

# Digital Research Day

Research & iPhone

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# Why choose iPhone for Research?

**Apple provides tools and frameworks for the iPhone that accelerate the development of health & research-related mobile apps with the goal to make it cheaper & faster to develop, and easier to recruit participants for studies.**

# What are the tools?



## HealthKit

The main purpose is to collect data (demographic, steps, heart rate, etc) from multiple sources into one central place.



## ResearchKit

The main purpose is to capture surveys, consent, and perform active tasks to capture data for the research.



## CareKit

The main purpose is to allow users to better understand their health by creating & tracking care plans, medications adherence, and sharing that information with their care team.



# HealthKit Overview

- The main purpose is to collect data (steps, heart rate, etc) from multiple sources into one central place.
- The user (not the app) has full control over what data point has read or write access.
- HealthKit manages, sorts, and analyzes data so you don't have to. For example, HealthKit will analyze and merge overlapping step data of a user who owns an Apple Watch, an iPhone, and a Jawbone device so you do not have to worry about doing so while analyzing and studying the data.
- HealthKit supports a wide array of data types and is around 3.5 years old. The age of HealthKit is important since users who have been the iPhone during that time will have a large data set that can be used for research.



# ResearchKit Overview

- **The main purpose is to capture surveys, consent, and perform active tasks to capture data for the research.**
- ResearchKit also comes with pre-built tasks that the user can be asked to perform as part of the survey or as a stand alone exercise.
- Tasks utilize the different sensors of the iPhone like the accelerometers, gyroscope, GPS, microphone, and/or display to collect data from the user to be used for research.



# ResearchKit Overview

Carrier 3:30 PM

< Cancel

## Review

Review the form below, and tap Agree if you're ready to continue.

### Demo Consent

#### Welcome

- Lorem
- ipsum
- dolor

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Disagree Agree

Carrier 3:30 PM

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## Consent

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First Name Required

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Last Name Required

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Next

Carrier 3:31 PM

< Cancel

## Signature

Please sign using your finger on the line below.



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Clear

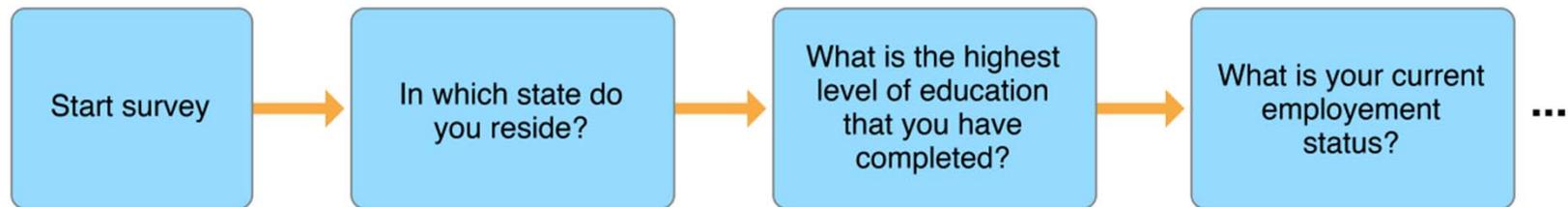
Done

Example of Review and Consent workflow

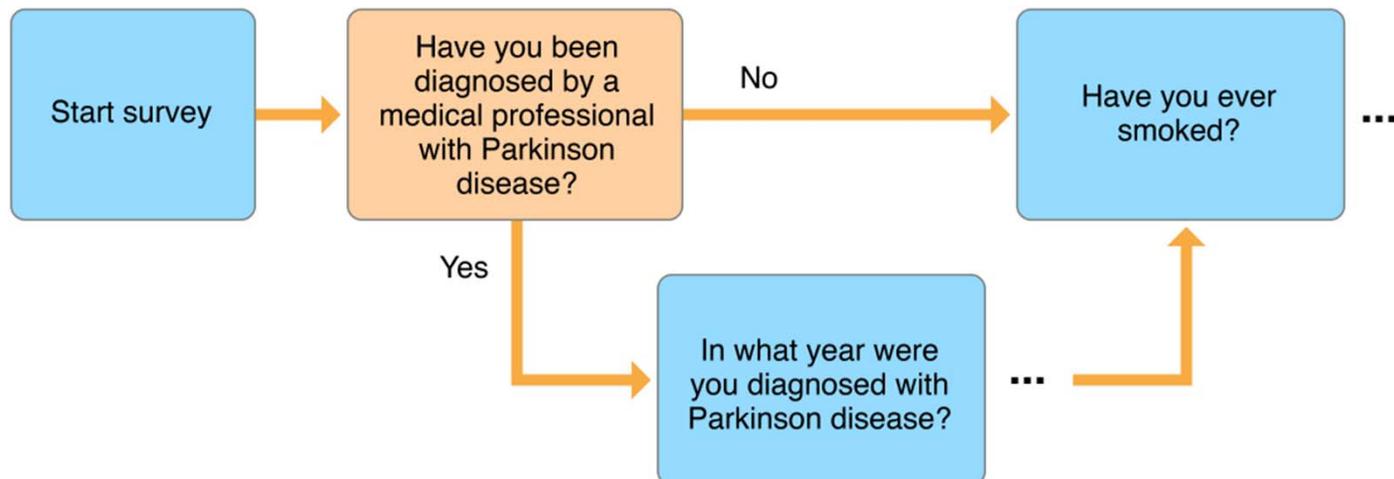


# ResearchKit Overview

With ResearchKit, your survey can follow an ordered pattern where the next question does not depend on the previous answer...

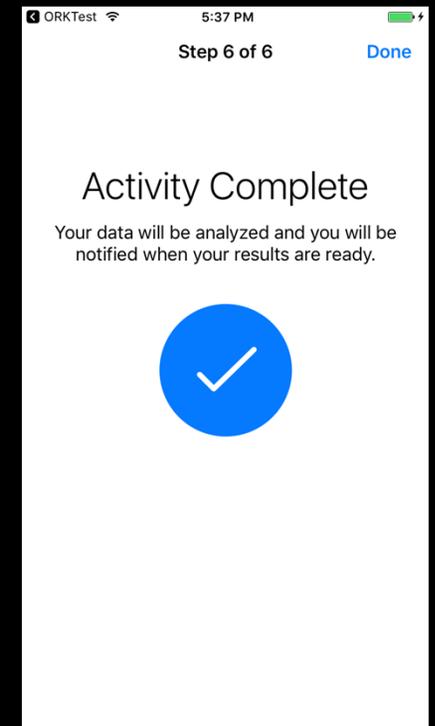
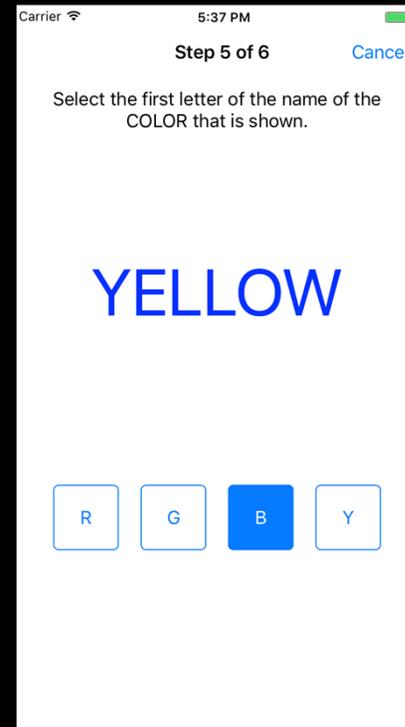
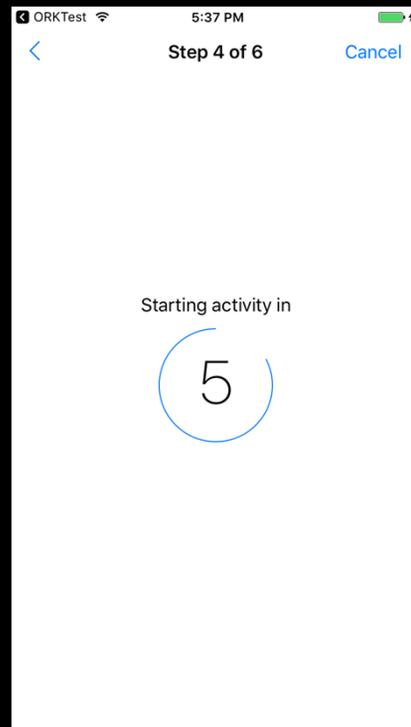
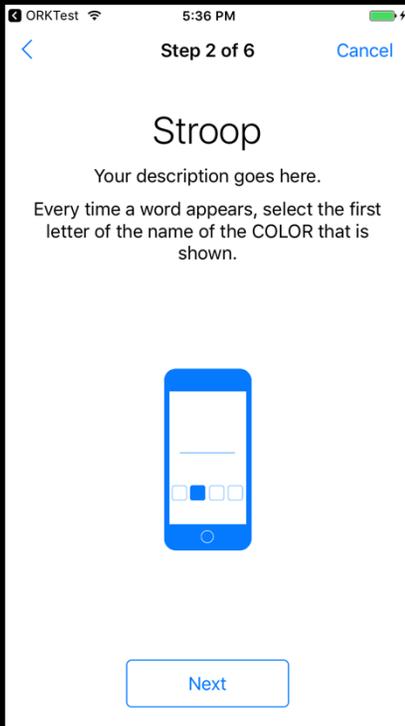


... but it also supports routing based on the user answer





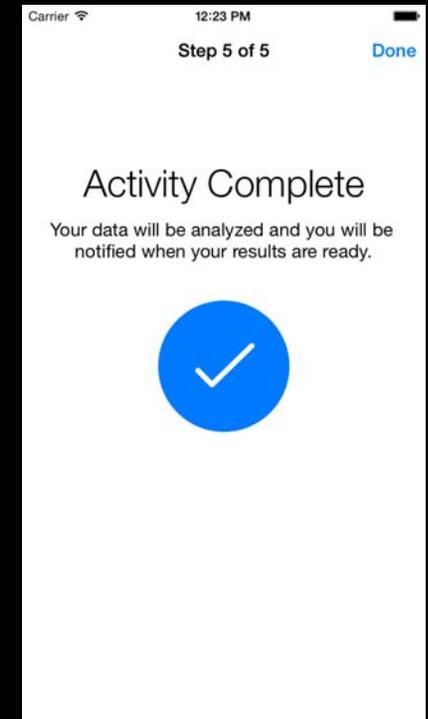
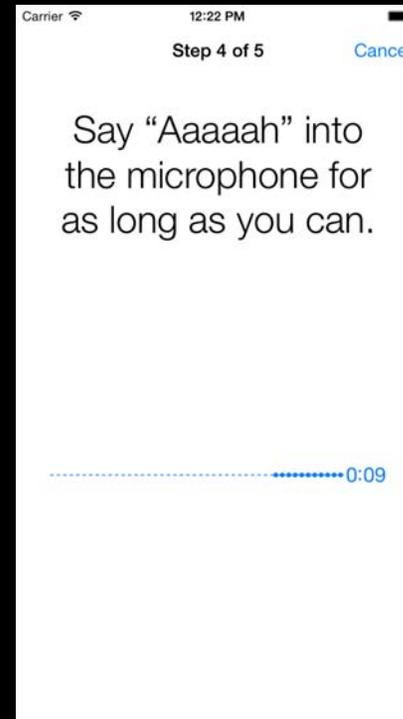
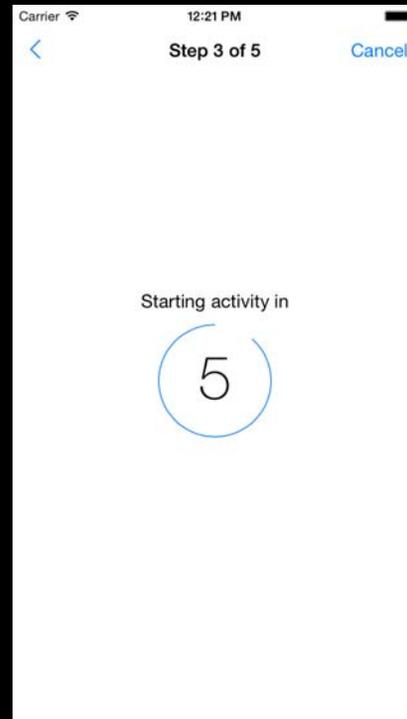
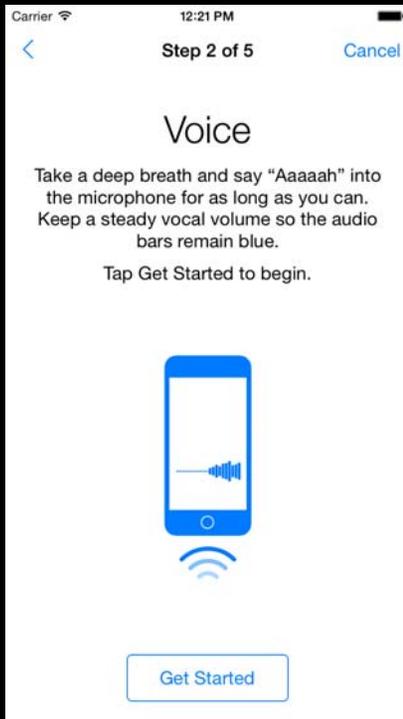
# ResearchKit Overview



Example of a cognitive Stroop test



# ResearchKit Overview



Example of a voice Sustained Phonation test



# ResearchKit Overview

ResearchKit also speeds up the development process when research needs to be done on an international scale by providing support for multiple languages like Arabic, Spanish, French, Simplified Chinese and more.

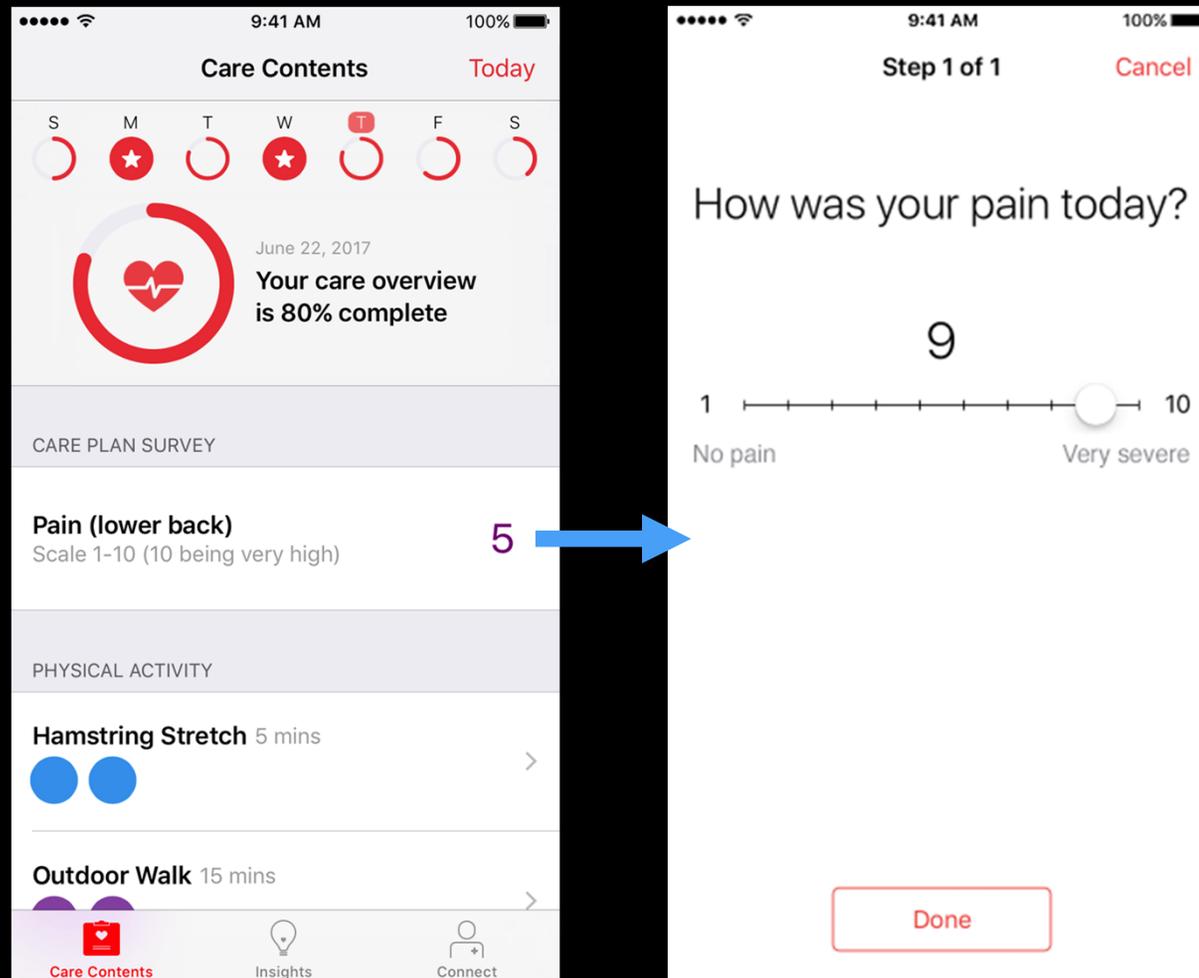
Custom text/terminology that you add into your research still needs to be localized, however.



**The main purpose is to allow users to better understand their health by creating & tracking care plans, medication adherence, tracking symptoms, and sharing that information with their care team by generating PDFs reports.**

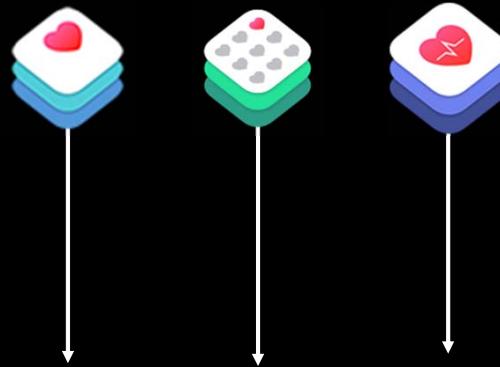
- CareKit, like ResearchKit, provide a set of pre-built user interface elements and localization that would speed up the development of the application.
- CareKit can be used together with ResearchKit so that users are asked to routinely perform a ResearchKit task like the Stroop test or take a survey.
- CareKit provides value to the user so that they continue to be engaged in the app and study.

# CareKit + ResearchKit

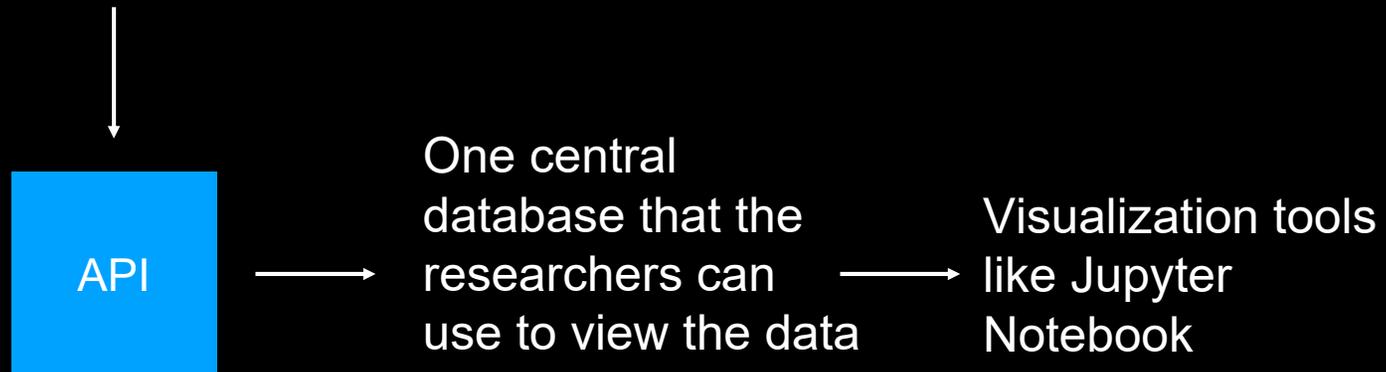


Example of CareKit (left) presenting a reoccurring ResearchKit survey to the user (right)

# How do you get your data?



Data from ResearchKit, CareKit, and HealthKit



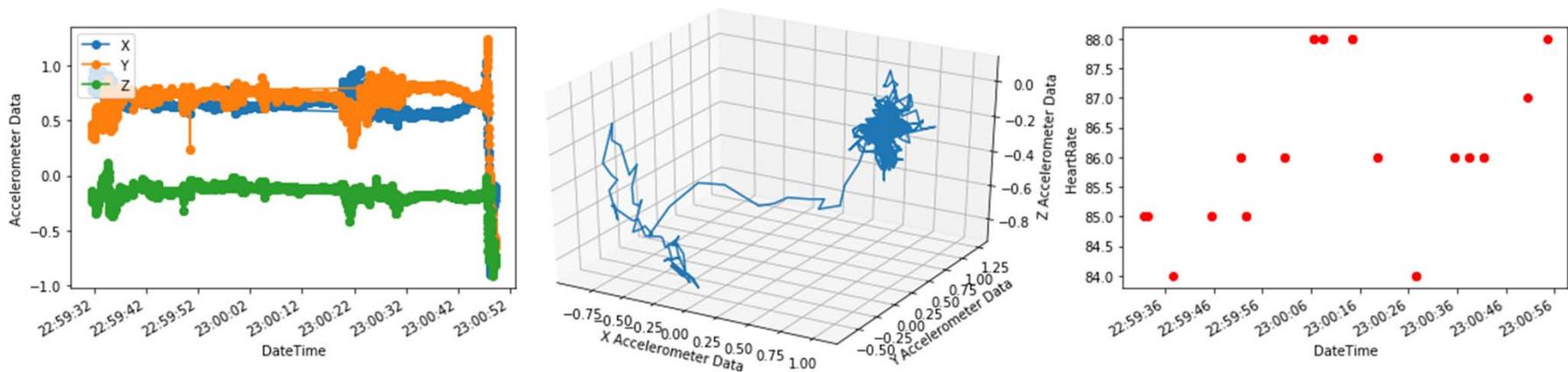
# Example: EpiWatch

EpiWatch is an iPhone/Apple Watch app with the goal of tracking epilepsy seizures and tracking treatment.

- EpiWatch uses both the iPhone and Apple Watch to collect sensor data that the HealthKit saves about the user.
- Utilizing ResearchKit surveys, the iPhone client then asks the user to take an initial survey that collects demographic information about the user.
- The app then asks the user to take a daily survey that records the users medication adherence and any seizure that the user might have experienced.

# Example: EpiWatch

- Utilizing HealthKit, the Apple Watch client can record information about the users heart rate and what the accelerometer is reporting about the users arm movement.
- All that data is then collected and sent to an API/database created by the TIC that researchers have access to.
- Jupyter hub help researchers visualize key data:



Accelerometer data visualized (left/middle) and heart rate over a specific time range

# More Info



## HealthKit

<https://developer.apple.com/healthkit/>



## ResearchKit

<https://developer.apple.com/researchkit/>



## CareKit

<http://carekit.org>



## EpiWatch

<https://epiwatch.jh.edu>



## TIC

[https://www.hopkinsmedicine.org/technology\\_innovation/index.html](https://www.hopkinsmedicine.org/technology_innovation/index.html)