

Internet of Health

Apps, Wearables, Population Health, and Integrated Care

Jeremy Nelson, CEO Afia Inc.



At a high level

1. New generation of **connected devices**
2. New **models for care delivery**
3. New class of **innovative startups**
4. Supported by **payment reform**



2010 Sensors & Technology

- GPS
- Cameras
- Microphones
- 6-axis accelerometer
- Compass
- Light sensor
- Proximity sensor
- Wi-Fi & 3G
- Bluetooth

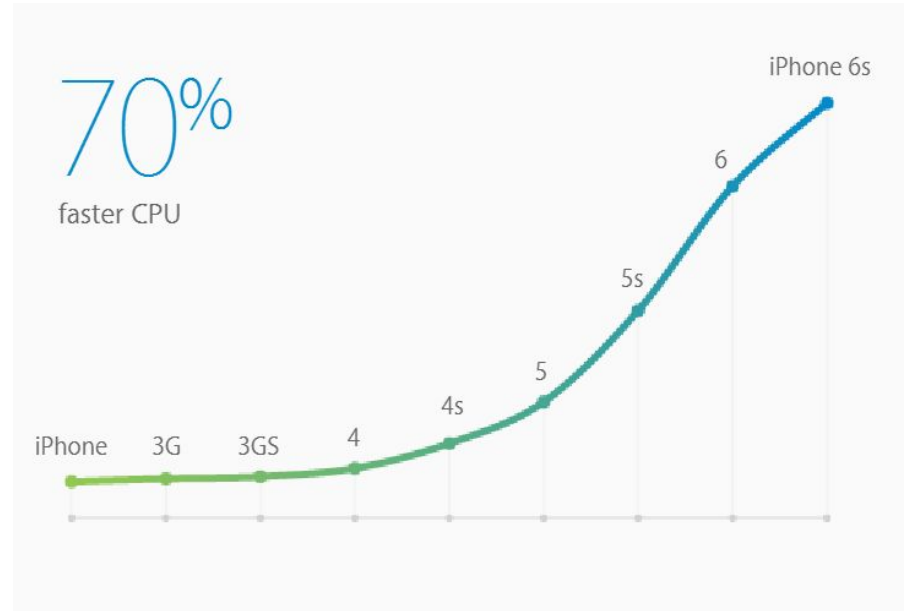


In Just The Last 7 Years

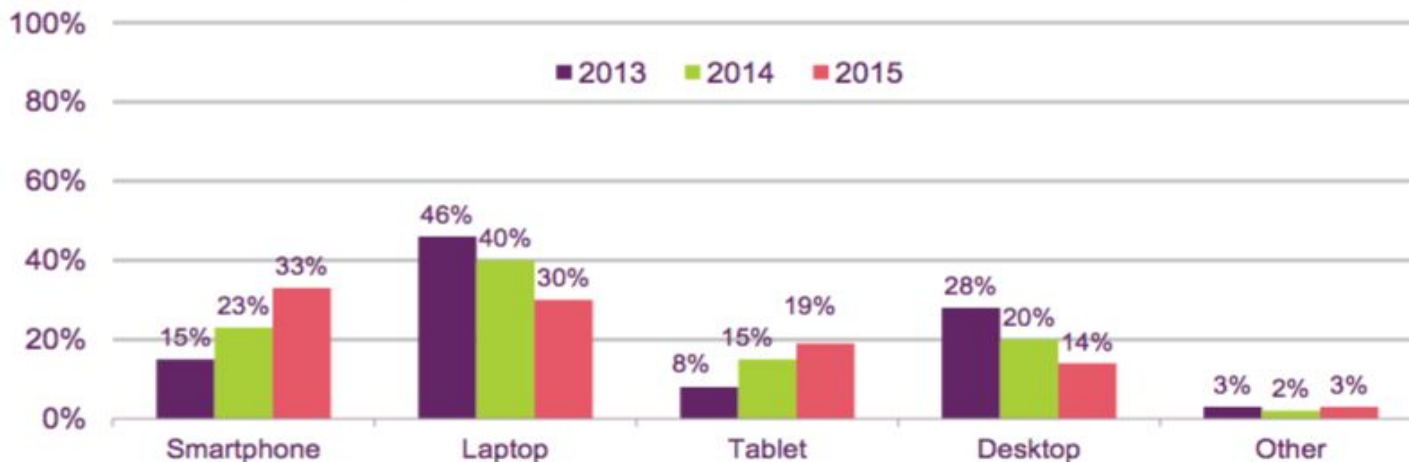


2015 Sensors & Technology

- 70x faster CPU
- 90x faster graphics
- NFC
- Barometer
- 4G/LTE
- Bluetooth Low Energy
- Motion Coprocessor
- 3D Touch



Proportion of internet users (%)



Source: Ofcom Technology Tracker, Data from Q1

Base: All adults aged 16+ who use the internet at home or elsewhere

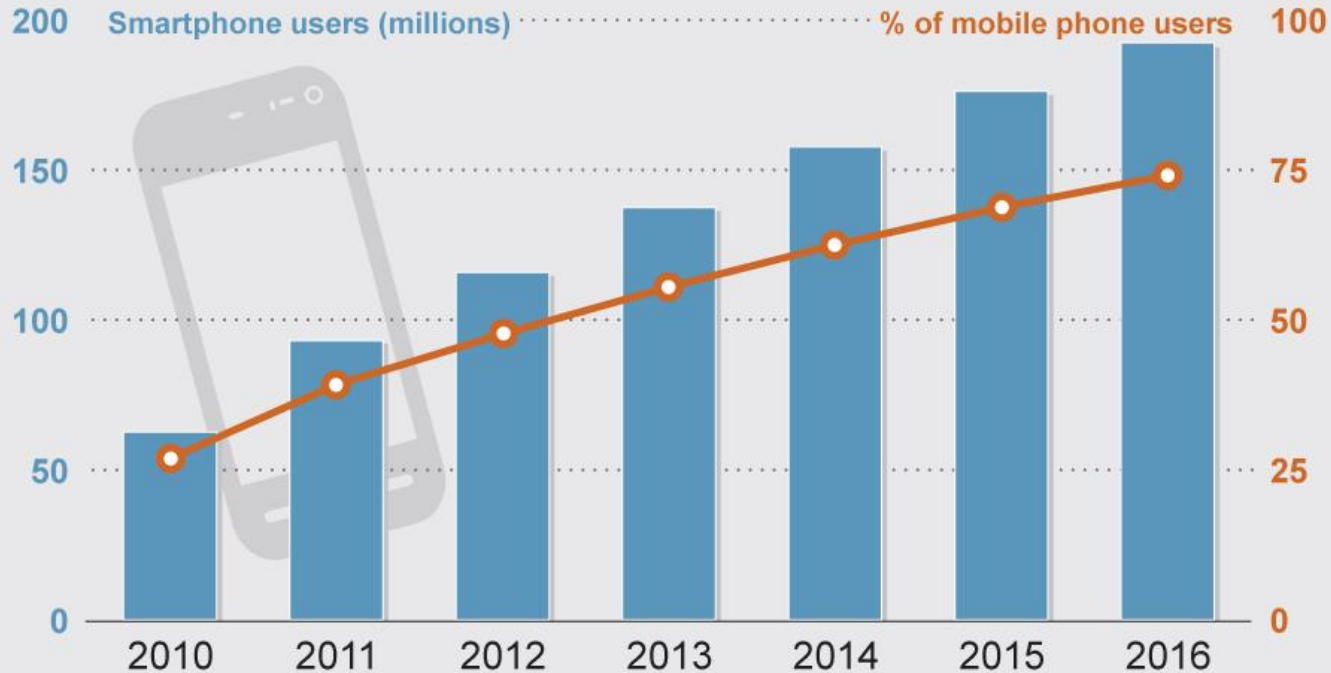
QE11(QE40): Which is the most important device you use to connect to the internet, at home or elsewhere? 'Other' includes: 'netbook', 'games console', 'other device', 'none' and 'don't know'.

Ranked by 2015

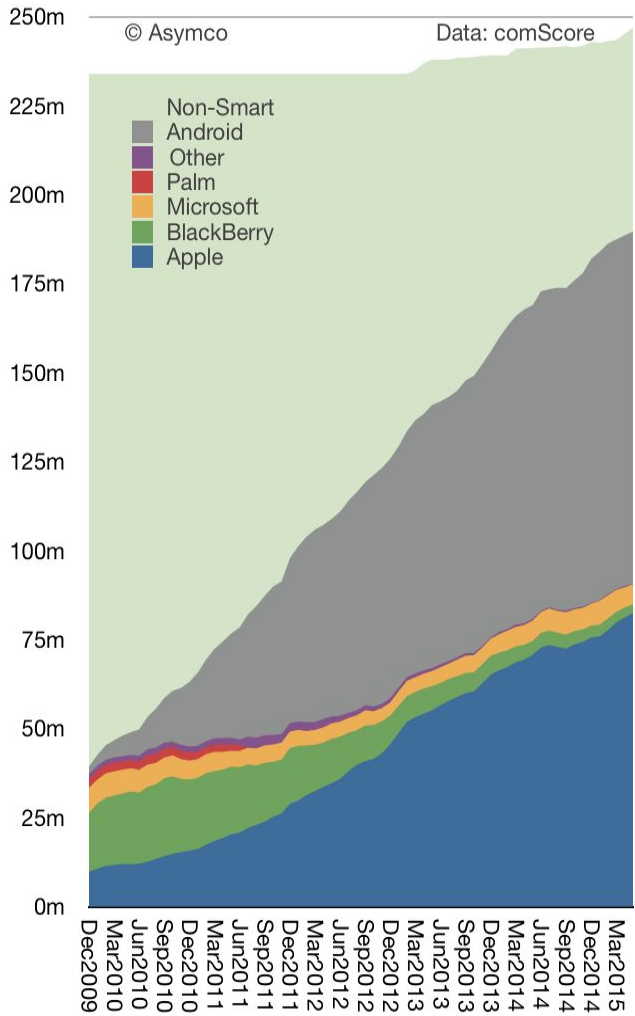
“What is your most important device?”

Smartphones Are Taking Over

U.S. smartphone user forecast



US phone install base



Smart Devices 1.0



The Pavlok Band



- Activity tracking
- Sleep tracking
- “Shock circuit”

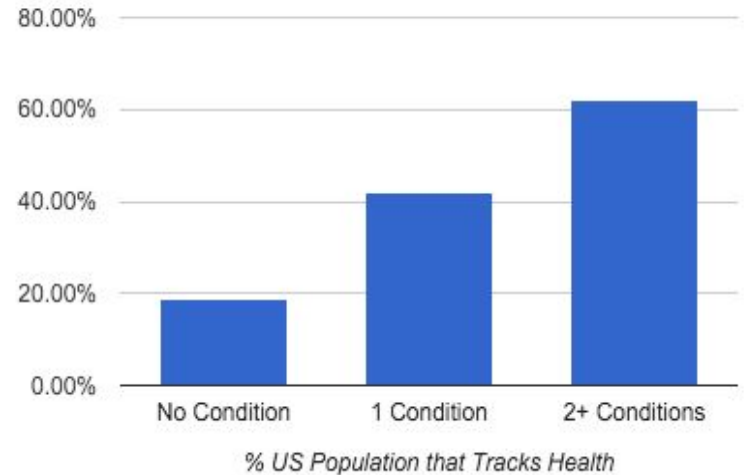
The Pavlok Band



“Pay a fine, lose access to your phone, even get an electric shock... at the hands of your friends” if you fail to meet goals

Who tracks their health?

- 45% of U.S. adults live with at least one chronic condition.
- Of those with 2+ Conditions
 - 78% have high blood pressure
 - 45% have diabetes



Connected Wearables

Show of Hands



Android Wear

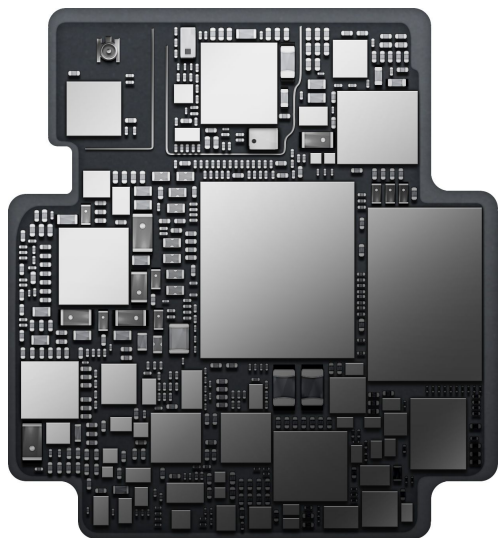


Apple Watch

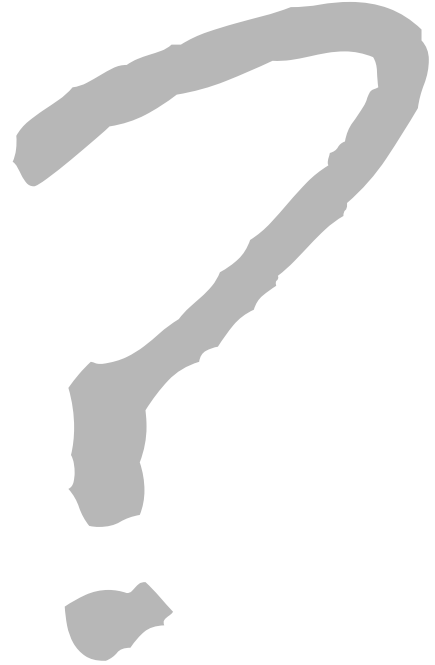
Common Sensors

- Heart rate sensor
- Accelerometer
- BTLE + Wifi
- GPS (Phone)





Apple S1 Chip



Fourteen Months In

- Battery life - good
- Hardware design - excellent
- Messaging - excellent
- Activity tracking & fitness - good
- Third-party apps - poor





October 2015

Activity 

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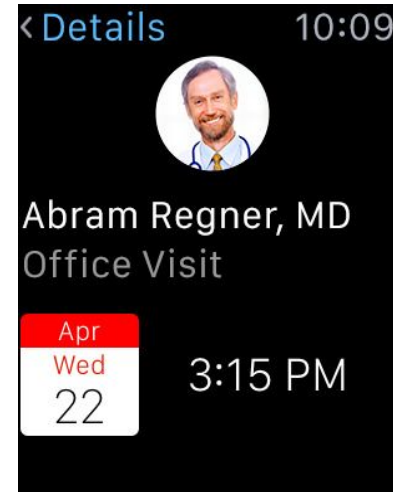
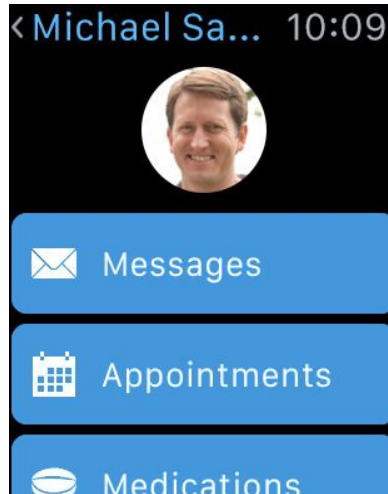
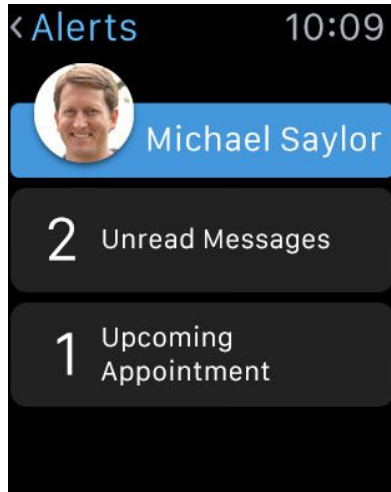
30

31



Epic - MyChart on Apple Watch

Appointment reminders, messages, medications integrated with EHR



Emotiv Insight

- Consumer EEG & inertial sensor
- Bluetooth integration with smartphone
- Available via API



Spire Mind & Body Tracker

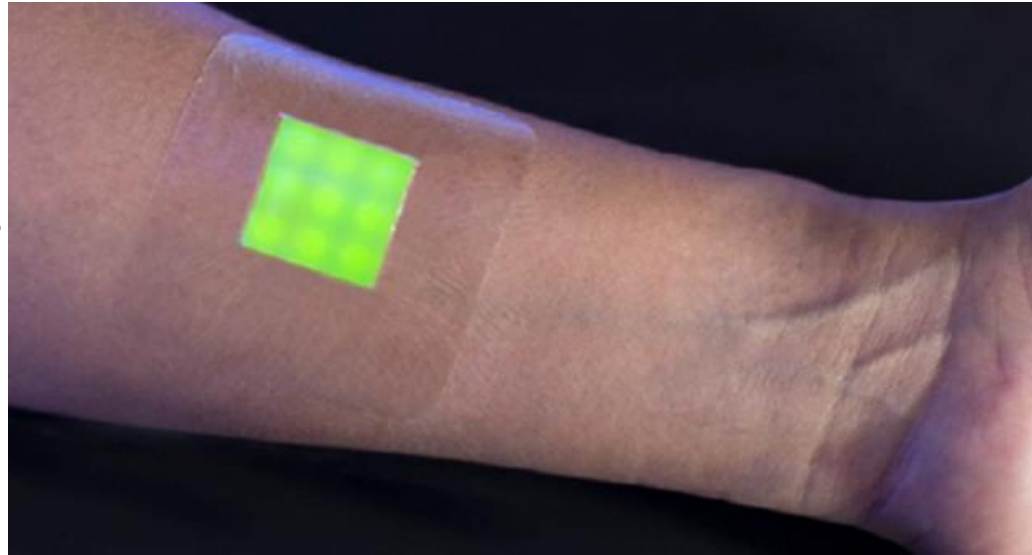
- Measures breathing & provides feedback
- Senses stress/tension, suggest deep breath
- Included iOS guides “mini-meditations”





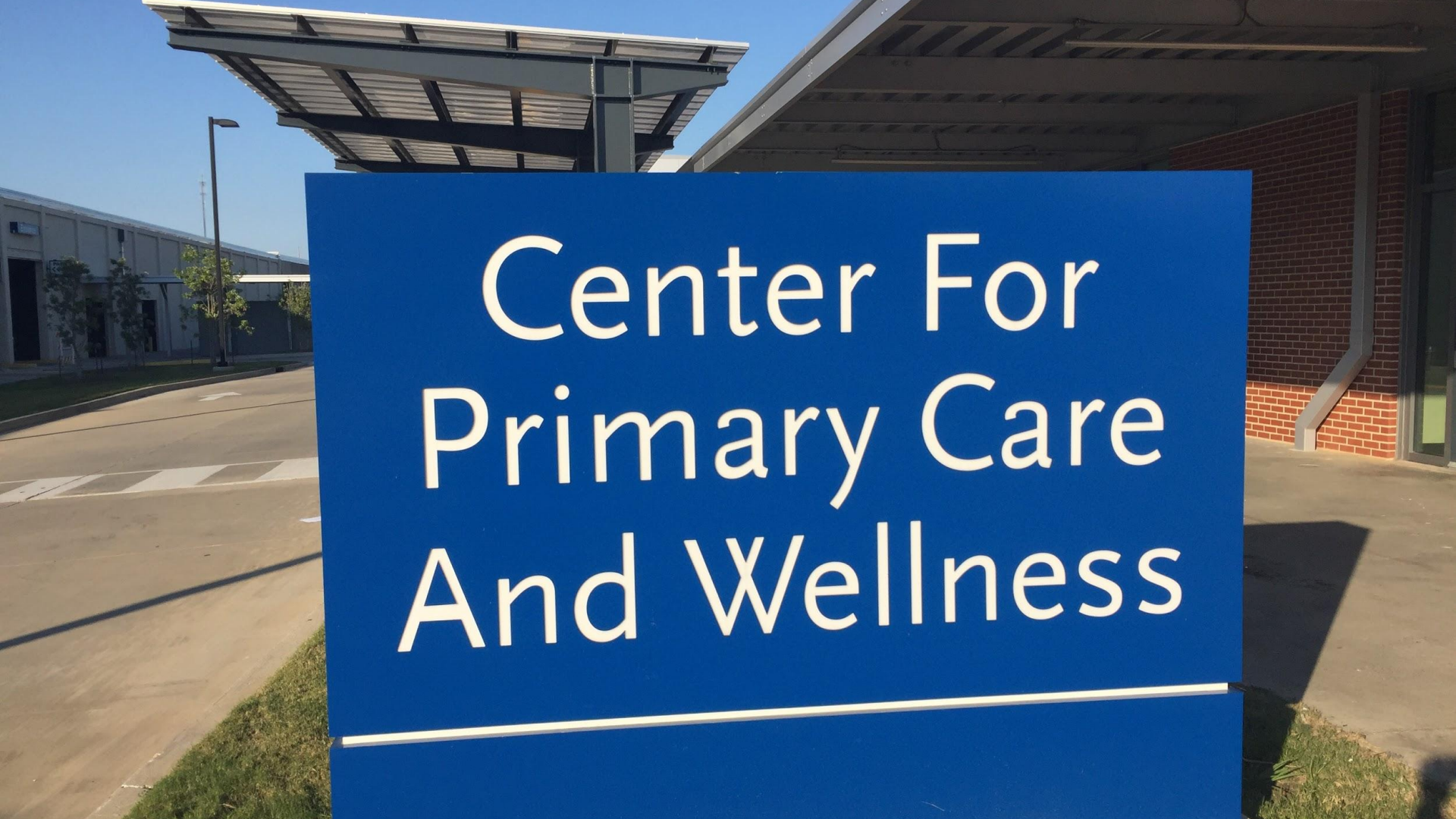
MIT “Band-aid of the Future”

- Sticky, stretchy, gel-like material
- Incorporates sensors (eg. temp to check for infection)
- Lights indicate status/med needs



New Models for Care Delivery





Center For
Primary Care
And Wellness



Bar






Bar

Ochsner Center for Primary Care and Wellness
1401 Jefferson Highway, New Orleans, LA 70121

504.842.8566
ochsner.org/obar

Patient

Visit the  Bar to get your apps & devices today!

 Your prescription for good health.

Rx APPS

- Nutrition
- Fitness
- Women's
- Oncology
- Diabetes
- Medication
- Smoking
- General Health

DEVICES

- Activity Monitor
- Blood Glucose Monitor with Bluetooth
- Wireless Scale
- Wireless Blood Pressure Monitor

Physician Signature

Tell me and I forget. Teach me and I may remember. Involve me and I learn.

- BEN FRANKLIN

iPad

3:20 PM

100%

Select which Apps you would like to try. Click Send when you are done.

Send

The Apps you choose will be e-mailed to you.

Remember to open the e-mail with the device you wish to install the Apps.

Misc Nutrition Fitness Women's Oncology Diabetes Medication Physician Smoking

App Name	IOS App Store	Google Play Store
<input type="checkbox"/> Pocket First Aid & CPR	★★★★★ \$1.99	★★★★★ \$1.99
<p>Quick: What do you do if you or someone you're with gets a snakebite? You don't know? This app from the American Heart Association does. The Pocket First Aid & CPR app walks you through the most common first-aid scenarios, such as choking, burns, bites, and even diabetic emergencies. It provides step-by-step instructions and videos. The App also has emergency CPR and AED information if you need to provide life-saving measures. Moms and dads, this app can also come in handy if you need help keeping track of your kids' medicines, allergies, or doctors' phone numbers. You can create medical profiles for each member of your family and save all their necessary medical information.</p> <p>More Info</p>		
<input type="checkbox"/> Symple - Symptom Tracker	★★★★★ \$1.99	
<p>For people with many chronic diseases - and even for those without - keeping track of symptoms and warning signs can help you and your doctors reach a diagnosis. It can also help with revising a treatment plan more specifically and quickly. Need to monitor how a medicine makes you feel for a month or more? This app can help you do just that. You can also keep track of how often you exercise, record what medicines you've taken and how often you've taken them, or even note factors that might have helped ease your symptoms. Take your phone with you to your next appointment, and go over your history with your doctor. Together, the two of you may be able to identify triggers that make conditions worse or treatments that make it better. (Note: The app only allows you to monitor one person's symptoms at a time.)</p> <p>More Info</p>		
<input type="checkbox"/> KidsDoc	★★★★★ \$1.99	★★★★★ \$1.99
<p>A little medical advice is always helpful when your child is sick. The American Academy of Pediatrics created the KidsDoc app to help you analyze what your child's symptoms mean, decide the best treatment, and know when to seek emergency help. Pick your child's predominant symptom, such as vomiting, or select an area of your child's body that hurts. Photos help you decide if symptoms match potential causes; a definition tells you other symptoms your child may be experiencing. Based on your child's problem, the app can tell you when to seek emergency care and how to know if the condition is getting worse and needs medical attention. If it's something you can treat, the app gives you step-by-step instructions and illustrations to take care of your child. A helping hand is never a bad thing.</p> <p>More Info</p>		
<input type="checkbox"/> Sleep Cycle	★★★★★ \$1.99	★★★★★ \$1.69
<p>How often does your alarm clock jolt you awake from the depths of slumber? A crappy wake-up can lead to fatigue and a cranky mood all</p>		

Ochsner Hypertension Pilot

Patients required to have BP readings outside of 140/90

Enrollees are given Apple Watch (must provide their own iPhone)

Clinicians ask patients to obtain a blood pressure cuff

Apple Watch allows patients to receive medication reminders & clinician feedback



Ochsner Hypertension Success

Over 500 patients in pilot

Under Control

- 30 days - 50%
- 60 days - 57%
- 90 days - 62%



King's College - Chemotherapy

Watch provided to patients

Real-time one-touch med, symptom & temp tracking

Feedback on drug adherence, regimen updates



Apple Watch saves a Cape Cod teen's life

Teen had chest pain

UPDATED 6:37 PM EDT Sep 20, 2015

Text Size: A A A



The Apple Watch takes your resting heart rate about every minute or so. Houle knew there was a problem when his resting heart rate was more than double his average.

He went to the hospital, where he learned he had heart, liver and kidney failure, which could have been fatal if not for his watch.

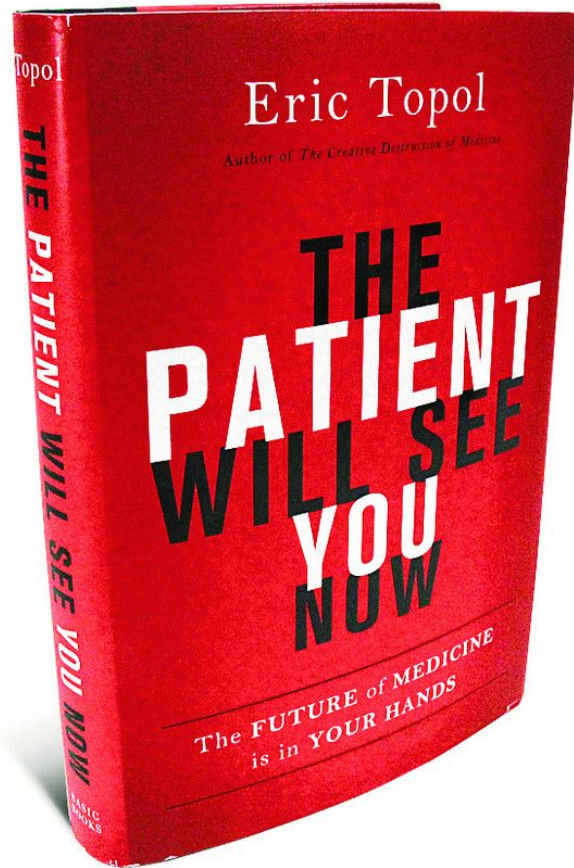
"If my Apple Watch hadn't shown me it was 145, I would have done nothing about it."

SHOW TRANSCRIPT »

BOSTON — A 17-year-old Tabor Academy senior was at football practice when something felt off.

Watch Newscenter 5's report.

"I had pain in my chest and my back whenever I took some deep breaths," said Paul Houle Jr.



Eric Topol
@EricTopol



Follow

Here's an interesting example of new medicine relayed by a cardiologist colleague

A patient requested a consultation for a pacemaker. This was based on information from his Apple watch. He had dizziness, tracked very fast and very slow heart rates on his watch, Googled this, and self-diagnosed sick sinus syndrome. I confirmed this at our visit. He asked me to put in a wireless pacemaker, which was done as an out-patient.

Dr. Rodney Dorand

8 min



Dr DOCTOR
ON DEMAND

Pics

Audio Only

End

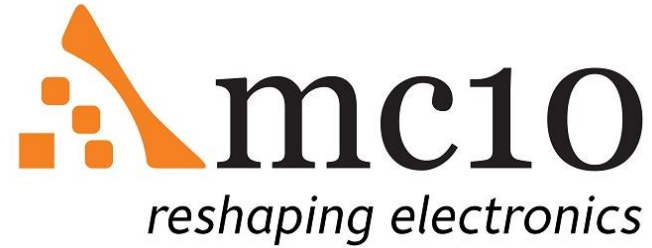
The Age of Wonders

Our Amazing Future

“Invisibles”

- Minimal, simple, intuitive
- Seamlessly integrated into the human body
- Potential for better adoption and engagement





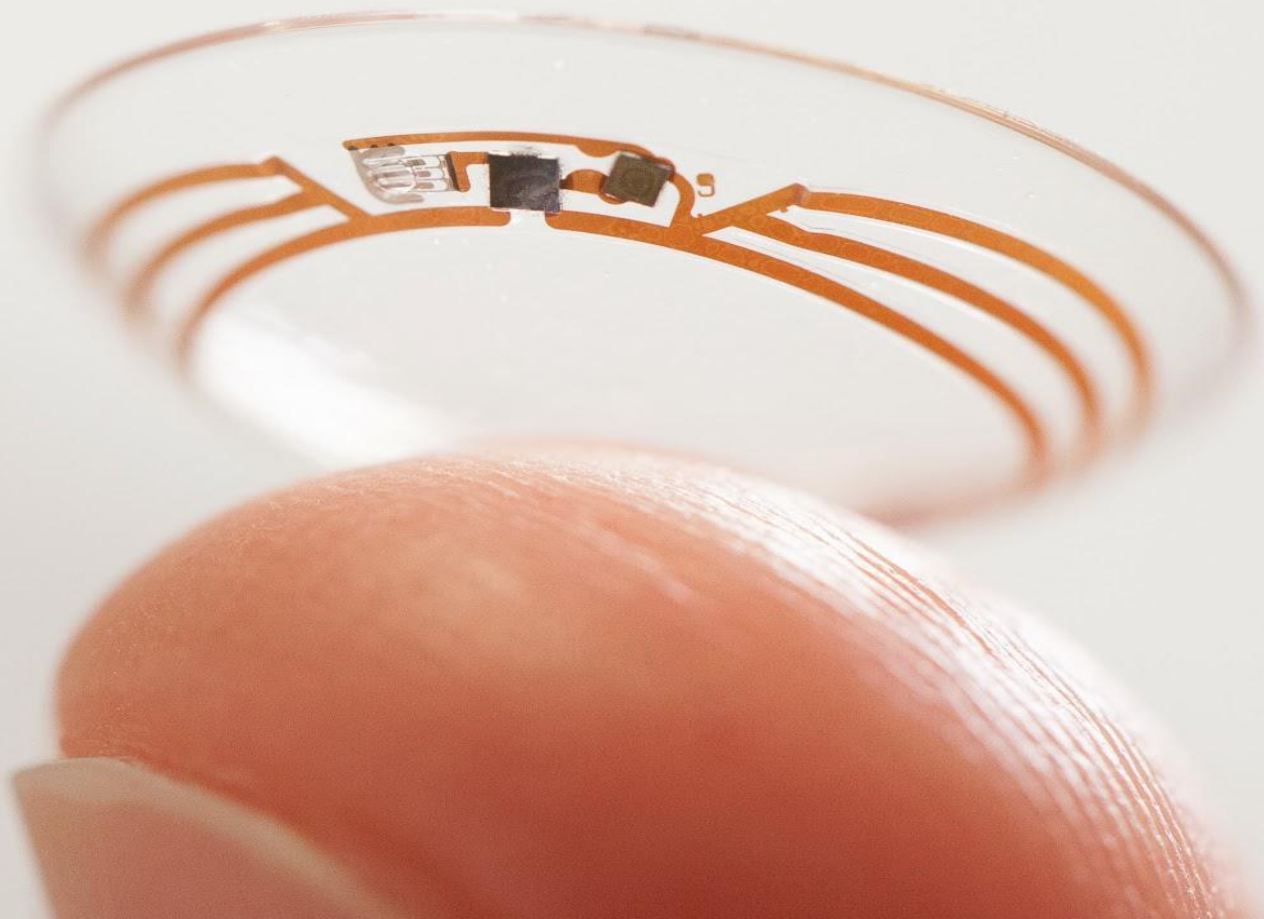
\$61M in venture capital raised





Google Contacts

Measures glucose in tears



“Ingestibles”

- Sensors operate within the body
- Often powered by stomach acid
- Diagnose, observe med adherence, monitor symptoms

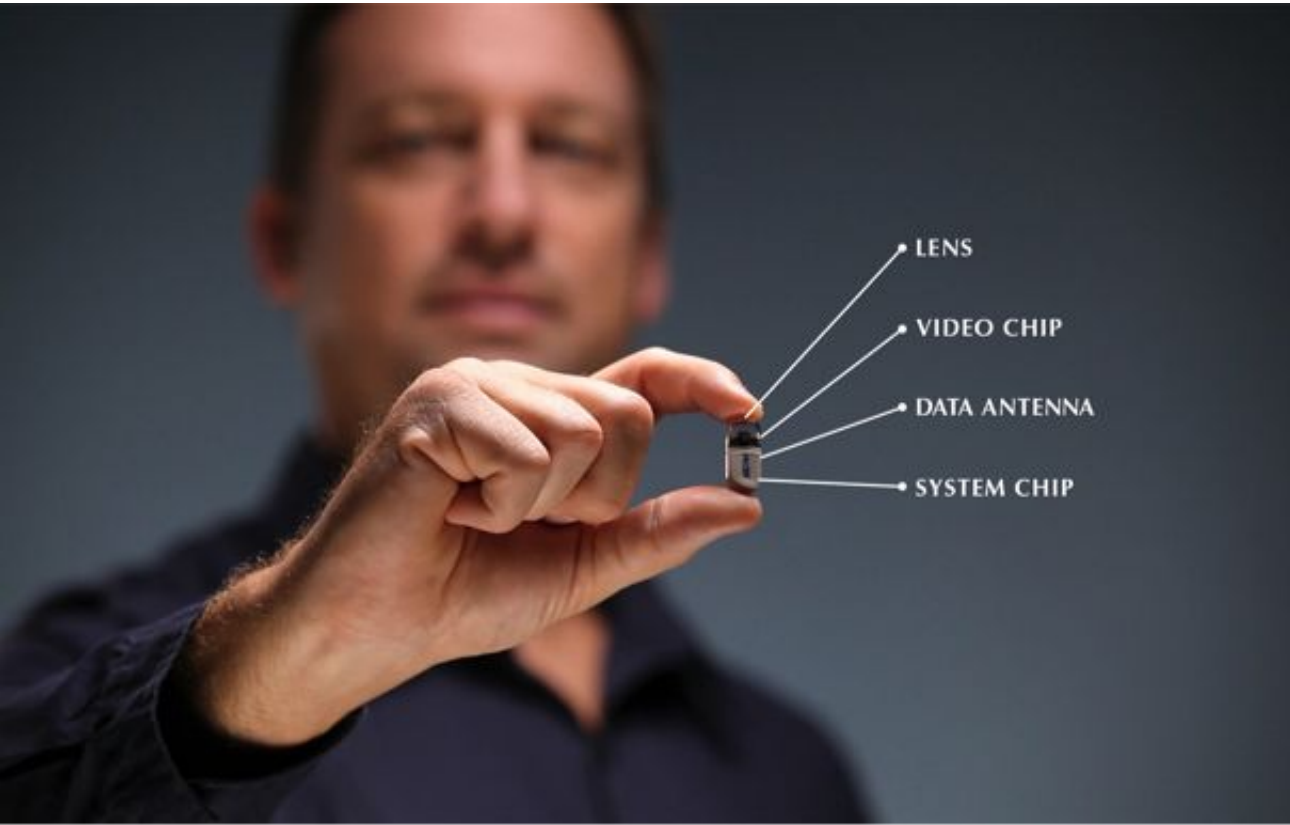


Proteus Digital Health

\$120M funding raised, cleared by FDA



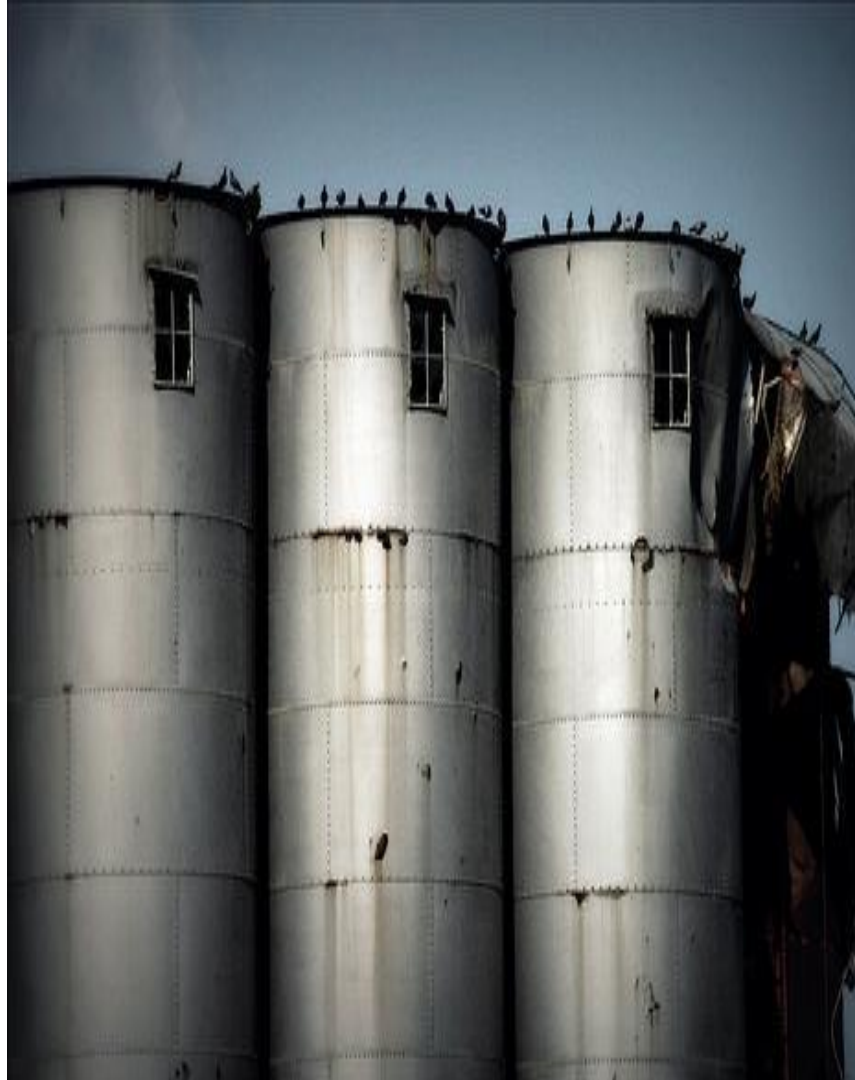
Given Imaging

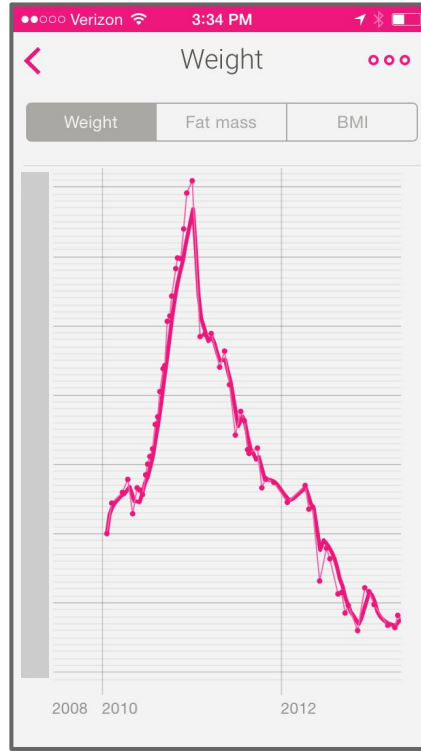
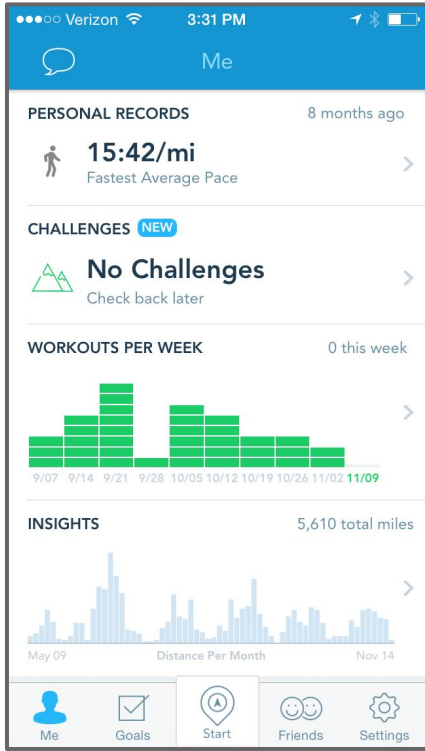


Data Silos vs Aggregators

Data Silos

- Hardware-specific
- Closed system
- Proprietary protocols
- Must be installed (↓ adoption)





Data Silos (Runkeeper, Withings, Fitbit)

Aggregators (Apple HealthKit/Google Fit)

- Hardware-agnostic
- Open system
- API-Driven (HealthKit, Google Fit)
- Included with OS





Google Fit



“Apple to fix Health app after blood glucose measurement issue”

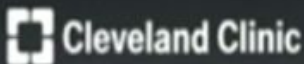
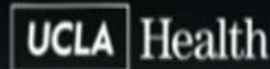
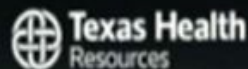
“Diabetics are being warned that Apple’s Health app is not compatible with some blood glucose measurements, meaning [some users] could see inaccurate readings.” – CNET, October 15, 2014



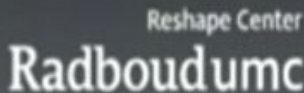
HealthKit

+

Epic



The Children's Hospital of Philadelphia



HealthKit/Epic Integration



- Patient is downloads the MyChart app
- Doctor “prescribes” tracking of certain data points
- EHR notifies doc if data is “abnormal”

“I’m sorry, there was nothing we could do for the patient. We tried our hardest, but they had an iPhone 4S. We can’t get their data.”

HealthKit/Epic – Ochsner Health System

- Avoiding readmissions of CHF patients by monitoring weights at home via Withings scales
- Alert docs and pharmacists when weight goes up (likely water retention) to titrate medication
- “O-bar” for support a la Genius Bar

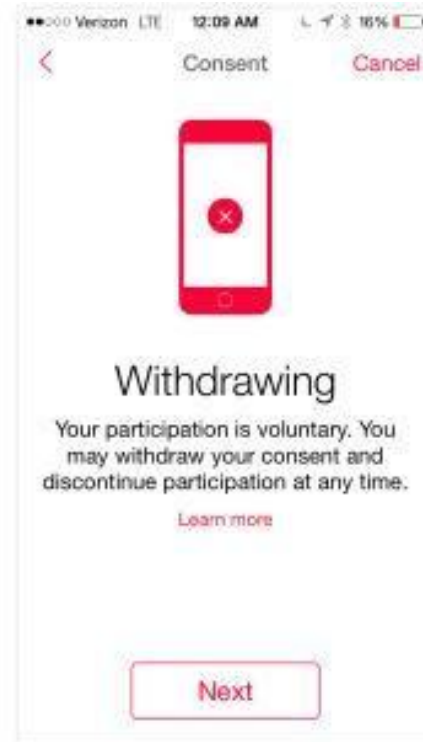
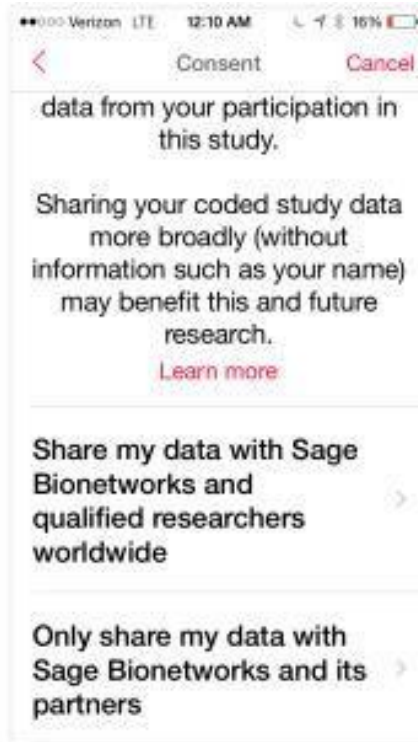


Apple ResearchKit



A software framework
made specifically for
medical research

Consent Process is Fully Automated





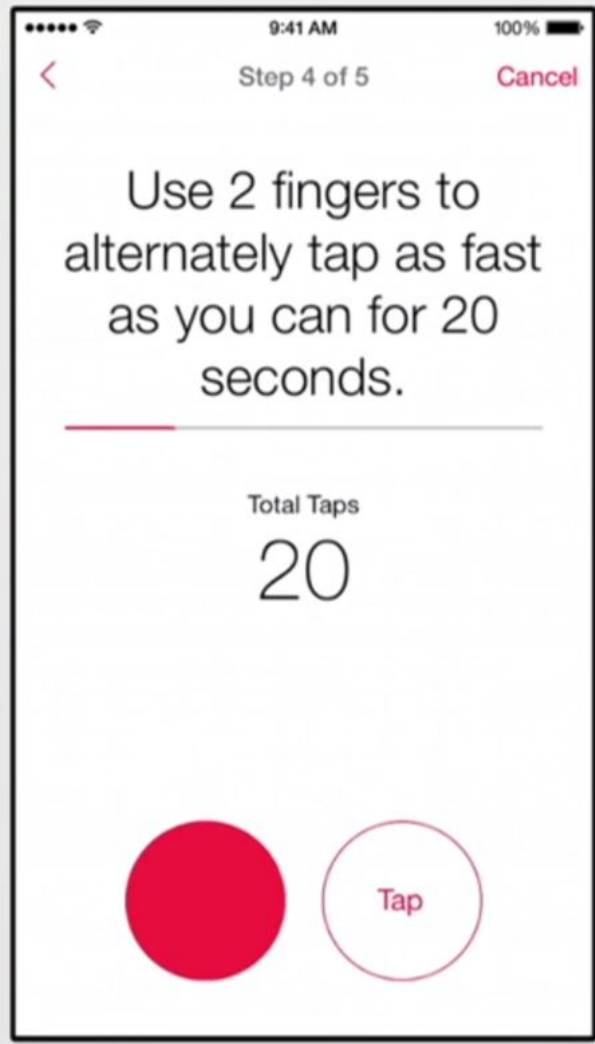
Parkinson's disease

mPower

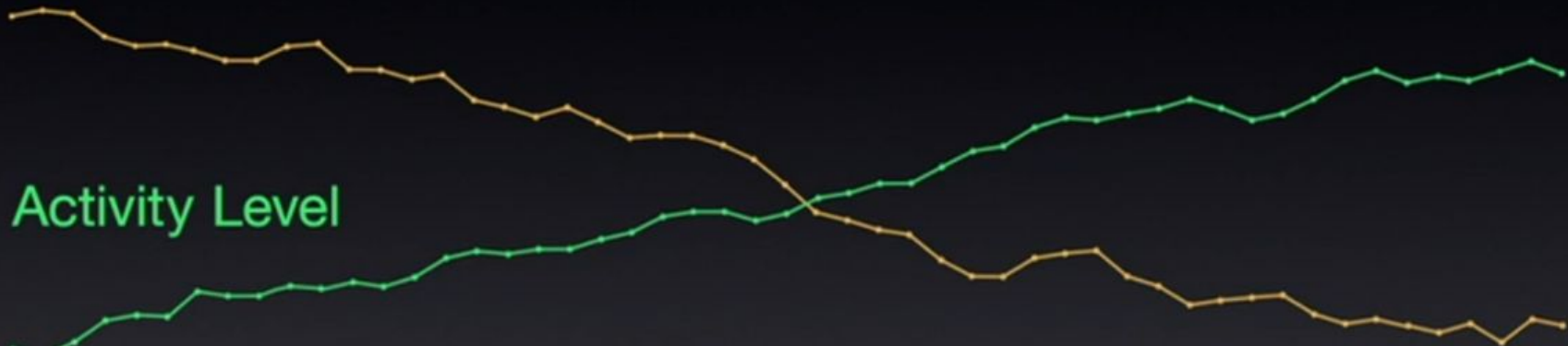
University of Rochester

Xuanwu Hospital, Capital Medical University

Sage Bionetworks



Tremor Severity



Activity Level



Breast Cancer



Diabetes



Parkinson's
Disease



Cardiovascular
Disease



Asthma



Stanford - MyHeart Counts



1. Download the app. Learn about the study. Review consent information.

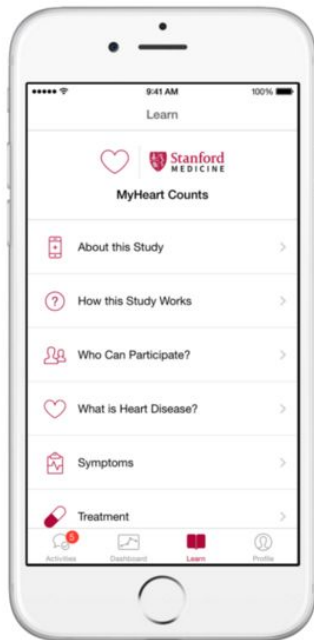


2. Start following your daily activity with your phone or wearable activity device.



3. Do a walk test and enter labs to see your heart risk. Learn how to improve your heart health.

11,000
Downloads
in First 24
Hours





Autism
Duke



EpiWatch
Johns Hopkins



MoleMapper
OHSU



Autism & Beyond

A Study of Young Children's Mental Health

[Read Consent Document](#)

[Email Consent Document](#)

Swipe to learn more



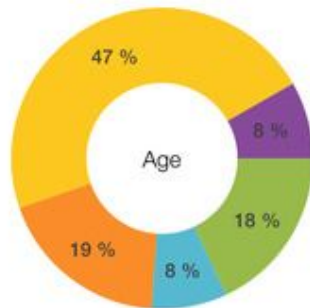
[Join Study](#)

Already Participating?

Who's Participating

1,287

Total Number of Families Enrolled



● 1 year olds
 ● 2 year olds
 ● 3 year olds
 ● 4 year olds
 ● 5 year olds

Caregivers



Activities



Dashboard



Learn



Profile



Sit your child on your lap.

Remove pacifiers or other objects that may block your child's face. We can detect your child's facial expressions if they're wearing glasses but not if something is covering their mouth.

Try not to tell your child what to do. We want to see how your child acts on his or her own.

About the Study



This study looks at young children's emotions and behaviors to better understand and identify risks for developmental and mental health disorders like autism.

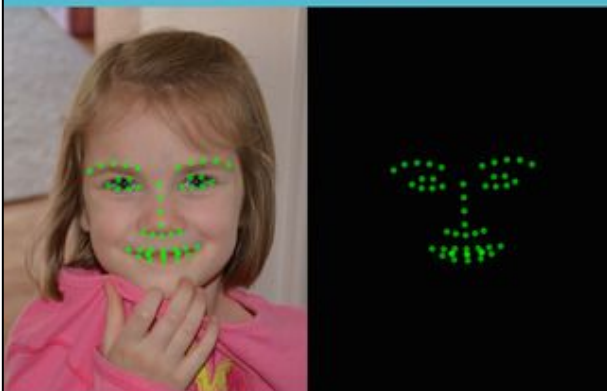
You'll be asked to answer surveys about your family and your child will watch several videos.



Join Study

Already Participating?

How it Works



While your child watches a video on your iPhone, we will record your child's face to measure emotion.

You can choose to share the video or only the facial expressions.



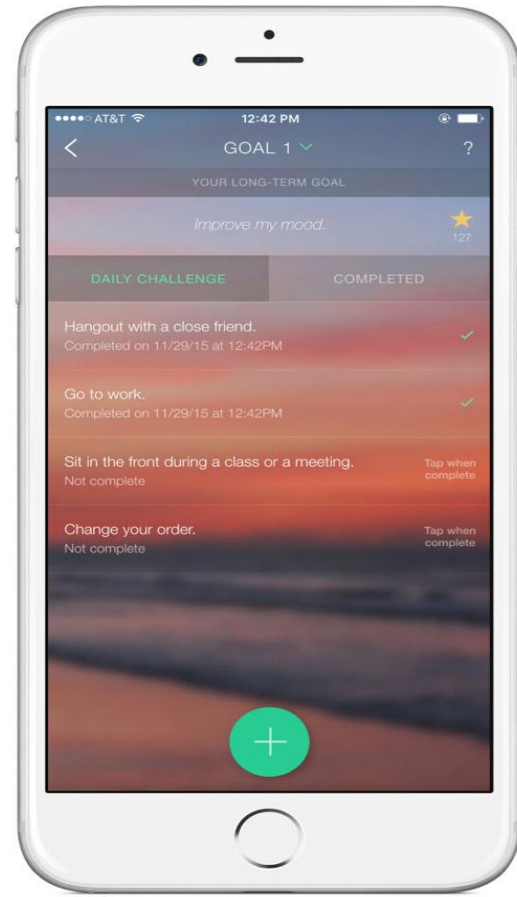
Join Study

Already Participating?

A New Class of Innovative Startups

Pacifica - Anxiety and Stress Management

- Based on Cognitive Behavioral Therapy & Meditation.
 - Mood Tracking
 - Relaxation Techniques
 - Thought Diary
 - Health Tracking
 - Daily Goals
 - Mood History



PillPack - Medication Reminders

- Prescriptions auto-populated from user demographics
- Taptic reminders for taking pills
- Custom medication schedules (“packs”)



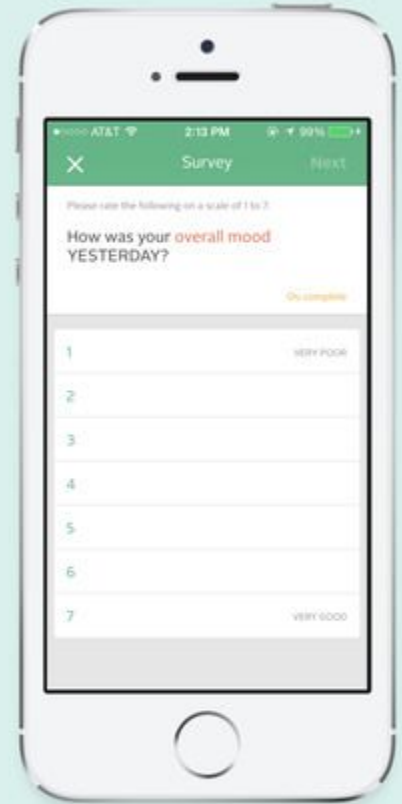
Kardia Mobile - ECG band for Apple Watch

- Apple Watch strap to take Electrocardiogram (EKG, ECG)
- Can record voice annotations
- Healthkit integration for longitudinal analysis



Ginger.io

- Used by providers
- Leverages smartphone data for behavioral analytics & alerts
- Enables more timely interventions



Wellframe – Clinical Tracking

- Payer-, provider-, pharma-driven
- Mobile app for health data collection
- Customizable, flexible clinical protocol



Activity Suggestions

Walk near East Ave
 1083 walks in 240 days. 20 mins of walk everyday.
 Each walk nearly 4 min.
 Let us get 20 mins or more walk here today.
 Each walk 16C 80C/d

Small walks each hour near Campus Rd
 Nearly 6 hours sedantary everyday.
 3 minute walking breaks each hour can give 18 minutes of walk here today.
 3min walk = 12C 64C/d

Exercise
 health club exercise classes
 123 times in 345 days. Daily nearly 63 cal lost.
 Keep up the good work
 Each time 179C 64C/d

Walk near Fall Creek Dr
 297 walks in 240 days. 8 mins of walk everyday.
 Each walk nearly 4 min.
 Let us get 8 mins or more walk here today.
 Each walk 16C 25C/d

Explore more suggestions

Walk near East Ave

Progress

Minutes walked per day

60 days ago 30 days ago Today

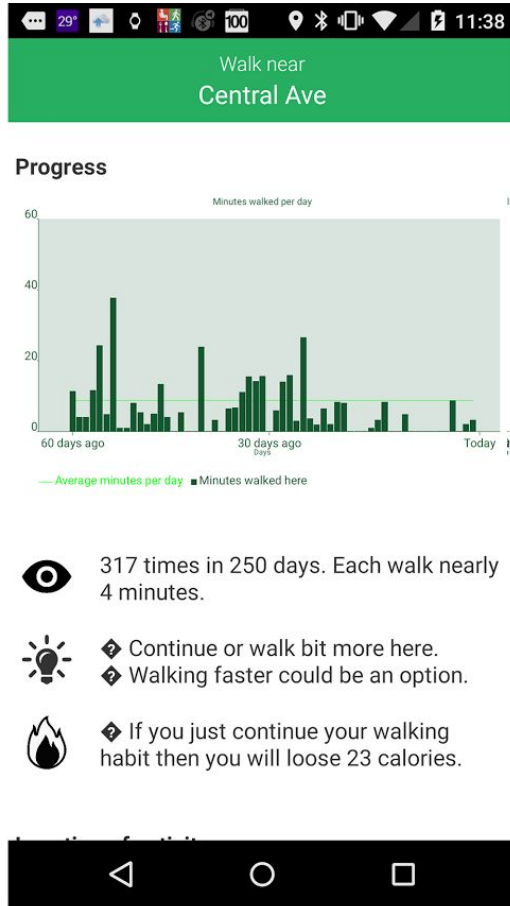
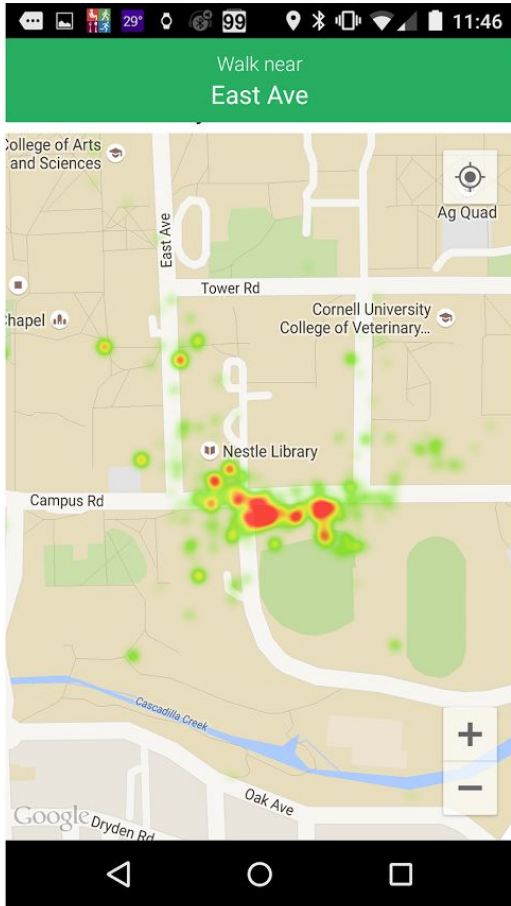
— Average minutes per day ■ Minutes walked here

1082 times in 240 days. Each walk nearly 4 minutes.

- Continue or walk bit more here.
- Walking faster could be an option.
- If you just continue your walking habit then you will loose 80 calories.

MyBehavior

Developed at Cornell



Few good meals from your past

970C 655C

Try to avoid the following foods

792C 614C 1139C 351C

A few healthy snacks

227C 122C 122C 20C
89C 65C

Lyra Health

- Raised \$35M, founded by Facebook CFO
- Surveys, provider matching, human care coord.
- Targeted towards large employers



Article

Cited By (2)

Tweetations (37)

Metrics

Original Paper

Utilizing a Personal Smartphone Custom App to Assess the Patient Health Questionnaire-9 (PHQ-9) Depressive Symptoms in Patients With Major Depressive Disorder

John Torous^{1,2}, MD ; Patrick Staples³, MS ; Meghan Shanahan², RN ; Charlie Lin⁴, MS ; Pamela Peck², PsyD ;

Matcheri Keshavan², MD ; Jukka-Pekka Onnela³, PhD 

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ABSTRACT

... of patient symptoms is critical for diagnosis and therapeutic



John Torous, MD

@JohnTorousMD



Following

We found patients report symptoms of [#depression](#) differently to an app than clinicians mental.jmir.org/2015/1/e8/

BlackboxPhD @BlackBoxPhD

Can smartphones be used to predict depression? ow.ly/Qmonf

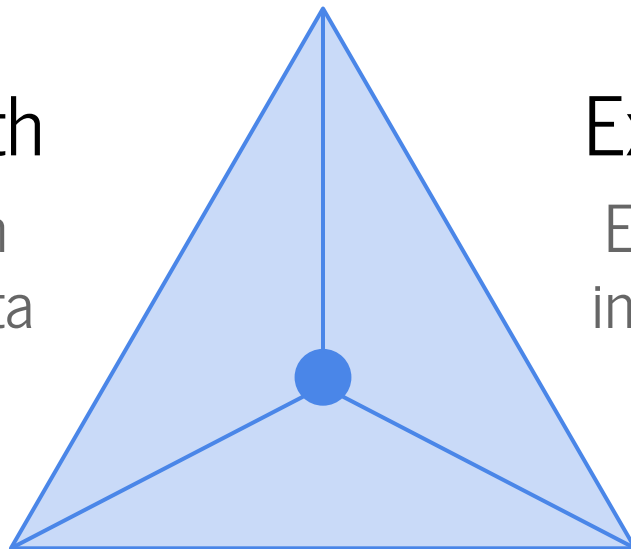
The “Triple Aim” of Health Reform

Population Health

Collection of health data enables big-data analytics

Experience of Care

Empowered, engaged, informed patients have better experiences



Per-Capita Cost

Reduction in person visits and earlier interventions bend the cost curve

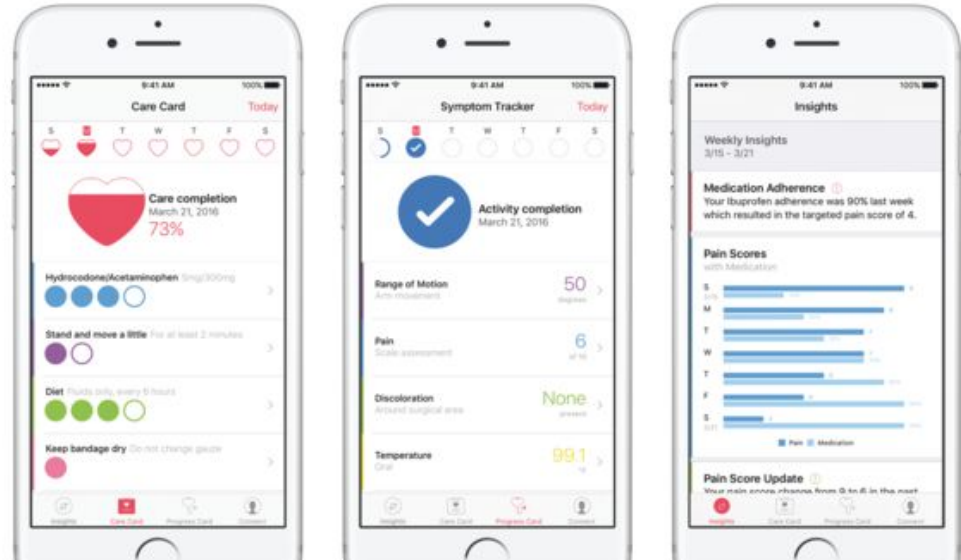
Apple CareKit



CareKit is a framework to build apps that empower people to take an active role in their care.

CareKit has four 'Modules'

- CareCard
- Symptom and Measurement Tracker
- Insight Dashboard
- Connect



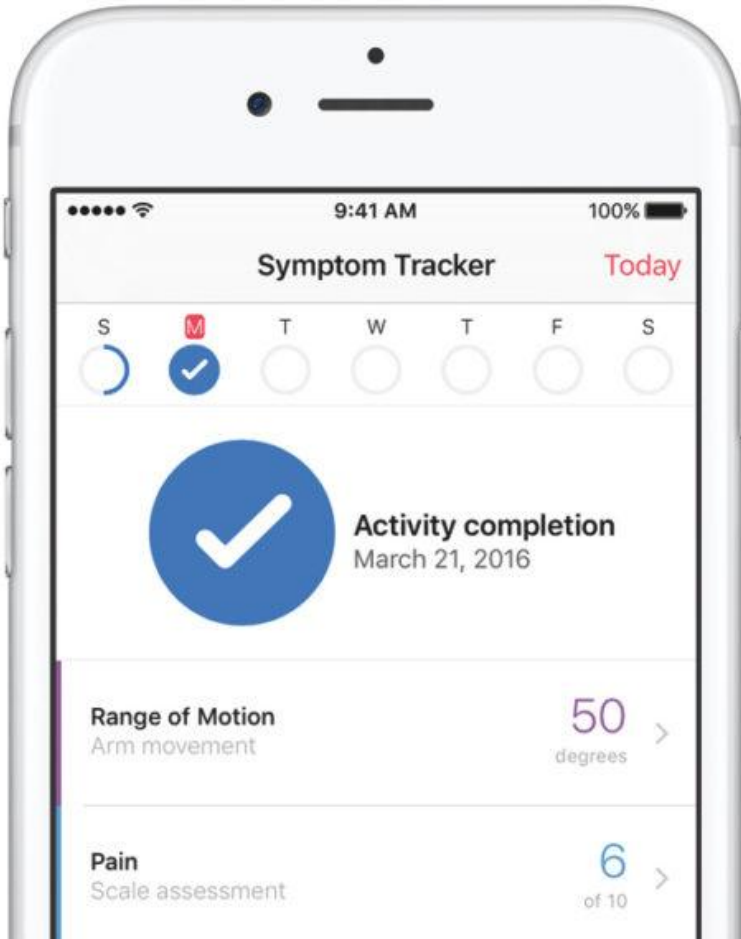
Care Card

- Manage Tasks
- Medications
- Changing Wound
- Meditation
- Nutrition

- iOS 10 will have HL7 CCD



Symptom & Measurement Tracker



- Manage Tx Plan
- Symptom Scales
- Objective Measures
 - PHQ-9

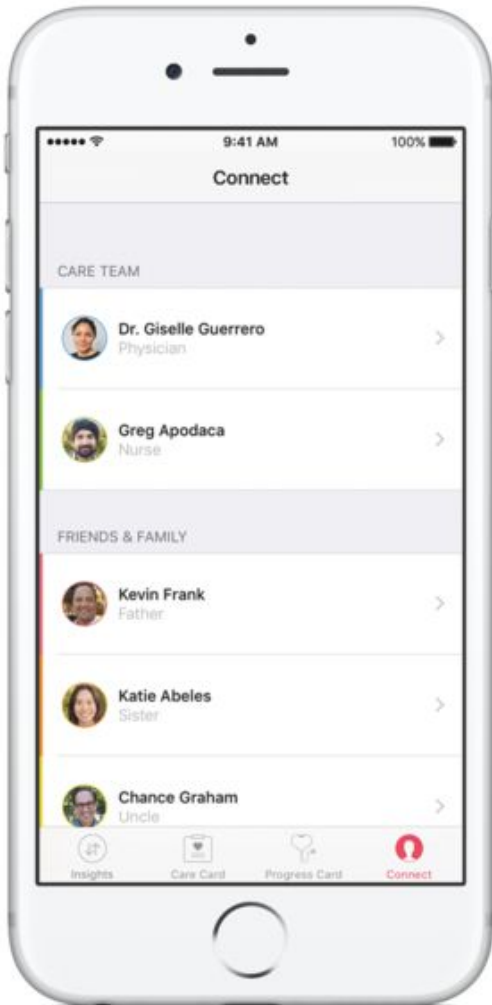
Insight Dashboard

- Treatment Progress Charts
- Text Reminders
- Goal Tracking



Connect

- Communicate Health Status
- Care Providers
- Family and Friends



These are the early days

- This is a snapshot
- Think creatively
- The future is wide open



Any Questions?

Jeremy Nelson - jeremy@afiahealth.com

