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Apple Report

https://www.technologyreview.com/s/527921/why-apple-wants-to-help-you-track-your-health/
June 9, 2014

Why Apple Wants to Help you Track Your Health

- The app Health (https://support.apple.com/en-ca/HT203037) was unveiled in June of 2014 at Apple's Worldwide Develops Conference in San Francisco
    - This is their first step into the world of tracking health data using phone apps
- Information on this app can be shared through a platform called HealthKit
- Apple's announcement came soon after Samsung announced a similar data-sharing platform and prototype of a wristband that tracks biometrics
- Similar efforts to compile health-care data including Google Health and Microsoft HealthVault did not have much success due to privacy concerns and because the benefits were not clear
- Apple is not taking the approach of mobile health monitoring which can also lead to sharing health data
- Mayo Clinic announced they are planning to upgrade their health app later in the year (in 2014) to match with the launch of Apple's HealthKit
- In terms of privacy – HealthKit gives users control by allows them to choose to share who they would like to share their health information with

https://support.apple.com/en-ca/HT203037

Health App

- collects health data from iPhone, Apple Watch, and other apps
- can monitor progress in 1 place
- Highlights 4 categories: Activity, sleep, mindfulness, and nutrition
    - Activity - Automatically tracks steps, walking and running distances
    - Sleep - Can track sleep with Bedtime in the Clock App on your phone
    - Mindfulness – Breathe app on Apple Watch
    - Nutrition – can help you track what you are eating and manage your goals through manual input or connecting it to third-party apps
- Can connect app with other health apps and choose categories that you want to track as well as control whether you want that other app to have access to your information from Health
- Can easily see your daily progress
- Can add your health records from other institutions onto your phone
    - This includes medications, immunizations, lab results etc.
    - Some hospitals and clinic support health records on the iPhone (https://support.apple.com/en-ca/HT208647)

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    - You can connect the app to these healthcare provider's website or apps so all of your medical and health information is on the Health app (https://support.apple.com/en-ca/HT208680)
- Can set up a Medical ID to access important medical information
    - Through the Health app you can enter your health information (allergies, emergency contact, medication etc) and set it so when a medical responder tries to unlock your phone and click "Emergency" and "Medical ID" all of your information pops up
- Health information is stored in iCloud and gets encrypted (hide personal information linked to health data)
    - But you can stop storing your Health data in iCloud if you do into the settings and turn it off

ResearchKit and CareKit
https://www.apple.com/ca/researchkit/

- ResearchKit = a tool that helps medical researchers gather health data from iPhone users
    - Is an open-source framework for building apps
    - Makes it easier to enroll participants and conduct studies
- Users can opt to share their medical data and for it to be used in meaningful studies
- The mPower app has grown to become the largest Parkinson's study in history
- The Autism & Beyond app – uses the front-facing HD camera in iPhone + innovative facial recognition algorithms to analyze emotional reactions to videos in children
    - Children can be screened without having to see a specialist in person – lead to earlier diagnosis and treatment
    - This app enrolled more people in the first month than a previous 9-month onsite study
    - https://itunes.apple.com/us/app/autism-beyond/id1025327516?mt=8&ls=1&v0=www-us-researchkit-itms-autism-beyond
- EpiWatch app – allow people to accurately track the onset and duration of seizures
    - Helping to create a correlation between episode history and medication
    - When users launch the app when they feel a seizure is about to occur, the accelerometer and heart rate sensors are triggered
    - An alert is also sent to a designated family member or caregiver
    - They hope that in the future, the Apple Watch and app can help to predict seizures
    - https://itunes.apple.com/us/app/epiwatch/id1047757228?mt=8&ls=1&v0=www-us-researchkit-itms-epiwatch
- Other apps created using ResearchKit:
    - Concussion Tracker app – monitors patients for 6 weeks after a head injury. Aims to better understand the long-term health consequences of concussions
        - https://itunes.apple.com/us/app/concussion-tracker/id1003284834?mt=8&ls=1&v0=www-us-researchkit-itms-concussion-tracker

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    - Mole Mapper app –by getting users to track moles over time, researchers hope to create an algorithm that can screen for melanomas
        - https://itunes.apple.com/us/app/mole-mapper-melanoma-study/id1048337814?mt=8&ls=1&v0=www-us-researchkit-itms-mole-mapper
    - Postpartum Depression ACT app – users mail in a DNA kit which helps researchers understand whether there is a genetic predisposition for PPD
        - https://itunes.apple.com/us/app/ppd-act/id1048185979?mt=8&ls=1&v0=www-us-researchkit-itms-ppd-act
    - SleepHealth app- aims to identify connections between sleep habits and conditions such as diabetes, heart disease, obesity, COPD, and depression
        - Tests daytime alertness and measures data against sleep patterns and sleep quality
- CareKit gives you tools to track your symptoms and medications and then share that information with your care team
    - Helps you better understand and manage your medical conditions
    - An open-source software framework that enables developers to build apps that help people manage their medical conditions
- Apps created using CareKit:
    - Corrie Health app – post-heart attack app
        - Using the Care Card module of CareKit, this app lets you track things like medications and physical activity
        - The MyVitals tab helps you track recovery
    - Caremap app – a pediatric care management app
        - Helps you track your child's daily symptoms
        - The Insight Dashboard module of CareKit can help you better understand patterns and relationships of symptoms
    - One Drop app – lets you incorporate CareKit modules to monitor your diabetes and how you are feeling
        - Tracks how you are feeling against glucose levels
        - https://itunes.apple.com/ca/app/one-drop-for-diabetes-management/id972238816?mt=8&ls=1&v0=www-ca-researchkit-itms-app-onedrop
- Many hospitals, medical institutions and foundations were consulted to develop ResearchKit and CareKit
    - So they can address both the needs of users and the challenges faced by medical researchers
    - Ex. Harvard Medical School, Keio University, Massachusetts General Hospital, American Heart Association, etc.
- Both ResearchKit and CareKit are open source so everyone can access the information and help to improve personal care and further medical research
    - Encourages everyone to collaborate and share their apps and methods

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https://splinternews.com/the-inside-story-of-how-apples-new-medical-research-pla-1793846479
March 17, 2015

- On September 27, 2013, Dr. Stephen Friend presented at Stanford's MedX conference and talked about the potential and value of having open-sourced genetic and medical information in a cloud network that people could easily access
    - Stephen Friend, is the head of Sage Bionetworks (http://sagebionetworks.org/bridge-platform/)
    - Sage Bionetworks believes in open since and data sharing
- Mike O'Reilly – vice president for medical technologies at Apple was in the audience that day
- After the presentation, O'Reilly approach Friend and asked to meet for coffee
- Fast forward about 18 months, in March of 2015, Apple unveiled ResearchKit – an open-source platform that aims to make it easier for scientists to build apps that collect health data for research studies from volunteers + 5 iPhone apps aimed collection more information on the most costly medical conditions in the world (breast cancer, heart disease, asthma, Parkinson's disease, and diabetes)
- A day later, thousands of people had already downloaded these apps
- The main idea behind ResearchKit was to use the iPhone to help researchers and scientists collect large amounts of clinical data
- Scientists can gather activity and biometric data on people who agreed to be part of research studies through features like the accelerometer, microphone, camera, and pressure sensors that are built into the iPhone
    - As well as other tools that can be connected to the iPhone like the FitBit, glucose monitors, or AliveCor's portable electrocardiogram recorder
- Cost of recruiting participants is basically zero
- Once Friend saw the potential benefits of collecting health data at Apple's scale, he made frequent trips to meet with scientists and engineers and on one trip, helped organize a DAEPA-funded workshop on how biosensors could help scientists understand Parkinson's disease
- Friend decided to work with Apple over Google or Facebook because the other two companies make money and power by selling data whereas Apple is a hardware manufacturer
- As the 5 apps for ResearchKit were being built, Apple was simply there as a facilitator, building the framework in the background → provided no input on the apps
- 3 months before the press event where ResearchKit and the Apple Watch were announced, Apple executives (alon with O'Reilly) met with the U.S. Food and Drug Administration
    - They met to let eh FDA know that they believe mobile technology platforms as a way for people to learn more about themselves and that there is an opportunity to do so with more mobile devices

https://www.technologyreview.com/s/536846/apple-and-ibms-plan-to-make-smarter-health-tracking-iphone-apps/

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April 22, 2015

Apple and IBM's Plan to Make Smarter Health-Tracking iPhone Apps

- HealthKit is an app that allows users to track and share their health records data
    - Collects health data from a person's Apple gadgets
    - It can be integrated into health and fitness apps for iOS and watchOS
    - When customers give consent, for Apple's Health app to access their data, the app becomes a valuable data source
    - https://developer.apple.com/healthkit/
- Some hospitals and electronic medical records companies have already begun using HealthKit to add detail to patient files
- Apple and IBM are now working together to help health-care providers make sense ofo data from the app and offer advice to patients
- IBM created a new online service called Watson Health Cloud (https://www.ibm.com/watson/health/) that analyzes data from HealthKit
    - Helps companies find useful patterns in data called via HealthKit and build tools that offer personalized medical advice based on the data
    - Ex. compare data from one user's phone against a data set of anonymized records
- No Apple executive was available to comment at the time this article was published
- HealthKit was announced in June 2014 and became available via an update to Apple's mobile operating system in September of 2014
- IBM struck a deal last year to sell Apple's hardware, software, and compatible apps to businesses
- Collaboration with IBM is Apple's first publicly announced HealthKit partnership focused purely on analyzing HealthKit data
    - Watson Health Cloud is also designed to be compatible with ResearchKit – Apple software platform that lets medical researchers collect data via iPhoens

https://www.technologyreview.com/s/537081/apple-has-plans-for-your-dna/

May 5, 2015

- Apple is working with U.S. researchers to launch apps that would offer iPhone users to chance to get their DNA tested
- Apps are based on ResearchKit – a software platform Apple introduced in March that helps hospitals and scientists run medical studies on iPhone by collecting data from the phone's sensors or through surveys
- **mPower – A ResearchKit that tracks symptoms of Parkinson's disease
    - Apple recruited thousands of participants in a few days
    - https://parkinsonmpower.org/your-story
- To join Apple's studies, a person agrees to have a gene test carried out and returning the kit to a laboratory approved by Apple
- An Apple representative said the company's aim is to allow users to show and share their DNA information with others

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- Starting in 2014, Apple has been taking steps to enter the digital health word → they introduced the Health app which has fields for more than 70 types of health data
    - They also entered a partnership with IBM to develop health apps for nurses and hospitals and mine medical data
- Stephen Friend is heading the ResearchKit program
    - However, he declined an interview

** https://parkinsonmpower.org/your-story

- mPower is a free, 2 year mobile research study developed by Sage Bionetworks
- The app allows you to track your symptoms and triggers and how they relate to your medication
- You can also track your physical and cognitive activities and see changes over time
- This can be presented to doctors and caregivers to help them understand your state
- The information that is inputted helps both the users and the Sage Bionetworks team to understand unique patterns and symptoms and understand the disease more
- Do not have to have Parkinson's Disease to join the study
- Just need to be over 18 years old, live in the U.S., and have a mobile phone
- Steps:
    - 1) Confirm eligibility and do through an informed consent process
    - 2) Download the mPower app for free from the apple store
    - 3) You will receive notices and text messages on your phone every 3 months asking you to complete daily activities
        - Activities will be span for 2 weeks and include exercises such as finger tapping and cognitive games
    - 4) Track medication and other factors

https://government.diginomica.com/2019/01/04/is-your-fitbit-or-apple-watch-data-being-used-for-less-than-healthy-means/
May 6, 2015

- Some researchers are concerned about the accuracy of research in gathering samples because of the bias in depending on subjects with iPhones
- ResearchKit could allow doctors and researchers to share data, thus eliminating the need for subject to give their saliva samples over and over again

https://www.dailymail.co.uk/sciencetech/article-3072423/Apple-s-designs-DNA-iPhone-owners-asked-groundbreaking-genetic-research-projects.html
May 7, 2015

- Apple is involved in 2 studies that collect DNA with research groups at the University of California, San Francisco, and Mount Sinai Hospital in New York
    - Apple however refused to comment on the reports
    - Insiders however have said that the company's goal is to allow individuals to share their DNA information with different people

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- Apple has made a statement saying they will not see data from ResarchKit projects
    - Instead, data will be anonymized and held by the researchers
- There is a risk that pharmaceutical companies will create apps to allow them to gather personal information about iPhone users for their own benefit

https://www.apple.com/newsroom/2016/03/21Apple-Announces-Advancements-to-ResearchKit/

- Researchers are continually working on ResearchKit and trying to build on the framework by creating new modules that bring exam room medical tests to iPhone apps
    - Recent addition: the ability to study tone audiometry, measure reaction time, assess speed of information processing and working memory, a timed walk test
- ResearchKit studies are now available in Australia, Austria, China, Germany, HK, Ireland, Japan, Netherlands, Switzerland, the UK, and the US
- ResearchKit apps are available on the App Store for iPhone 5 and later + latest generation of iPod touch

https://med.stanford.edu/news/all-news/2016/03/genetic-research-now-integrated-into-myheart-counts-app.html

Genetic Research now integrated into myHeart Counts app on iPhone

March 24, 2016

- Stanford Medicine and 23andMe have collaborated to add anew module to Stanford's free myHeart Counts app that runs on the iPhone
- 23andMe customers can use the module to share their de-identified genetic data with MyHeart Counts researchers
- MyHeart Counts – a mobile health apps launched on Apple's ResarchKit platform in March 2015
    - Allows users to monitor their own cardiovascular health and share their heart and activity data with researchers at Stanford
    - Data submitted by users to forwarded to a secure server where each person's name is replaced with a random code
    - Coded and encrypted data is them used for research
    - So far, 50,000 people in the US, Hong Kong, and the UK have joined the study
- Their digital consent form allows users to decide what kind of data to share and this choice can be changed later on
    - First time that consent for secure sharing of genetic data has been done on a phone
- The genetic data they receive from 23andMe customers will allow Stanford researchers to study the interaction of genetic variation, activity levels, fitness, and cardiovascular health to better understand what keeps the heart healthy
- The new 23andMe plug-in will also work with Mount Sinai's Asthma Health app which is also on Apple's ResearchKit platform
- The first 3 apps that will begin incorporating genetic data PPD Act (use genetic data to explore why some people experience postpartum depression, MyHeartCounts app, and

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Asthma Health app (use genetic data to better understand ways to personalize asthma treatment)
- https://www.healthcareitnews.com/news/apple-aligns-23andme-pull-genetic-data-researchkit

https://9to5mac.com/2016/04/04/genetics-in-researchkit-23andme/
23andMe using ResearchKit for new genetic research module
April 4, 2016
- At the same time Apple revealed CareKit, they announced that researchers can now integrate genetics into their ResearchKit apps with a new 23andMe module
  - Researchers who are using the ResearchKit platform can allow 23andMe customers to contribute their data to a study → collect genetic data through their studies
  - Researchers can also offer genotyping services to their study participants through 23andMe
- Once participants agree to share their genetic data, the researchers can access the information via the 23andMe API
- Users can disconnect from an app in their 23andMe settings at any time to stop sharing additional data
- Any study that uses the 23andMe ResearchKit module must hae their study approved by an institutional Review Board

https://www.cbinsights.com/research/report/apple-strategy/
Apple's ResearchKit generates reliable health data from asthma patients
March 13, 2017
- Researchers from Mount Sinai Hospital found that Apple's ResearchKit platform and an app for asthma were fairly accurate when compared to existing patient studies
- An article published in Nature Biotechnology about the asthma mobile app and ResarchKit suggest health care apps may be reliable
  - https://www.nature.com/articles/nbt.3826

https://www.cnbc.com/2018/01/30/apple-will-finally-replace-the-fax-machine-in-health-care-commentary.html
January 30, 2018
- SMART is an interface to make doctors' electronic health records work like iPhones do
  - Apps can be added or deleted easily
- Apple uses SMART to connect the health app to hospitals and doctor's offices
- Since it is an open connection, any other app can use the same interface to connect
- Apple seems to be competing on value and customer satisfaction over a lock on the data

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https://www.telegraph.co.uk/technology/2018/02/26/apple-spying-fears-icloud-data-moved-china/

Apple spying fears as iCloud data moved to China

February 26, 2018

- Apple is giving Chinese authorities greater access over customers' iCloud accounts to comply with new laws in China
- New law requires cloud services offered to Chinese citizens to be operated by Chinese companies and that the data be stored in China
- Chinese authorities will no longer have to use the US courts to seek information on iCloud users
    - Instead can use their own legal system to ask Apple to hand over iCloud data for Chinese users
- Apple said that they have to comply with each country's laws
- They have established a data center for Chinese users in a contractual arrangement with state-owned firm Guizhou – Cloud Big Data Industry Co Ltd.
    - A firm set up and funded by the provincial government
    - They have close ties to the Chinese government and the Chinese Communist Party

https://www.theguardian.com/technology/2018/feb/27/apple-launching-technology-enabled-healthcare-service

Apple to launch 'technology enabled' healthcare service

February 27, 2018

- Apple is launching its own primary care health clinics called AC Wellness
    - Aims to serve Apple's roster of employees and their families
- 2 healthcare centers are planned to open
    - In Santa Clara County, California
- The centers will be 'enabled by technology'
- Apple did not immediately comment

https://techcrunch.com/2018/06/04/apple-is-introducing-a-health-record-api-for-developers-this-fall/

June 2018

- Apple states that when consumers share their health record with trusted apps, the data flows directly from HealthKit to the third-part app and dis not sent to Apple's servers

https://www.wareable.com/apple/how-to-use-apple-health-iphone-fitness-app-960

How to Use Apple Health

August 16, 2018

- Apple has continually updated the Health App since its launch in 2014
- Don't need to wear wearable technology → iPhone can retrieve data using its motion sensors and GPS

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- HealthKit allows third-party apps to contribute metric to Apple Health
- The Activity Section will give you a snap shot of your day as well as a snapshot of your entire year
- Apple Watch doesn't include a sleep tracking feature yet but it is thought to arrive in the next update
- The Health app also provides a recommended list of apps for each of the4 categories
- You can add and delete data from Health

http://researchkit.org/blog.html#article-14
ResearchKit 2.0 Stable Release
September 14, 2018

- In early September 2018 the improved ResearchKit became available on Github
- Now includes support for over 40 languages

https://www.cnn.com/2018/12/06/health/apple-watch-ecg-app-review/index.html
December 8, 2018

- Apple ambition is for Apple and health to become as closely linked as Apple and music
    - Commercial promoting this new ambition: https://www.youtube.com/watch?v=N-x8Ik9G5Dg
- Apple's new ECG app uses electrodes built into the crystal on the back of the watch
- It is a single-lead ECG with limited capabilities
    - It can't reliably detect electrical changes associated with a heart attack
    - Won't help detect most heart rhythm abnormalities or worsening heart failure
- Apple recognizes this and cautions users against overinterpreting the results
- It can however help detect a condition known as atrial fibrillation (this is often hard to conclusively diagnose since symptoms can dissipate before patients get to a doctor)
- How it works: open the app, touch the digital crown with a free hand, after 30 seconds, iPhone will alert you that your ECG is available to review → description of the finding will also pop up (tells you if you are in a sinus rhythm which is normal, abnormal atrial fibrillation, if your heart rate is abnormally low or high, or if the test is inconclusive)
- In one study, Apple tested the app on nearly 600 people – half had atrial fibrillation and half did not
    - 12% of the time, the result was inconclusive
    - App was able to accurately tell people they did not have a-fib 99.6% of the time and that they did have a-fib 98% of the time
- The ECG feature is cleared but not approved by the FDA
    - To be approved, more rigorous testing and data collection is needed
- The FDA suggests only adults use the app and that it is not for people who have been diagnosed with a-fib who should be under a doctor's care
- ECG data is stored only on the phone but you can choose to share it

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- They have made it easy for users to share their ECG with their doctor uising the app

https://www.cnbc.com/2018/10/14/apple-is-donating-1000-watches-for-a-new-study-to-track-binge-eating.html
Apple is donating 1000 watches for a new study to track binge eating
October 14, 2018

- Apple is donating 1000 watches to help in a study called BEGIN (Binge Eating Genetics Initiative) that aims to better understand overeating
    - Ran by the University of North Carolina's medical school
- Participants 18 years or older will get a free watch and sign up with a mobile app called Recovery Record where they log their thoughts and feelings and share this information with their doctor
    - Their heart rate will also be monitored using the device's sensor
- They are trying to see if binge eating has a biological and behavioral signature
- An apple spokesperson has declined to comment
- Participants who enroll will also receive tests to analyze their genetics and bodily bacteria so researchers can better understand the root causes of the disease
    - A startup called UBiome is sending free at-home testing kits to participants
-

http://fortune.com/2018/12/17/review-apple-watch-series-4/
Apple Watch Series 4
December 17, 2018

- Announced in September 2018
- The new Apple Watch can measure your heart beat using a FDA-cleared electrocardiogram app
- New watch also has the computing power to run real apps and work well without a linked phone
- Added features:
    - Automatically remind user if they start exercising without tracking it on the watch
    - Can track different swimming strokes (can tell apart breast stroke from free style)
    - Fall detection
- In previous models, some apps disappeared since the watch's slower processor made it difficult for users to use them

https://government.diginomica.com/2019/01/04/is-your-fitbit-or-apple-watch-data-being-used-for-less-than-healthy-means/
January 4, 2019

- There is privacy concern around healthcare data that is collected using smart devices → may not be protected as much as they think
    - Even if information is encrypted, someone could put it all back together if they had the right kind of information

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- Many groups, such as tech companies are not covered by HIPAA
    - Only very specific information is not allowed to be shared by HIPAA rules
- DeepMind is currently being questioned by UK legislators as to why they are transferring control of Streams (a digital health app it developed using NHS identifiable patient data) over to Google
    - Their explanation is that this will open up global reach for the apps
    - Legislators are worried that this transfer means that the app now falls outside the scope of an independent review panel set up to monitor DeepMind's handling of patient data

https://www.cbinsights.com/research/report/apple-strategy/

- There are almost 1 million iPhone users
- Apple acquired Gliimpse – a company that offers a personal health data platform that allows users to collect, personalize, and share a picture of their health data
- Apple also has a partnership with Health Gorilla – a provider in digital health
    - They connect doctors, vendors, and patients within a single secure interface
    - Health Gorilla automates lab results, referrals, and test results for physicians and medical facilities thereby improving communication
- The company's partnership with American Well and its existing telemedicine patents suggest that Apple is also looking to be involved in connecting patients to care
- They also reportedly considered buying corporate clinic startup Crossover Health, but instead built their own clinics
- Compared to other tech giants, Apple also has a sizeable health-related patent portfolio

https://www.yourgenome.org/stories/personal-genomics-the-future-of-healthcare

- Steve Jobs was one of the first 20 people in the world to have his DNA sequenced – paid $100,000
    - Also had the DNA of his cancer sequenced in hopes it would provide more information about appropriate treatments for him and others with the same cancer