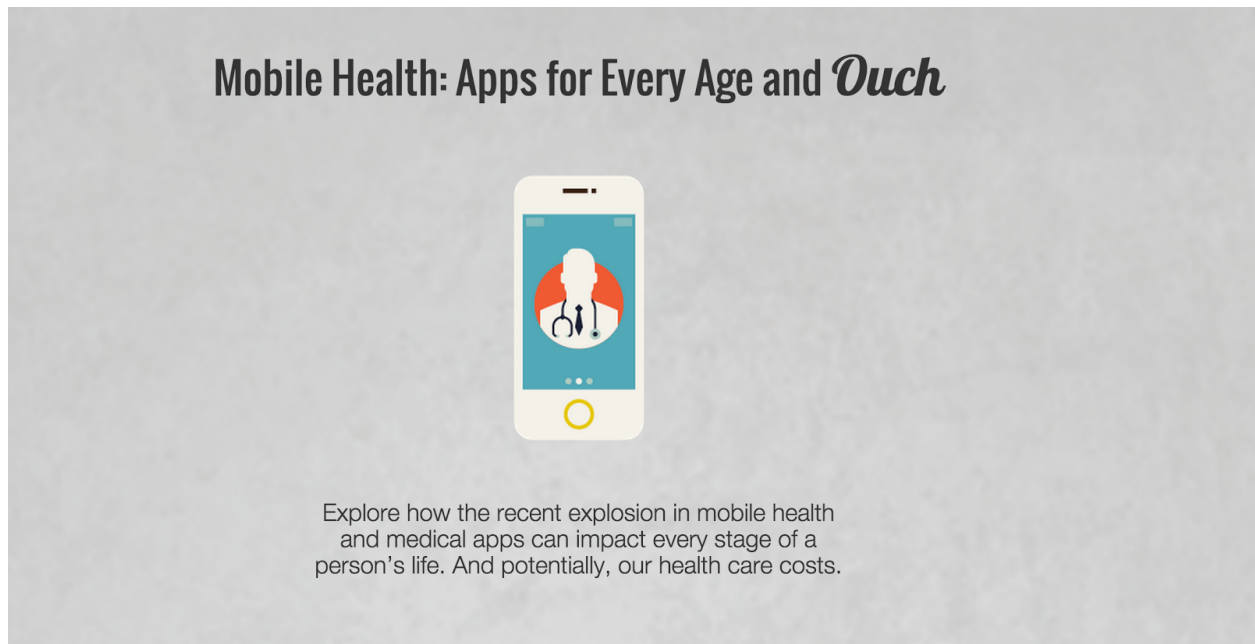
Users can also see how mobile health apps might impact the existing costs for each ailment in our health care system based on cost statistics that are interspersed throughout.

To create this project, I researched, reported, wrote and edited the text content. I shot video and recorded audio segments of people who use health and medical apps. I designed and produced an animated After Effects project using the audio of one person who uses a mental health app. I also coded the entire interactive site.

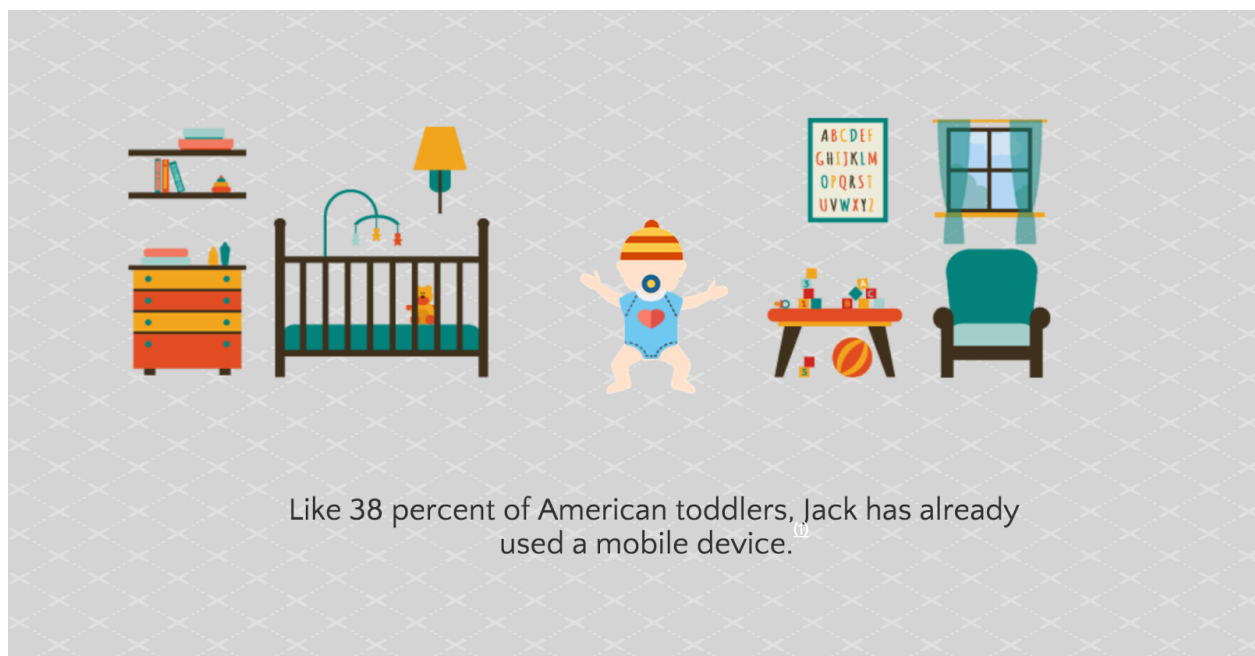
At the end of the site, the user is taken to a text article, which I reported, wrote and edited, exploring the context around this subject. I interviewed experts in various areas of this field, exploring regulatory issues, cost issues, challenges and the future of where this area is headed.

Let's explore the site:

Introduction to the site:



We meet the first character:



In each of the situations, the character scrolls down into different settings - with the first scene, the baby scrolls down into his onesie and then scrolls down from his bedroom into his doctor's office:



We see elements slide into and out of the scene, such as the image of the smartphone-turned-otoscope that slides into the doctor's office scene from the right side of the screen.

We learn about the first app:

CellScope Oto is a smartphone attachment that allows doctors to take **high-res images of the inside of an ear**.

There's an **at-home version** of it, too — right now it's only available in California, but there are plans to expand to other states. Parents who want to skip the middle-of-the-night ER trip with a screaming child can send video of the inside of their child's ear to an on-call doctor who will review it within two hours for \$49.

Jessica Kaplan, a pediatrician in San Francisco, has been using the device with her patients for two years.

We see a video of Dr. Jessica Kaplan using the app, CellScope Oto, with patients in her pediatric practice in San Francisco:



We meet our next character and learn about the NFL Play 60 app that will help him keep active even when he'd rather be inside playing on a smartphone:



Tim would rather play games on his mom's smartphone than go outside and play.

We learn about the prevalence of childhood obesity and how an app called Smash Your Food is aiming to educate kids in a fun way about the salt, sugar and oil present in foods:



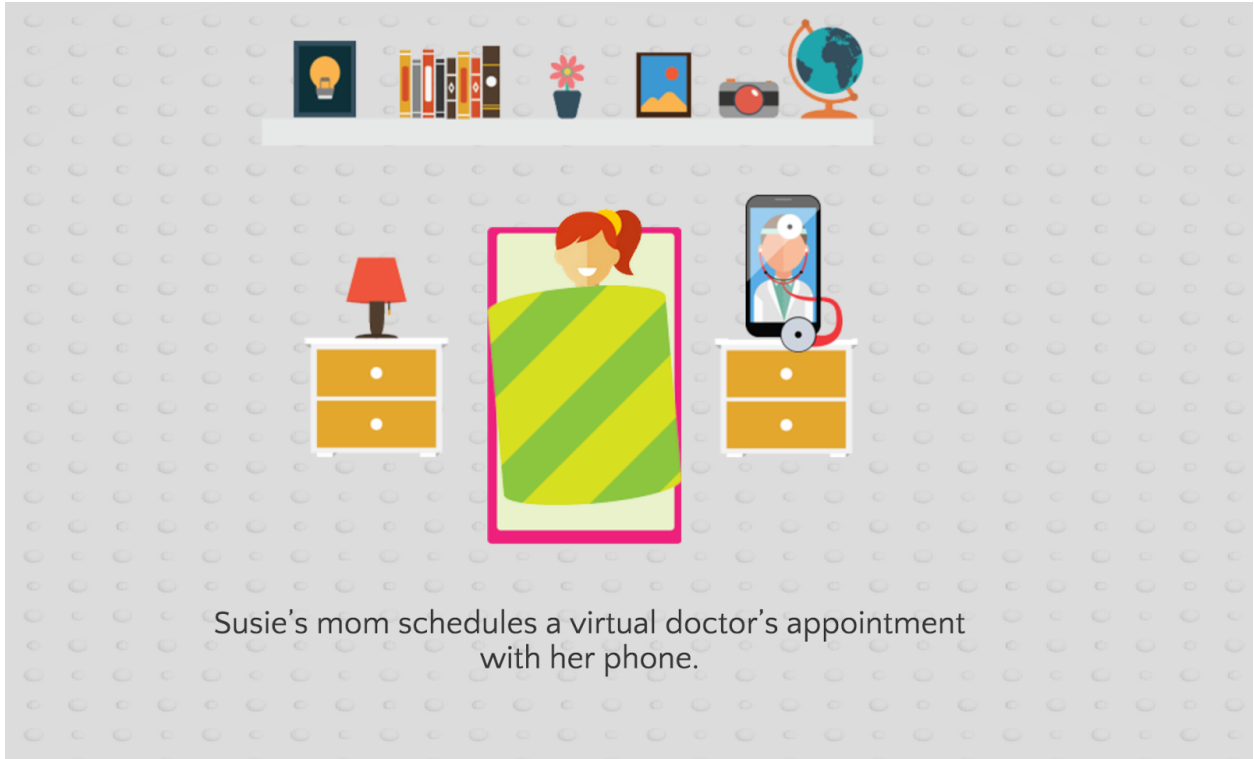
Throughout the site, users learn about the costs associated with different health ailments — costs that could be reduced if apps are able to make inroads in addressing some of these health concerns:

Did you know? Under private insurance, the average annual health cost of treating a child is **\$1,108.**

The cost of treating a child for obesity is more than three times that amount: **\$3,743.** ⁽⁴⁾

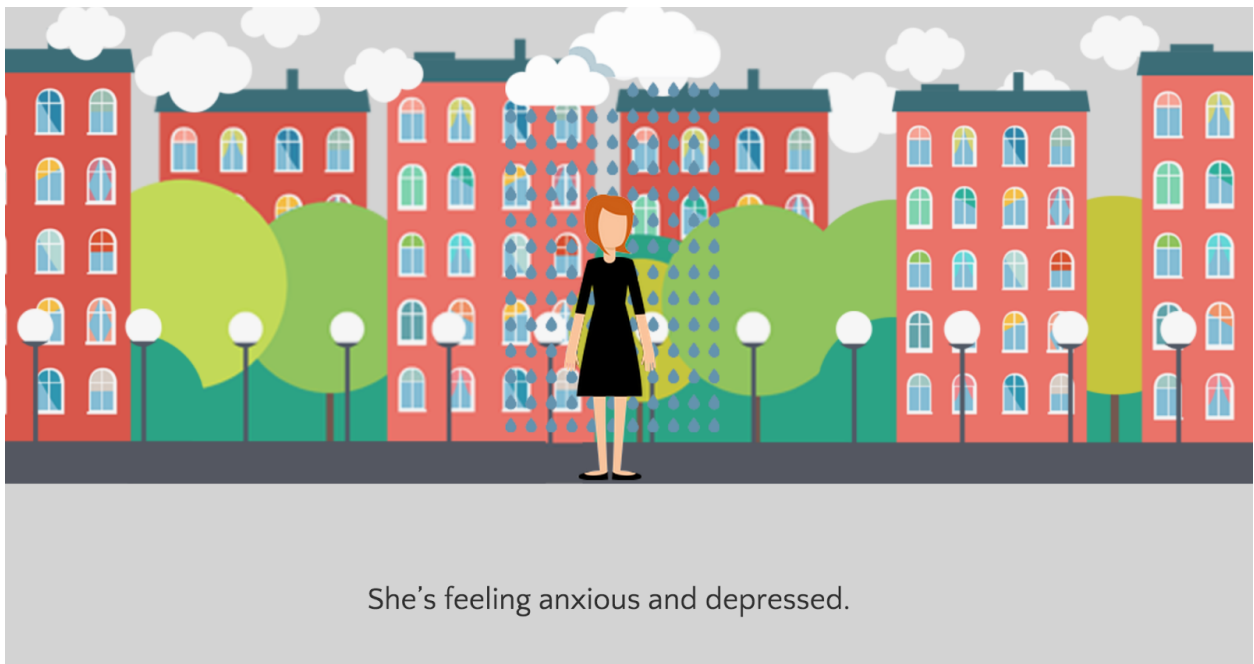
The complex block features a dark grey background. On the left is a black smartphone icon with a white screen displaying a red square with a white dollar sign. To the right of the phone, the text is centered and uses a mix of bold and regular fonts to highlight key statistics.

We meet Susie, a teen who doesn't have time to make it to the doctor so Susie's mom schedules a virtual doctor visit — something UnitedHealthcare announced in April that it will soon be covering for its members:



For \$40, the **Doctor On Demand** app offers 15-minute **video visits** with a physician licensed in your state.

We meet Jane, who is going to try an app to help improve her mental health:



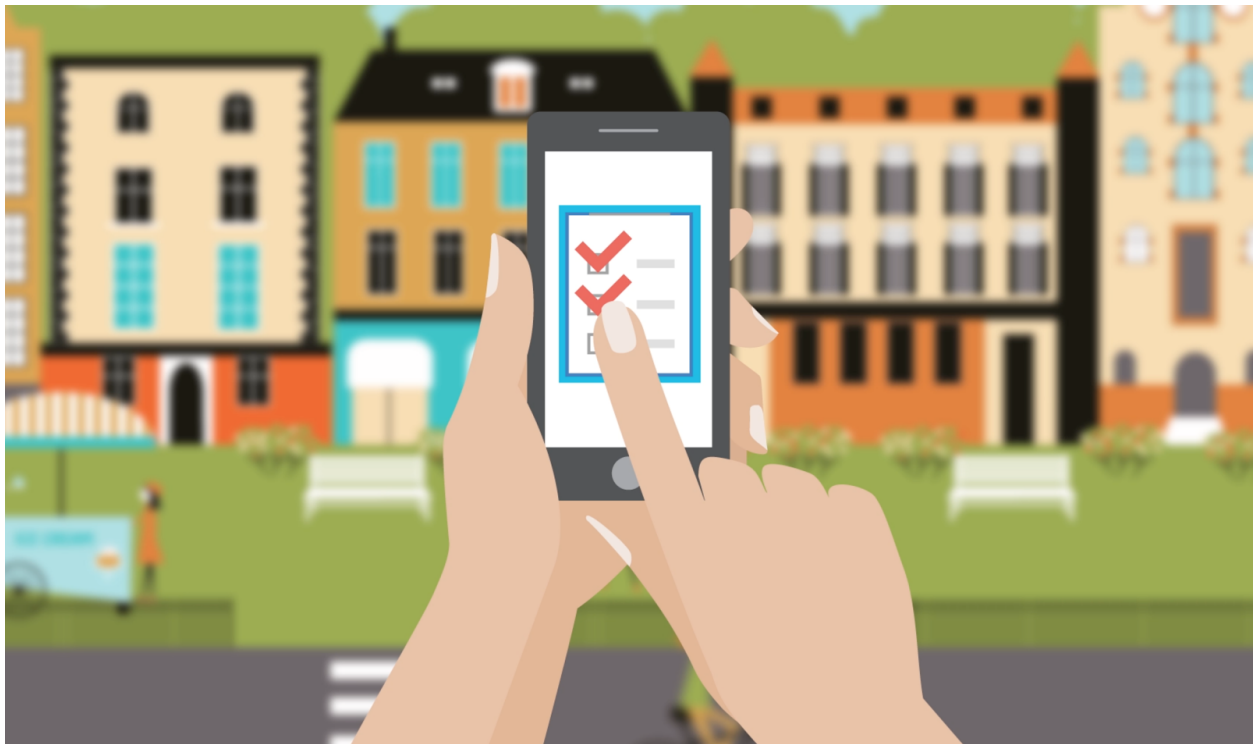
With each app, users learn about what it is:

The people behind the **Ginger.io app** think that better mental health can come via smartphone.

The Ginger.io app, which was developed at the MIT Media Lab, asks users periodic questions about their **well-being**. It collects other data through sensors in the smartphone: things like how much a person **moves, sleeps and communicates** with others.

Users can **share** that information with care providers.


I interviewed a person who uses a mental health app and with the audio I recorded from our interview, I created an animated After Effects project to illustrate how the app helps her:



We meet a father who uses a First Aid app from the American Red Cross when his son gets stung by a bee and then we meet a woman who uses a fitness app to help her lose weight. I interviewed a woman in San Francisco who uses a calorie-tracking app; I shot and produced a video of her:



There are also two interviews I did that are audio pieces embedded in the site: one is a pediatric endocrinologist who uses a mobile diabetes app called Glooko and the other is a man from Danville, California whose mobile electrocardiogram app helped diagnose his atrial fibrillation:



Glooko is part of a pilot study at Children's Hospitals and Clinics of Minnesota that began earlier this year involving adolescent girls with type 1 diabetes.

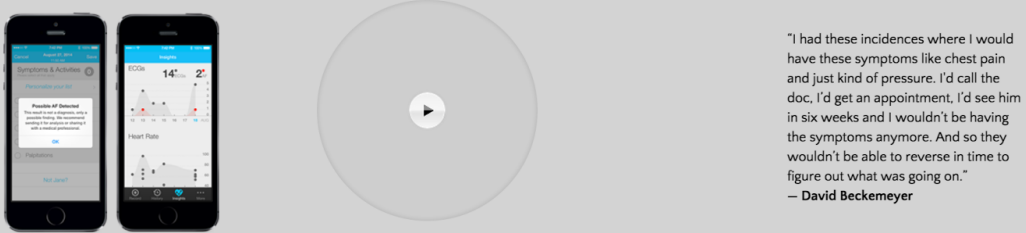
Glooko can be used by patients of any age who have type 1 or type 2 diabetes.

Click above to hear from **Dr. Laura Gandrud**, a pediatric endocrinologist who uses Glooko with patients.

[2 min 22 sec]

The **AliveCor Heart Monitor** is a special sensor-equipped smartphone case that pairs with an app, allowing users to take an **electrocardiogram (ECG) at home**. Rest the phone on your fingers or chest and the FDA-cleared app records an ECG in 30 seconds.

The app helped **David Beckemeyer of Danville, California**, to diagnose his atrial fibrillation (also known as "A-fib"), which can lead to stroke and heart failure.



Click above to hear **David Beckemeyer's** story

[1 min 8 sec]

"I had these incidences where I would have these symptoms like chest pain and just kind of pressure. I'd call the doc, I'd get an appointment, I'd see him in six weeks and I wouldn't be having the symptoms anymore. And so they wouldn't be able to reverse in time to figure out what was going on."
— David Beckemeyer

We meet Mary, who learns she has COPD and begins using an app that tracks where and when she uses her inhaler:



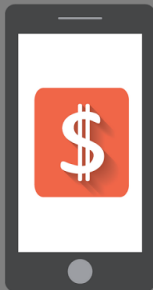
Mary has been coughing a lot and feeling short of breath.



Users learn about the app and about COPD's cost to the health care system:

A sensor made by **Propeller Health** attaches to the top of an inhaler. The sensor wirelessly connects with Propeller's mobile app, **which records when and where the inhaler is used.**

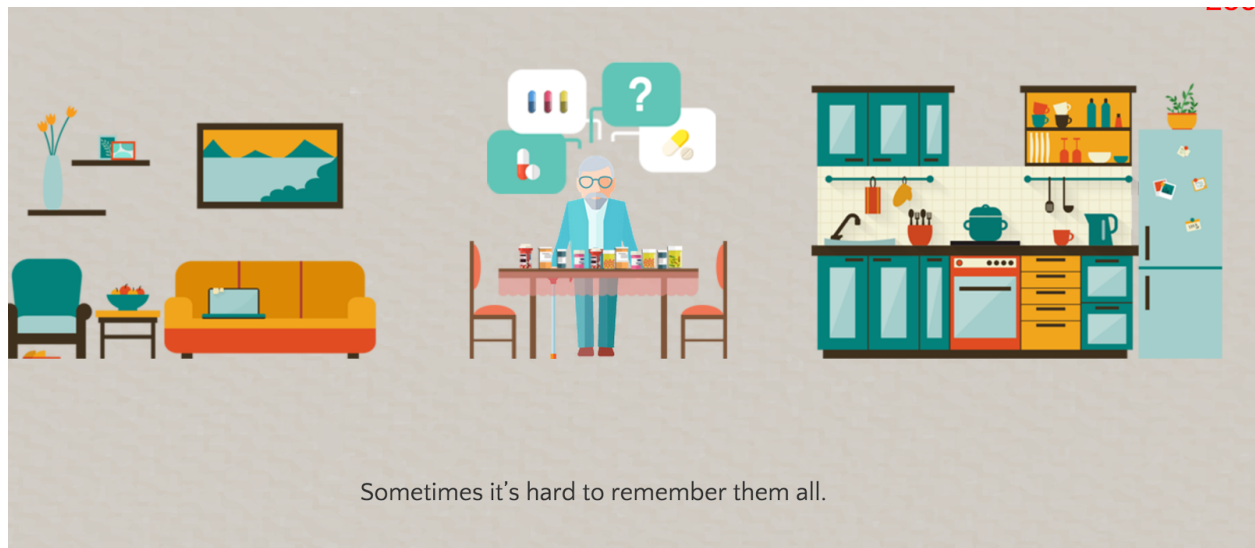
Asthma and COPD patients are often told to keep track of that data. With this **FDA-cleared app**, the data is collected — and is then shareable with a patient's health care provider.



Did you know? By 2020, the cost of caring for U.S. adults with COPD is estimated to be more than **\$90 billion.**

That's about the same amount of money it would take to buy **90 professional sports teams.**⁽¹⁰⁾

Lastly, we meet a man who has trouble remembering all his medications and learn about a medication management app that can help him:



At the end of the site, users scroll down to a 3,500-word article on the context surrounding this area of health and medical mobile technology, which I have included here:

Will the smartphone revolution mean better health care for you?

Just as the printing press made information available to the common man hundreds of years ago, the smartphone could revolutionize access to health and medicine.

Just ask Eric Topol, a cardiologist and director of the Scripps Translational Science Institute near San Diego. He uses the Gutenberg printing press metaphor to make the point that smartphones are forever changing the way we conceptualize the medical system and our own health.

Topol calls smartphone health care “democratized, bottom-up medicine.” And the apps, sensors and seemingly unlimited data at our fingertips put people — not providers — in charge of their own health. Medical procedures that once cost thousands of dollars can be reduced to pennies in the form of an app.

“This represents the emancipation of patients,” says Topol, who recently authored “The Patient Will See You Now,” a book about the mobile future of medicine. “Wherever there's a mobile signal, there's a potential for better health care.”

And more of us have that “potential” than ever before, simply because more of us have smartphones than ever. Almost two-thirds of American adults now own a smartphone, up from

just over one-third four years ago. And the trend is only growing: 85 percent of people getting a new phone choose a smartphone.

Two-thirds of Americans would be willing to use mobile apps to manage their health, according to a survey. That rate is even higher among people diagnosed with a mental health, gastrointestinal, obesity, pulmonary or cardiovascular condition.

David Beckemeyer of Danville, California is one of those willing app users with a cardiovascular condition.

About two years ago, he was having a frustrating, all-too-common health care experience. Beckemeyer would have intermittent episodes of chest pain. Each time, he would call his doctor and they would schedule him for an appointment. By the time he got to the appointment, he wasn't having the pain anymore.

"They couldn't figure out what was going on, I think to the point where they kind of started to say, well, this guy's — it's all in his head kind of thing," Beckemeyer says.

But then Beckemeyer's doctor stumbled upon the AliveCor Heart Monitor. With a special sensor-equipped smartphone case, the FDA-cleared AliveCor app allows a user to record an electrocardiogram (ECG) in about 30 seconds.

Beckemeyer got the app and began using it at home. When he would have an incidence of chest pain, he'd pop the case on his smartphone and record an ECG right then and there.

But, as it turned out, the app exposed a stumbling block in the integration of mobile technologies into health care.

"I applaud the doc for giving me the device, but it was actually an interesting problem because he couldn't actually look at it," Beckemeyer says. "They didn't have a way to bill for it. And that particular doc, at the end of the day, simply couldn't — wouldn't — look at the reports because he didn't ... know how to bill for them. And I ultimately had to change docs because of that."

Obstacles and opportunities

According to a study last year from the Brookings Institution, Beckemeyer's situation is far from an anomaly.

The Brookings study examined mobile health technologies, or mHealth, in China and the United States and found reimbursement to be one of the most important policy challenges facing mobile health tech in America.

Most American doctors are inadequately reimbursed when they use mobile health technologies with patients, regardless of whether those patients have public or private health

insurance coverage. “This has slowed the adoption of mHealth initiatives,” the study’s authors wrote, “and made it difficult to reap the benefits of the mobile technology revolution.”

The Affordable Care Act did little to clarify the reimbursement issue or promote the advancement of mobile health technologies. “The Affordable Care Act was primarily driven by the need to improve access of [the] uninsured,” Topol says, “and it wasn’t at all really into how can we change medicine, how can we make it better, how can we get people to take advantage of these new tools and opportunities.”

Some health insurance companies are seeing the potential in these technologies and taking steps forward on their own. In April, UnitedHealthcare announced that its members could soon visit the doctor via their smartphones in the comfort of their own living room. The insurance company is partnering with telehealth providers Doctor On Demand, NowClinic and Amwell to offer the video doctor visits.

While the Affordable Care Act may have missed an opportunity to move the health care system more toward embracing mobile technologies, the law did push away from a fee-for-service model in the direction of a system that rewards efficient, effective care. That move opens up opportunities for innovation, says Iltifat Husain, an assistant professor of emergency medicine at Wake Forest University’s School of Medicine.

Take, for example, the law’s penalties on hospitals with high rates of Medicare patients being readmitted to hospitals within 30 days of having been released. “Hospitals don’t want 30-day readmission [penalties], so how do you prevent that? Well, potentially utilize mobile technology to do that in a cost-effective way,” Husain says.

As for Beckemeyer, he didn’t let his doctor’s billing reimbursement hurdle stand in his way. He found a new doctor and gave that doctor the ECG reports from his AliveCor app. “[The new doctor] sort of just informally took the papers and looked at them himself. No lab technician, no anything. Just during the office visit, just looked at them, and said, ‘Oh, well, this is [atrial fibrillation].’”

‘Health care for a fraction of the cost’

The AliveCor app offered the answer that Beckemeyer and his doctors had been pursuing for years. Although it took two doctors to get to that answer, Scripps’ Topol sees cost savings in those kinds of situations.

“We have very strong evidence that you can do a lot of things that previously were very expensive using cheap chips and software, and that at the individual and at the societal level that we can radically reduce costs,” Topol says. “It costs a hundred dollars or more to do a cardiogram. It costs a thousand dollars or more to go to the emergency room to be evaluated for a possible arrhythmia. But you can do that for pennies doing it through your smartphone.”

Not to mention reducing the cost of additional doctor's office visits. Now, when Beckemeyer is having chest pain, he takes an ECG at home instead of calling the doctor to make an appointment. He saves his ECG records and shows them to his doctor at their next scheduled appointment.

"We have a whole new way of providing digitized, democratized health care for a fraction of the cost," Topol says.

Across the country in Minnesota, Laura Gandrud sees the same cost-savings potential with a mobile app for diabetes patients.

Gandrud, a pediatric endocrinologist at Children's Hospitals and Clinics of Minnesota, is helping to lead a study at the hospital using the Glooko diabetes app. Glooko is for patients of any age who have type 1 or type 2 diabetes.

Diabetes patients monitor their blood glucose levels on a regular basis. The Glooko device connects to a patient's blood glucose meter and transfers the data wirelessly to the Glooko app on the patient's smartphone. As soon as the glucose data is downloaded, the patient's doctors can see it as well.

Allowing doctors to see that information immediately is a radical change from the status quo, where doctors see a patient's blood glucose readings during checkups only about four times a year. "What happened two weeks ago? What happened three weeks ago? What happened this day when your blood sugar went really low? So we're always doing retrospective review of what's going on with their diabetes," says Gandrud, whose study involves adolescent girls with type 1 diabetes.

Using Glooko, doctors can see in real-time which patients are struggling — Glooko organizes patients into a list and flags patients who are outside the normal range — and doctors can then intervene with immediate support.

"We don't want to spend time looking through blood glucose data in someone who's doing wonderfully," Gandrud says. "You know, you don't even want to open up their chart. We can see in a whole list and see the flags of who we need to intervene with. It's focusing our resources on the patients who really need it."

When health care providers can intervene before small issues become big issues, emergency room visits and hospitalizations can be prevented. Translation? "That's going to allow for huge cost savings," Gandrud says.

"We are on the brink of really exciting things in diabetes," she says. "I think it's time where we have to embrace this technology in medicine. Think of all the other means in which mobile

technology's helped our lives. And we have to help people with their medical illnesses, we have to use the technology to help them more aggressively.”

Disconnected data

Michael Blum gets emails every single day from entrepreneurs in California's Silicon Valley with new ideas for digital health technologies. Blum, who directs the University of California, San Francisco's Center for Digital Health Innovation, tells those entrepreneurs one thing up front: rigorous, scientific validation is a must.

“If they bring in a technology that they are convinced that it works but it turns out that it's really not that accurate or reliable, they'll quickly lose in the space,” says Blum, who was trained as an engineer before becoming a cardiologist. “And you don't really get that many chances at this.”

There's an avalanche of innovation when it comes to digital health devices, but it's often disconnected from the actual health care delivery system. “Much of it is driven by technology with really good ideas,” Blum says, “but not really a great understanding of how the health care system works.”

That can lead to a “last-mile” problem, where valuable health data is collected through apps but then that data sits idle somewhere, without making its way to the health care providers who can put it to use in patient care.

That's one issue the Center for Digital Health Innovation is trying to address: bridging the gap between the technology and what it takes for that technology to work in a health care space. They're working to develop a platform that will integrate patient-collected data into the clinical space, Blum says, making it possible for the data to actually help health care providers on the front lines.

“When we start from the perspective of ‘This is fantastic technology and it's worked in a business or it's worked in communications,’ we see those fail on a fairly regular basis,” Blum says.

Blum admits there's a widespread belief that health care is technophobic. “There's a perception that physicians in particular don't like to use technology in the care of their patients,” he says.

But that characterization is largely untrue, Blum says, fueled by doctors' lagging adoption of electronic health records, due mainly to the complicated, non-user-friendly interfaces.

Topol doesn't see things quite the same way. He thinks there's truth to the perception that too few doctors are embracing promising, new mobile health technologies. And he sees a few potential reasons as to why.

“Either [these technologies] represent challenging the autonomy of physicians’ control, or they represent patient-generated data, which most doctors don’t really have high regard for,” Topol says.

Or, doctors might see the technologies as diminishing the need for the doctors themselves. “And that of course is threatening, too,” he says.

When Wake Forest’s Husain senses foot-dragging among his fellow physicians over mobile health technologies, he tells them to focus on the incredible opportunity to step up and lead, even though these technologies weren’t part of how they learned to provide care in medical school.

“If you have an idea, if you have a passion or a niche, you can truly innovate in the current marketplace, as opposed to doing things the way that they’re always done,” says Husain, who also serves as the director of the medical app curriculum at Wake Forest’s School of Medicine. “Because guess what? You can’t do things the way they’ve always been done. And unless physicians and providers really go out there and take ownership of that, we’re just going to let industry dictate everything. Instead, we need to work with industry. Tell them what we care about, what matters.”

Doctors who are hesitant about mobile technologies now might be surprised to find those innovations prove indispensable in only a matter of months or years.

Think of searching online for health information. Even five years ago, doctors might have been terrified to hear their patients Googled their health ailments because of all the erroneous, anecdotal information lingering on the Internet.

But now, Google has incorporated verified medical information, including symptoms and treatments, that people see to the right of the search results when they look up a certain condition, a change that Husain calls “tremendous.”

“If anything, [doctors] should feel more reassured that the patient will land on a page that is very similar to how [the doctor has] described what’s going on with their body,” Husain says.

Medical vs. recreational

In his role as founder and editor-in-chief of iMedicalApps, a website dedicated to mobile medical app reviews and research, Husain has written about scores of health-related apps. He’s a huge proponent of these technologies, seeing firsthand how they save doctors time, lead to more efficient treatment, empower patients and encourage us to make healthier choices.

But Husain also sounds the alarm on the apps he thinks could lead users to make the wrong conclusions about their health.

Take, for example, an app called Instant Blood Pressure. The app claims to “measure blood pressure with just your phone,” according to the app’s website. “No [blood pressure] cuff required.”

In the fine print of its description on Apple’s App Store, the app says it’s “for recreational use only.” Husain says that line was added after he reached out to the app’s maker, Aura Labs, and asked how the blood pressure was being measured. The company told Husain they would release the data showing how the app works within a few months — that was more than a year ago and Husain hasn’t seen it.

Aura Labs did not respond to requests for comment.

Although Husain says there is no verified data on how the app works, Instant Blood Pressure is among the top 10 paid health and fitness apps on the App Store. “If you look in the comments section, it’s absolutely terrifying because you have people that mention how they’re no longer using a traditional blood pressure cuff but using this application to track their blood pressure readings,” Husain says.

When patients are tasked with keeping track of their blood pressure, doctors assume they are using a traditional blood pressure cuff, Husain says, not an app designed for recreational use. Erroneous readings could lead to serious health complications if the doctor adjusts the patient’s medication the wrong way. “Blood pressure is not something to play with,” he says.

Apps of questionable medical value can also undermine adoption of effective health and medical apps. “It makes people lose faith in overall digital health,” Husain says.

Regulating the ‘digital snake oil’

The Food and Drug Administration regulates mobile medical apps. The agency issued guidance in 2013 and clarified it again earlier this year, saying that it will target apps for regulation that serve as an accessory to a medical device or apps that essentially transform a smartphone into a medical device.

Of those, the FDA said it plans to regulate only the apps “whose functionality could pose a risk to a patient’s safety if the mobile app were to not function as intended.”

The FDA has cleared more than 100 mobile medical apps to date.

While some have sought clearer guidelines as to which apps the FDA will and won’t regulate, including some efforts toward legislation in Congress, Nathan Cortez warns against limiting the FDA’s discretion too much.

“I think the convenient narrative that frustrates me is that the FDA is the overbearing federal government regulator and it's going to stifle innovation and American entrepreneurialism,” says Cortez, a professor at Southern Methodist University’s School of Law, who researches and writes about FDA regulation of mobile medical devices. “And this is a really old and convenient story. And I just don't think it's the case. The FDA has been really accommodating to industry, and I think if anything, you could criticize them for being too accommodating and having too much of a light touch with its regulation.”

Cortez doesn’t see regulation and innovation as mutually exclusive. “If you have over a hundred thousand different mobile health apps on the market since the iPhone is introduced in 2007, that doesn't tell me that there's not enough innovation in the mobile health industry.”

With that many health apps on the market, it can be hard for consumers and health care providers to know the difference between the good and the bad. “There's definitely modern-day digital snake oil out there,” Cortez says. “At the same time, there are a lot of really high-quality apps. And if I was a high-quality product and I had spent the time and money researching to figure out how to make my product better and how to actually help people, I'd be frustrated too that there were snake-oil equivalents.”

While it can be difficult to draw the line between the apps that should be regulated and those that should not, Cortez wants to make sure the FDA retains the leeway to step in when apps turn out to be problematic.

“Medical quackery has always been around, and until we had federal legislation, the vast majority of drugs we consumed did not help us and, in fact, probably hurt us,” Cortez says. “So I think we're in an era now where we just don't have an excuse to go back to a system like that. Smart, early regulation can help the market function better by discouraging the kind of fly-by-night snake-oil salesman practices that have been around for centuries.”

Yet the FDA simply may not have the bandwidth to regulate all the worrisome apps on the market today. “This area is the wild, wild West,” says Wake Forest’s Husain. “You have thousands and tens of thousands of pieces of software out there, and the FDA's not going to be able to parse through all of them.”

A smarter strategy would be to focus on the apps that are getting the most use, making sure those in particular are above-board. “That’s something that I haven't really seen the FDA step into,” Husain says, “and I wish that they would.”

Making sense of the data

When Christy Tomkins-Lane looks at the future of mobile health technologies, one of the biggest potential benefits she sees is the ability for those technologies to help people own and understand their health data without health care providers needing to spoon-feed it to them.

But for that vision to become reality, there needs to be more analysis of how to use the data to improve a person's health.

"You might wear a Fitbit [a wearable fitness tracker] for a month, and you might find that your average number of steps is 7,000. And that you get eight hours of sleep. But until somebody can tell you, what does that mean — what does that mean for my health, is it good, is it bad, should I change, should I not? I think that's what's missing."

Tomkins-Lane is a visiting associate professor in the Department of Orthopaedic Surgery at Stanford University and a member of the university's Wearable Health Lab, where she's researching the use of mobile technology in musculoskeletal medicine. But she's also the cofounder of a Canadian health data analytics company, Vivametrica, which aims to provide exactly the analysis that she says is missing — the meaning behind the health data.

"The gap that we need to bridge is understanding the data and interpreting it, and using it or being able to use it in making decisions about health," she says. "So taking your number of steps per day, knowing what it means. What does that mean to other people my age and gender? What does that mean in terms of my risk for disease? Is that enough steps? Is it not? How can I alter my behavior to improve health outcomes?"

There's a surplus of exciting mobile health devices measuring everything from steps to blood glucose and lactic acid. "But it's a whole lot of data that the average person doesn't know what to do with," Tomkins-Lane says.

Earlier this year, Tomkins-Lane went to the International Consumer Electronics Show and she counted more than 50 booths dedicated to mobile health wearables. "And there was not one booth there of analytics," she says.

Scripps' Topol agrees that ramping up high-level interpretation of all the health data that's being collected is the next step. He envisions a virtual medical assistant built into our smartphones that can process data on everything from sleep to activity to blood pressure and heart functioning.

That virtual medical assistant would tell us that something's brewing in our bodies before we actually have a problem.

No one's ever had access to this vast amount of health data before, Topol says, and no human has the ability to process all of it.

What's the next frontier in mobile health? "Building the algorithms and the machine learning to be able to accomplish that," he says.

Source List

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3. "Interview with Laura Gandrud, Pediatric Endocrinologist." Telephone interview. 6 Jan. 2015.
4. "Interview with Jessica Kaplan, Pediatrician at Noe Valley Pediatrics." Personal interview. 30 Dec. 2014.
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7. "Interview with Michael Blum, Director of UCSF's Center for Digital Health Innovation." Personal interview. 23 Mar. 2015.
8. "Interview with Eric Topol, Director of the Scripps Translational Science Institute." Telephone interview. 26 Mar. 2015.
9. "Interview with Nathan Cortez, Professor of Law at Southern Methodist University." Telephone interview. 14 Apr. 2015.
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