Advances in Research and Care Frameworks

Session 205

Srinath Tupil Muralidharan, Health Engineer
Gabriel Blanco, Core Motion Engineer
Akshay Yadav, Health Engineer
What's New in CareKit and ResearchKit

Connecting CareKit to the Cloud

WWDC 2017
What's New in CareKit and ResearchKit

Connecting CareKit to the Cloud
Penn Life Gained
Bariatric Surgery Apps
<table>
<thead>
<tr>
<th>Active Patients</th>
<th>Inactive Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>MWM (3)</td>
<td></td>
</tr>
<tr>
<td>Pre-Operative</td>
<td>Surgery (1)</td>
</tr>
<tr>
<td>2 Weeks (0)</td>
<td></td>
</tr>
<tr>
<td>Surgery (1)</td>
<td></td>
</tr>
<tr>
<td>Post-Operative</td>
<td></td>
</tr>
<tr>
<td>30 Days (5)</td>
<td></td>
</tr>
<tr>
<td>Post-Op Long Term (0)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Surgeon</th>
<th>Days Post-Op</th>
<th>Last Weight</th>
<th>Date of Weight</th>
<th>7 Day Calories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peters, Patty</td>
<td>Noel N. Williams, MD</td>
<td>12</td>
<td>251 lb</td>
<td>10/3/17</td>
<td>383</td>
</tr>
<tr>
<td>Plant, Robert A</td>
<td>Daniel T. Dempsey, MD</td>
<td>6</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Ticket 115,</td>
<td>Daniel T. Dempsey, MD</td>
<td>8</td>
<td>67 lb</td>
<td>9/25/17</td>
<td>--</td>
</tr>
<tr>
<td>Patient A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ticket 127,</td>
<td>Daniel T. Dempsey, MD</td>
<td>6</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Patient A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Health Frameworks

ResearchKit

CareKit

HealthKit
Research and Care

ResearchKit updates
Research and Care

ResearchKit updates

Movement Disorder API
Research and Care

ResearchKit updates

Movement Disorder API

Demo
ResearchKit Updates
Community
ResearchKit Updates
UI improvements
ResearchKit Updates
UI improvements
ResearchKit Updates
Active tasks
ResearchKit Updates
Active tasks
Community Updates
Repository Privileges

Expanded GitHub privileges
• Direct write access to the repository
• Merge in PRs

Community Members
• Erin, Fernando, Nino, Ricardo, and Shannon
Release Schedule Updates

Release → Master

Stable
UI Updates
### Mini Form

Mini form groups multi-entry in one page

<table>
<thead>
<tr>
<th>BASIC INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Type: B+</td>
</tr>
<tr>
<td>Date of Birth: 2/28/1989</td>
</tr>
<tr>
<td>Weight: 165 lb</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DO YOU HAVE A HEADACHE?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WHICH FRUIT DO YOU LIKE MOST? PLEASE PICK ONE FROM BELOW.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple</td>
</tr>
</tbody>
</table>
Mini Form

Basic Information

Blood Type: B+
Date of Birth: 2/28/1989
Weight: 165 lb

Do you have a headache?
- Yes
- No

Which fruit do you like most? Please pick one from below.
- Apple

ResearchKit 1.5
Mini Form

ResearchKit 2.0
Mini Form
Mini Form

Mini form groups multi-entry in one page

Basic Information

Blood Type  B+
Date of Birth  2/28/1989
Weight  165 lb

Do you have a headache?

Yes  No  Unsure
Mini Form

Mini form groups multi-entry in one page

Basic Information

Blood Type  B+

Date of Birth  2/28/1989

Weight  165 lb

Do you have a headache?

Yes
Mini Form

Mini form groups multi-entry in one page

Basic Information

Blood Type  B+
Date of Birth  2/28/1989
Weight  165 lb

Do you have a headache?

Yes

No
Mini Form

Mini form groups multi-entry in one page

Basic Information

Blood Type   B+

Date of Birth  2/28/1989

Weight  165 lb

Do you have a headache?

Yes

No
Mini Form

Mini form groups multi-entry in one page

Basic Information

Blood Type  B+

Date of Birth  2/28/1989

Weight  165 lb

Do you have a headache?

Yes
No

Navigation Item

Large Titles
Mini Form

Mini form groups multi-entry in one page

**Basic Information**

- **Blood Type**: B+
- **Date of Birth**: 2/28/1989
- **Weight**: 165 lb

**Do you have a headache?**
## Basic Information

<table>
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<th>B+</th>
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</tr>
<tr>
<td>Weight</td>
<td>165 lb</td>
</tr>
</tbody>
</table>

Do you have a headache?

- [ ] Yes
- [ ] No
Mini Form

Mini form groups multi-entry in one page

**Basic Information**

- **Blood Type**: B+
- **Date of Birth**: 2/28/1989
- **Weight**: 165 lb

**Do you have a headache?**
Blood Type  B+

Date of Birth  2/28/1989

Weight  165 lb

Do you have a headache?

Yes

No

Next

Skip  Cancel
Do you have a headache?

Yes

No

Next

Skip

Cancel
Blood Type  B+
Date of Birth  2/28/1989
Weight        165 lb

Do you have a headache?

Yes  

No

Next
Consent Document

INFORMED CONSENT DOCUMENT

TITLE: Apple Heart Study: Assessment of Watch-Based Photoplethysmography to Identify Cardiac Arrhythmias

PROTOCOL: Apple Heart Study

SPONSOR: Apple Inc.

INVESTIGATORS: Nuno Turcato, MD, MA, and Marco Peral, MD

24 HR. TELEPHONE: 1-844-405-1609

INTRODUCTION

This consent document describes the purpose, procedures and risks associated with participating in the study. You also describe your right to withdraw from the study at any time. Before agreeing to participate in this research study, it is important that you take the time necessary to read and understand this informed consent document with the explanation of the proposed study. Your participation in this study is completely voluntary.

BACKGROUND AND PURPOSE

You are being asked to participate in this research study because you are an adult 20 years of age or older, reside in the United States, use an Apple Watch Series 1 or later with a heart rate sensor, and have downloaded and installed the Apple Heart Study App on your iPhone and Apple Watch.

The purpose of this research study is to evaluate if the Apple Heart Study App can identify irregular heart rhythms. The Apple Heart Study App is a mobile medical app developed by Apple Inc. that analyzes heart rate data and can detect certain abnormalities, including, but not limited to, atrial fibrillation (AF). A sustained heart rhythm abnormality is identified by the Apple Heart Study App, and you will receive a notification on your Apple Watch and within the Apple Heart Study App on your iPhone. This study is not to provide any treatment, but rather to collect information for research purposes.

NUMBER OF SUBJECTS / LENGTH OF PARTICIPATION

Approximately 500,000 participants may participate in this study. Your participation in this study is completely voluntary and will last for 90 days. You will be notified if you are selected to participate in the study. The length of participation will be determined by eligibility and other factors.

DONE
INFORMED CONSENT DOCUMENT

TITLE: Apple Heart Study: Assessment of Wristwatch-Based Photoplethysmography to Identify Cardiac Arrhythmias

PROTOCOL NUMBER: Apple Heart Study

SPONSOR: Apple Inc.

INVESTIGATORS: Mintu Turakhia, MD, MAS and Marco Perez, MD

24 HR TELEPHONE: #1-844-606-1909

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BACKGROUND AND PURPOSE

You are being asked to participate in this research study because you are an adult 22 years of age or older, reside in the United States, use an Apple Watch (Series 1 or later with watchOS 4.0 or later) paired to an iPhone (5s or later with iOS 11.0 or later), are comfortable understanding, reading, writing, and speaking in English while using your Apple Watch and iPhone, and have downloaded and installed Apple Heart Study App on your iPhone and Apple Watch.

The purpose of this research study is to evaluate if the Apple Heart Study App can identify irregular heart rhythms. The Apple Heart Study App is a mobile medical app developed by Apple Inc. that analyzes heart rate (HR) and beat-to-beat calculation (tachogram) data captured by the Apple Watch Photoplethysmography (PPG) sensor. The Apple Heart Study App's design is based on the Apple Watch's ability to detect continuous ECG data and provide real-time feedback to users regarding their cardiac health.
Consent Document

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TITLE: Apple Heart Study: Assessment of Wristwatch-Based Photoplethysmography to Identify Cardiac Arrhythmias

PROTOCOL NUMBER: Apple Heart Study

SPONSOR: Apple Inc.

INVESTIGATORS: Minton Turakhia, MD, MAS and Marco Perez, MD

24 HR. TELEPHONE: #1-844-606-1909

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The purpose of this research study is to evaluate if the Apple Heart Study App can identify irregular heart rhythms. The Apple Heart Study App is a mobile medical app developed by Apple Inc. that analyzes heart rate (HR) and beat-to-beat calculation (tachogram) data captured by the Apple Watch Photoplethysmography (PPG) sensor. The Apple Heart Study App also allows users to record heart rhythm anomalies such as atrial fibrillation and heart rate irregularities.
INFORMED CONSENT DOCUMENT

TITLE: Apple Heart Study: Assessment of Wristwatch-Based Photoplethysmography to Identify Cardiac Arrhythmias

PROTOCOL NUMBER: Apple Heart Study

SPONSOR: Apple Inc.

INVESTIGATORS: Mintu Turi, MD, MAS and Marco Perez, MD

24 HR. TELEPHONE: #1-844-806-9609

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This consent document describes the purpose, procedures and risks associated with participating in the study. It also describes your right to withdraw from the study at any time. Before agreeing to participate in this research study, it is important that you take the time necessary to read and understand this informed consent document with the explanation of the proposed study. Your participation in this study is completely voluntary.

BACKGROUND AND PURPOSE
You are being asked to participate in this research study because you are an adult 22 years of age or older, reside in the United States, use an Apple Watch (Series 1 or later with watchOS 4.0 or later) paired to an iPhone (6s or later with iOS 11.0 or later), are comfortable understanding, reading, writing, and speaking in English while using your Apple Watch and iPhone, and have downloaded and installed Apple Heart Study App on your iPhone and Apple Watch.

The purpose of this research study is to evaluate if the Apple Heart Study App can identify irregular heart rhythms. The Apple Heart Study App is a mobile medical app developed by Apple Inc. that analyzes heart rate (HR) and beat-to-beat calculation (beachogram) data captured by the Apple Watch Photoplethysmography (PPG) sensor. The Apple Heart Study App uses this data to identify pulse irregularities consistent with heart rhythm abnormalities including, but not limited to, atrial fibrillation (AF). If a sustained heart rhythm abnormality is identified by the Apple Heart Study App algorithm, you will receive a notification on your Apple Watch and within the Apple Heart Study App on your iPhone. This study is not to provide any treatment, but rather to collect information for research purposes.

NUMBER OF SUBJECTS / LENGTH OF PARTICIPATION
Approximately 500,000 participants may participate in this study. Your participation in this study is voluntary and will last approximately one year.
CONSENT DOCUMENT

INFORMED CONSENT DOCUMENT

TITLE: Apple Watch Study: Assessment of Wristwatch-Based Photoplethysmography to Identify Cardiac Arrhythmias

PROTOCOL
Apple Watch Study

SPONSOR: Apple Inc.

INVESTIGATORS: Mintu Turakhia, MD, MAS and Marco Perez, MD

TELEPHONE: #1-844-806-1909

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NUMBER OF SUBJECTS / LENGTH OF PARTICIPATION
Approximately 500,000 participants may participate in this study. Your participation in this study is voluntary, and you are free to withdraw from the study at any time without any penalty or adverse consequence.

Your signature shows that you have read and understood the above information and agree to participate in this study.

(Signature)

Date: ____________________
INFORMED CONSENT DOCUMENT

TITLE: Apple Heart Study: Assessment of Wristwatch-Based Photoplethysmography to Identify Cardiac Arrhythmias

PROTOCOL NUMBER: Apple Heart Study

SPONSOR: Apple Inc.

INVESTIGATORS: Mintu Turakhia, MD, MAS and Marco Perez, MD

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The purpose of this research study is to evaluate if the Apple Heart Study App can identify irregular heart rhythms. The Apple Heart Study App is a mobile medical app developed by Apple Inc. that analyzes heart rate (HR) and beat-to-beat calculation (tachogram) data captured by the Apple Watch Photoplethysmography (PPG) sensor. The Apple Heart Study App will be used as an additional tool in the diagnosis and management of cardiac arrhythmias.
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The purpose of this research study is to evaluate if the Apple Heart Study App can identify irregular heart rhythms. The Apple Heart Study App is a mobile medical app developed by Apple Inc. that analyzes heart rate (HR) and beat-to-beat calculation (tachogram) data captured by the Apple Watch Photoplethysmography (PPG) sensor. The Apple Heart Study App can identify rapid heart rates, tachycardia, and abnormal heart rhythms such as atrial fibrillation (AFib), atrial tachycardia, atrial flutter, and ventricular tachycardia (VT).

You will be asked to use your Apple Watch and the Apple Heart Study App for consecutive 28-day periods. After each 28-day period, you may continue to participate in this research study after consent is re-obtained. You may withdraw from the study at any time without providing a reason.
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The purpose of this research study is to evaluate if the Apple Heart Study App can identify irregular heart rhythms. The Apple Heart Study App is a mobile medical app developed by Apple Inc. that analyzes heart rate (HR) and beat-to-beat calculation (tachogram) data recorded by the Apple Watch. Photoplethysmography (PPG) is a key component of the Apple Heart Study App.
Consent Document

INFORMED CONSENT DOCUMENT

TITLE: Apple Heart Study: Assessment of Watch-based Photoplethysmography to Identify Cardiac Arrhythmias

PROTOCOL NUMBER: Apple Heart Study

SPONSOR: Apple Inc.

INVESTIGATORS: [List of investigators]

TELEPHONE: [Contact information]

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BACKGROUND AND PURPOSE
You are being asked to participate in this research study because you are an adult 30 years of age or older, reside in the United States, use an Apple Watch (Series 1 or later with watchOS 4.0 or later) paired to an iPhone (iOS 11 or later) and can comfortably understand, read, and write in English while using your Apple Watch and iPhone. You have downloaded and installed Apple Heart Study App on your iPhone and Apple Watch.

The purpose of this research study is to evaluate if the Apple Heart Study App can identify irregular heart rhythms. The Apple Heart Study App is a mobile medical app developed by Apple Inc. that analyzes heart rate (HR) and heart rate variability (HRV). It uses data captured by the Apple Watch Photoplethysmography (PPG) sensor. The Apple Heart Study App saves this data to identify irregularities consistent with heart rhythm abnormalities including, but not limited to, atrial fibrillation (AF). If a sustained heart rhythm abnormality is identified by the Apple Heart Study App algorithm, you will receive a notification on your Apple Watch and within the Apple Heart Study App on your iPhone. This study is not to provide any treatment, but rather to collect information for research purposes.

NUMBER OF SUBJECTS / LENGTH OF PARTICIPATION
Approximately 0,000,000 participants may participate in this study. Your participation in this study is completely voluntary.
import ResearchKit

let pdfViewerStep = ORKPDFViewerStep(identifier: "pdfViewerStep")
let pdfURL = Bundle.main.bundleURL.appendingPathComponent("consentDocument.pdf")
pdfViewerStep.title = "Consent Document"
pdfViewerStep.pdfURL = pdfURL
Active Tasks
ORKResult
Data from Active Task

```
1 0 0 1 1 0 1 1 0 0
0 1 0 0 1 1 0 0 1 0
0 1 1 0 0 1 1 0 1 1
1 0 1 1 0 1 0 1 0 1
1 0 0 1 1 0 1 1 0 0
1 0 0 1 1 0 1 1 0 0
1 0 1 1 0 1 1 0 0
0 1 0 0 1 1 0 0 1 0
```
ORKResult
Data from Active Task

Health Records
Data from HealthKit API
//Active Step with Health Records Recorder
import HealthKit
import ResearchKit

var healthClinicalType: HKClinicalType!
var healthFHIRResourceType: HKFHIRResourceType?

let step = ORKShoulderRangeOfMotionStep(identifier: "rangeOfMotionStep", limbOptions: .left)
let config = ORKHealthClinicalTypeRecorderConfiguration(identifier: "medicationRecorder",

    healthClinicalType: healthClinicalType,
    healthFHIRResourceType: healthFHIRResourceType)

step.recorderConfigurations = [config]
//Active Step with Health Records Recorder
import HealthKit
import ResearchKit

var healthClinicalType: HKClinicalType!
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let step = ORKShoulderRangeOfMotionStep(identifier: "rangeOfMotionStep", limbOptions: .left)
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step.recorderConfigurations = [config]
dBHL Tone Audiometry

Implements Hughson-Westlake method

• Determine hearing threshold in dB HL scale
dBHL Tone Audiometry

Implements Hughson-Westlake method
• Determine hearing threshold in dB HL scale

Open sourcing calibration data for AirPods
• Volume curve
• Sensitivity (dB SPL) per frequency
• RETSPL BETA
dBHL Tone Audiometry

Implements Hughson-Westlake method

- Determine hearing threshold in dB HL scale

Open sourcing calibration data for AirPods

- Volume curve
- Sensitivity (dB SPL) per frequency
- RETSPL BETA
Hughson-Westlake Method
Hughson-Westlakke Method

Successive Tone Playback

dBHL
Tone Generation Parameters
Tone Generation Parameters

Pre-Stimulus Delay
Random: Developer Specified Max
Tone Generation Parameters

- Pre-Stimulus Delay
  Random: Developer Specified Max

- Tone Duration
  Developer Specified Value
Tone Generation Parameters

- Pre-Stimulus Delay
  Random: Developer Specified Max

- Tone Duration
  Developer Specified Value

- Response Window
  Developer Specified Value
//dBHL Tone Audiometry Step

import ResearchKit

let step = ORKdBHLToneAudiometryStep(identifier: "dBHLToneAudiometryStep")

step.frequencyList = [1000.0, 2000.0]
step.maxRandomPreStimulusDelay = 2.0
step.toneDuration = 3.0
step.postStimulusDelay = 1.0
import ResearchKit

let step = ORKdBHLToneAudiometryStep(identifier: "dBHLToneAudiometryStep")

step.frequencyList = [1000.0, 2000.0]
step.maxRandomPreStimulusDelay = 2.0
step.toneDuration = 3.0
step.postStimulusDelay = 1.0
import ResearchKit

let step = ORKdBHLToneAudiometryStep(identifier: "dBHLToneAudiometryStep")

step.frequencyList = [1000.0, 2000.0]
step.maxRandomPreStimulusDelay = 2.0
step.toneDuration = 3.0
step.postStimulusDelay = 1.0
//dBHL Tone Audiometry Step

import ResearchKit

let step = ORKdBHLToneAudiometryStep(identifier: "dBHLToneAudiometryStep")

step.frequencyList = [1000.0, 2000.0]
step.maxRandomPreStimulusDelay = 2.0
step.toneDuration = 3.0
step.postStimulusDelay = 1.0

step.initialdBHLValue = 30.0
step.dBHLStepUpSize = 5.0
step.dBHLStepDownSize = 10.0
step.maxNumberOfTransitionsPerFrequency = 15
Result
{
  headphoneType
  outputVolume
  postStimulusDelay
  toneDuration
  [ Sample ]
}

Result

```
{
  ...
}
```

Sample

```
{
  channel
  frequency
  threshold
  [ Unit ]
}
```
Environment SPL Meter

Measures environment sound pressure level

- Implements an A-weighting filter
- Accepts an upper threshold limit
- Can be used as a gating step
Environment SPL Meter

Measures environment sound pressure level

• Implements an A-weighting filter
• Accepts an upper threshold limit
• Can be used as a gating step
import ResearchKit

let step = ORKEnvironmentSPLMeterStep(identifier: "environmentSPLMeterStep")
step.thresholdValue = 60.0
// Environment SPL Meter Step
import ResearchKit

let step = ORKEnvironmentSPLMeterStep(identifier: "environmentSPLMeterStep")
step.thresholdValue = 60.0
step.samplingInterval = 2.0
step.requiredContiguousSamples = 5
Speech Recognition

Real-time speech recognizer

• Supports over 50 languages and locales
• Users can be asked to repeat a sentence or describe a picture
• Evaluate speech patterns for various medical conditions including cognition and mood
Speech Recognition

A quick brown fox jumps over the lazy dog
A quick brown fox jumps over the lazy dog
Speech Recognition

A quiet brown box jumps over the lazy dog
Speech Recognition

A brown box jumps over the lazy dog

Edit Transcript
Edit transcript text to correct any misinterpretation of the speech.
Speech Recognition

A brown box jumps over the lazy dog
Speech Recognition

A quick brown box jumps over the lazy dog
Speech Recognition

A quick brown box jumps over the lazy dog
A quick brown box jumps over the lazy dog
A quick brown box jumps over the lazy dog
Speech Recognition

A quick brown fox jumps over the lazy dog
import ResearchKit

let step = ORKSpeechRecognitionStep(identifier: "speechRecognitionStep",
    image: nil,
    text: "A quick brown fox jumps over the lazy dog")
// Speech Recognition Step
import ResearchKit

let step = ORKSpeechRecognitionStep(identifier: "speechRecognitionStep",
    image: nil,
    text: "A quick brown fox jumps over the lazy dog")

step.speechRecognizerLocale = .englishGB
step.shouldHideTranscript = false
Result
{
    formattedString
    [
        Segment
    ]
}
Result

{ ... }
Result

Segment

Alternative

[ "Kelsey",
   "Chelsea",
   "Kelsie",
   "Celgie"
]
Speech in Noise

Speech Audiometry
- Identify hidden hearing loss
- Complements Tone Audiometry
- Determine Speech Reception Threshold (SRT)

Speech in Noise

* Listen to the audio recording and pay attention to the sentence that you hear.

* Repeat the sentence you heard or skip ahead to type the sentence using the keyboard.

* You will have the option to modify the transcript generated by the speech engine at the end.
Speech in Noise

* Listen to the audio recording and pay attention to the sentence that you hear.

* Repeat the sentence you heard or skip ahead to type the sentence using the keyboard.

* You will have the option to modify the transcript generated by the speech engine at the end.
Speech in Noise

* Listen to the audio recording and pay attention to the sentence that you hear.

* Repeat the sentence you heard or skip ahead to type the sentence using the keyboard.

* You will have the option to modify the transcript generated by the speech engine at the end.
Did someone say cake?

Chuck burnt the toast again!

Devin broke something again!

Of course Devin broke something again!

Kelsey do you still have chocolate at your desk?

Hi Mom, how are you and Dad doing?

Of course Kayla and Trey are ordering pizza again.

Dan is coming to town tomorrow.

Welcome to WWDC 2018

Yea, I am going on vacation next week. Looking forward to seeing some of my family that I have not had a chance to see in years.

Sam and I are going to lunch.

Jason says it’s just typing.

I am going for a run later do you want to join me?

Brett, did you get peanut butter pretzels?

Do you want to grab dinner next week?
The actor tried three green pictures. The father took four new items. The actor kept three green bags.

Kelsey, do you still have chocolate at your desk?

Hi Mom, how are you and Dad doing?

Yea, I am going on vacation next week. Looking forward to seeing some of my family that I have not had a chance to see in years.

Welcome to WWDC 2018.

I am going for a run later do you want to join me?

Jason says it’s just typing.

Let’s come to town tomorrow.

Do you want to grab dinner next week?

The actor tried three green pictures. The father took four new items. The actor kept three green bags.

Kelsey, do you still have chocolate at your desk?

Hi Mom, how are you and Dad doing?

Yea, I am going on vacation next week. Looking forward to seeing some of my family that I have not had a chance to see in years.

Welcome to WWDC 2018.

I am going for a run later do you want to join me?

Jason says it’s just typing.

Let’s come to town tomorrow.

Do you want to grab dinner next week?
// Speech in Noise Step

import ResearchKit

let step = ORKSpeechInNoiseStep(identifier: "speechInNoiseStep")

step.speechFileNameWithExtension = "Sentence17.wav"
step.gainAppliedToNoise = 0.73
Amsler Grid

* Align device 12-17 inches away from your face.
* Stare at the dot in the center and mark areas where you notice distortions.
* Swipe left anywhere outside the chart once you are done.
Amsler Grid

Vision Test

• Standard square grid
• Distortions visible in grid indicate problems
Amsler Grid

Vision Test

- Standard square grid
- Distortions visible in grid indicate problems
Amsler Grid

Vision Test

• Standard square grid
• Distortions visible in grid indicate problems
Amsler Grid

Vision Test
• Standard square grid
• Distortions visible in grid indicate problems
Amsler Grid

Vision Test

• Standard square grid
• Distortions visible in grid indicate problems
Amsler Grid

Vision Test

- Standard square grid
- Distortions visible in grid indicate problems
Active Tasks
Specified Duration of Time
Active Tasks
Specified Duration of Time
Movement Disorder API

Gabriel Blanco, Core Motion Engineer
API Features
API Features

All-day monitoring
API Features

All-day monitoring
Relevant to Parkinson’s Disease
API Features

- All-day monitoring
- Relevant to Parkinson’s Disease
- Code signing entitlement
Parkinson’s: Symptoms and Side-Effects

Tremor
Shaking, quivering

Dyskinesia
Fidgeting, swaying
Parkinson’s: Symptoms and Side-Effects

**Tremor**
- Shaking, quivering

**Dyskinesia**
- Fidgeting, swaying
Parkinson’s: Symptoms and Side-Effects

Tremor
- Shaking, quivering

Dyskinesia
- Fidgeting, swaying
Parkinson’s: Symptoms and Side-Effects

Tremor
Shaking, quivering

Dyskinesia
Fidgeting, swaying
Current Tools for Symptom Tracking
Current Tools for Symptom Tracking

In clinic
Current Tools for Symptom Tracking

In clinic

Diagnostic tests
Current Tools for Symptom Tracking

In clinic
Diagnostic tests
Patient diaries
Dyskinesia
Tremor
let status = CMMovementDisorderManager.authorizationStatus()

if CMMovementDisorderManager.isAvailable() {
    let manager = CMMovementDisorderManager()
}

//Initialization
import CoreMotion.CMMovementDisorderManager
// Initialization
import CoreMotion.CMMovementDisorderManager
let maxRecordingDuration = 7 * 24 * 3600  // Seven Days
let status = CMMovementDisorderManager.authorizationStatus()

if CMMovementDisorderManager.isAvailable() {
    let manager = CMMovementDisorderManager()
    manager.monitorKinesias(forDuration: maxRecordingDuration)
}
// Initialization
import CoreMotion.CMMovementDisorderManager

let maxRecordingDuration = 7 * 24 * 3600  // Seven Days

let status = CMMovementDisorderManager.authorizationStatus()

if CMMovementDisorderManager.isAvailable() {
    let manager = CMMovementDisorderManager()

    manager.monitorKinesias(forDuration: maxRecordingDuration)
}

let now = Date()
manager.queryTremor(from: self.lastQueriedDate, to: now) { (tremor, error) in
    if let error = error {
        print("Could not query data")
        return
    }

    self.writeRecordsToFile(tremor)
}

manager.queryDyskineticSymptom(from: self.lastQueriedDate, to: now) { (dyskinesia, error) in
    if let error = error {
        print("Could not query data")
        return
    }

    self.writeRecordsToFile(dyskinesia)
let now = Date()

manager.queryTremor(from: self.lastQueriedDate, to: now) { (tremor, error) in
    if let error = error {
        print("Could not query data")
        return
    }
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}

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    if let error = error {
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        print("Could not query data")
        return
    }
    self.writeRecordsToFile(tremor)
}

manager.queryDyskineticSymptom(from: self.lastQueriedDate, to: now) { (dyskinesia, error) in
    if let error = error {
        print("Could not query data")
        return
    }
    self.writeRecordsToFile(dyskinesia)
tremor
dyskinesia
CMTremorResult

percentUnknown: Float
percentNone: Float
percentSlight: Float
percentMild: Float
percentModerate: Float
percentStrong: Float

CMDyskineticSymptomResult

percentUnlikely: Float
percentLikely: Float
<table>
<thead>
<tr>
<th>CMTremorResult</th>
<th>CMDyskineticSymptomResult</th>
</tr>
</thead>
<tbody>
<tr>
<td>percentUnknown: Float</td>
<td>percentUnlikely: Float</td>
</tr>
<tr>
<td>percentNone: Float</td>
<td>percentLikely: Float</td>
</tr>
<tr>
<td>percentSlight: Float</td>
<td>percentStrong: Float</td>
</tr>
<tr>
<td>percentMild: Float</td>
<td>percentNone: Float</td>
</tr>
<tr>
<td>percentModerate: Float</td>
<td>percentSlight: Float</td>
</tr>
</tbody>
</table>
CMTremorResult

percentUnknown: Float
percentNone: Float
percentSlight: Float
percentMild: Float
percentModerate: Float
percentStrong: Float

CMDyskineticSymptomResult

percentUnlikely: Float
percentLikely: Float
Demo
Parkinson’s ResearchKit Study App

Akshay Yadav, Software Engineer
ResearchKit Study App

watchOS 5
Movement Disorder API

iPhone
ResearchKit Study App
Summary
Summary

ResearchKit

- Community expansion
- Updated UI
- New active tasks
Summary

ResearchKit
• Community expansion
• Updated UI
• New active tasks

Movement Disorder API
• Available on watchOS 5
Accessibility

Tap Get Started to begin.

Localization

Audiometria Tonal

Antes de começar, conecte e coloque seus fones de ouvido.

O som será muito sutil e diferente de um ton de alerta. O som iniciará suave e, lentamente, aumentará o volume. Preste atenção e toque no botão esquerdo ou direito para indicar em qual ouvido você o escuta.

Toque em Iniciar para começar.

Cancel

QA
Tone Audiometry

Tap Get Started to begin.

Get Started
Cancel

Audiometria Tonal

Antes de começar, conecte e coloque seus fones de ouvido.
O som será muito sutil e diferente de um tom de alerta. O som iniciará suave e, lentamente, aumentará o volume. Preste atenção e toque no botão esquerdo ou direito para indicar em qual ouvido você o escuta. Toque em Iniciar para começar.

Iniciar
Cancelar

Accessibility
Localization
QA
Tone Audiometry

Tap the left or right button to indicate which ear you hear it in.

Tap Get Started to begin.

Audiometria Tonal

Antes de começar, conecte e coloque seus fones de ouvido.

O som será muito sutil e diferente de um tom de alerta. O som iniciará suave e, lentamente, aumentará o volume. Preste atenção e toque no botão esquerdo ou direito para indicar em qual ouvido você o escuta.

Toque em Iniciar para começar.
Speech Recognition
* Click on Start Recording when you are ready to speak.
* Click on Stop Recording when you are done speaking.
* Edit the transcript for any misinterpretations.

Speech in Noise
* Listen to the audio recording and pay attention to the sentence that you hear.
* Repeat the sentence you heard or skip ahead to type the sentence using the keyboard.
* You will have the option to modify the transcript generated by the speech engine at the end.

Tone Audiometry
* This activity is used to identify hearing threshold levels of an individual in dBHL.
* The sound will be very subtle and is unlike a regular alert tone.
* Please pay attention and tap the button to indicate that you heard the tone.

Amsler Grid
* Align device 12-17 inches away from your face.
* Stare at the dot in the center and mark areas where you notice distortions.
* Swipe left anywhere outside the chart once you are done.
ResearchKit is an open source software framework that makes it easy to create apps for medical research or for other research projects.

Add topics

- 2,986 commits
- 3 branches
- 14 releases
- 110 contributors

Branch: master
- New pull request
- Merge pull request
- Checkin new sample app
- Removing duplicate code
- Merge pull request
- Checking new sample app
- Removing duplicate code
- Merge pull request
- Converting to 6.1
- Merge pull request
- Converting to 6.1
- Adding new sample app
- Adding new sample app
- Contributing guidelines
- Initial commit
- Merge pull request
- Merge pull request
- Merge pull request
- Merge pull request
- Merge pull request
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Introducing ResearchKit

ResearchKit is an open source framework introduced by Apple that allows researchers and developers to create powerful apps for medical research. Easily create visual consent forms, real-time dynamic active tools, and surveys using a variety of customizable elements that you can add upon and share with the community. And since ResearchKit works seamlessly with HealthKit, researchers can access even more relevant data for their studies — like daily step counts, calorie use, and heart rate.

Frameworks
The core ResearchKit framework offers core modules that include a survey engine, visual consent flow, and active tools.

The core framework comes with Swift and Objective-C examples, and full conceptual and API documentation. It has also been localized to many languages.

ResearchKit Tutorials
These tutorials, along with the ResearchKit documentation, will help you get up and running fast. Please note that these materials are authored by members of the ResearchKit community and Apple does not endorse or make any representations as to the accuracy of the content.

- How to set up a ResearchKit project
- Advanced ResearchKit Project Setup
- Learning ResearchKit
- Incorporating Heart Rate Data for Your ResearchKit Study
- How to create a new ResearchKit Active Task
More Information

https://developer.apple.com/wwdc18/205

<table>
<thead>
<tr>
<th>Event</th>
<th>Location</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health and Fitness Technologies Lab</td>
<td>Technology Lab 1</td>
<td>Tuesday 3:45PM</td>
</tr>
<tr>
<td>Accessing Health Records with HealthKit</td>
<td>Executive Ballroom</td>
<td>Tuesday 3:00PM</td>
</tr>
<tr>
<td>Health, Fitness, and Research Get-Together</td>
<td>Market Terrace</td>
<td>Wednesday 6:15PM</td>
</tr>
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</table>