MOBILE TOOLBOX

Measuring Cognitive and Functional Change Where It Matters

Remote Self-Administered Assessments for the Smartphone
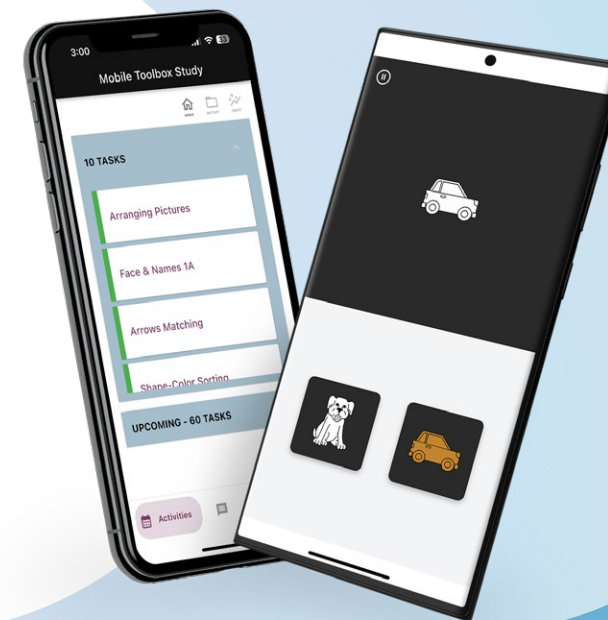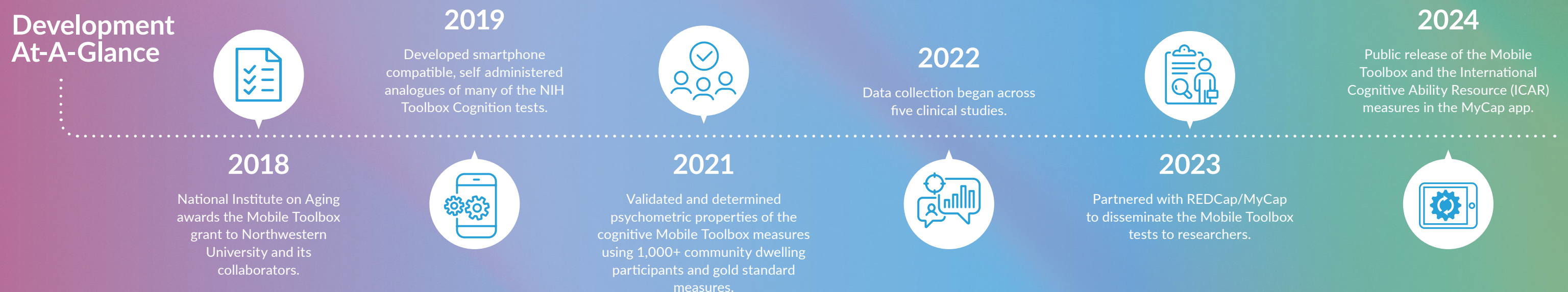
mobiletoolbox.org

MOBILE TOOLBOX

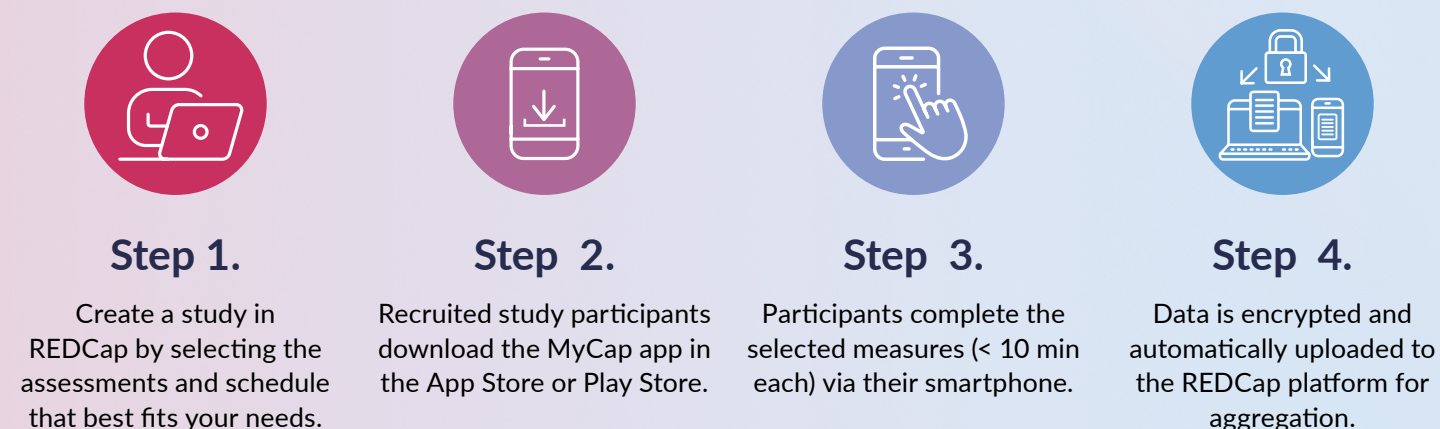## Measuring Cognitive and Functional Change Where It Matters

The Mobile Toolbox leverages large-scale accessibility of smartphones by offering clinical and non-clinical researchers a library of well-validated, easy-to-use, standardized smartphone measures and remote assessment software. The Mobile Toolbox's partnership with REDCap and their companion MyCap App makes the Mobile Toolbox assessment library widely accessible and provides a study management and administration system familiar to researchers. This allows researchers, particularly those studying cognition, functional outcomes, and aging, to administer neurocognitive and non-cognitive measures to participants remotely. Given its capabilities, the Mobile Toolbox is suitable for a large variety of study designs and assessment of adult participants (18 to 85+ years).

Development At-A-Glance

2019
Developed smartphone compatible, self administered analogues of many of the NIH Toolbox Cognition tests.

2022
Data collection began across five clinical studies.

2024
Public release of the Mobile Toolbox and the International Cognitive Ability Resource (ICAR) measures in the MyCap app.

2018
National Institute on Aging awards the Mobile Toolbox grant to Northwestern University and its collaborators.

2021
Validated and determined psychometric properties of the cognitive Mobile Toolbox measures using 1,000+ community dwelling participants and gold standard measures.

2023
Partnered with REDCap/MyCap to disseminate the Mobile Toolbox tests to researchers.

How it Works

Step 1.
Create a study in REDCap by selecting the assessments and schedule that best fits your needs.

Step 2.
Recruited study participants download the MyCap app in the App Store or Play Store.

Step 3.
Participants complete the selected measures (< 10 min each) via their smartphone.

Step 4.
Data is encrypted and automatically uploaded to the REDCap platform for aggregation.

Overview of Development

The Mobile Toolbox delivers a library of brief and sensitive measures to create a comprehensive research platform that can remotely assess neurological and behavioral functions across the adult lifespan in large-scale studies. Developed and validated by content experts, our growing library of digital measures is derived from well-established measurement systems such as the NIH Toolbox®, Patient Reported Outcomes Measurement Information System (PROMIS®) and the International Cognitive Ability Resource (ICAR). Through our partnership and integration with REDCap and their companion MyCap App, the Mobile Toolbox assessment library is further elevated by a widely accessible study management and administration system. Together, users will find an easy-to-navigate system, allowing for ready selection and administration of remote measures which can be used across diverse study designs and populations.

During its development, we completed four pilot studies, two pre-calibration studies, three validation studies, as well as five clinical studies, which together tested over 20,000 participants. Validity evidence has been obtained from healthy adults ages 18-85 and from clinical samples, including persons at risk for mild cognitive impairment or Alzheimer's Disease and Alzheimer's Disease-Related Dementia, adults diagnosed with cognitive impairment, those with Parkinson's disease, and individuals with HIV-Associated Neurocognitive Disorders. Convergent validity studies were performed using gold standard external measures and the NIH Toolbox V3.

Available Cognitive Tests:

The Mobile Toolbox measures cover a variety of areas in cognition. These measures are currently available in English and will be available in Spanish later in 2024.
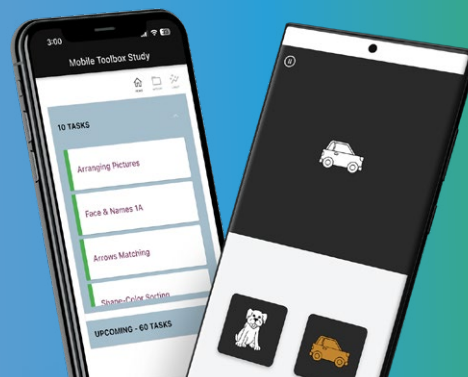
Language

Spelling

This task assesses the ability to spell words administered in a computer-adaptive test format. Respondents listen to audio clips and, using the keyboard, enter the corresponding letters to spell the word, completing a maximum of 30 items.

⏱ 4 min

Associative Memory

Faces and Names

This is a two-part test that targets associative memory function. Respondents are first presented with an encoding task and then prompted to recall a series of face-name associations after a 5- to 20-minute delay.

⏱ 6 min

Episodic Memory

Arranging Pictures

This measure examines episodic memory. A series of images is presented in a specific order on the screen. Following this presentation, the images are scrambled, and the respondent is asked to recall the original order and place the images accordingly.

⏱ 5 min

Working Memory

Sequences

This is a measure of working memory. It requires a participant to remember a string of letters and numbers and manipulate them to put them in alphabetical and numeric order

⏱ 4 min

Language

Word Meaning

This is a computer adaptive test that measures general vocabulary knowledge. Respondents select the word that most closely matches the meaning of a target word, completing a maximum of 25 items.

⏱ 2 min

Attention, Executive Function

Arrow Matching

This measure targets inhibitory control and attention. This measure requires respondents to indicate the left-right orientation of a centrally presented stimulus while inhibiting attention to potentially incongruent stimuli that surround it.

⏱ 3 min

Executive Function

Shape-Color Sorting

This measure targets cognitive flexibility. Images are presented that vary along two dimensions (color and shape) and respondents are asked to sort images based on one of the dimensions.

⏱ 3 min

Processing Speed

Number-Symbol Match

This measure assesses processing speed. Respondents are asked to match numbers with specific symbols using a digit/symbol key. They are given 90 seconds to correctly match as many number-symbol pairs as they can.

⏱ 2 min

Additional measures to be released in 2024
International Cognitive Ability Resource (ICAR)

Mental Rotation

Block Rotation

This task assesses the ability to mentally rotate a spatial representation of a 3D object.

🕐 15 min　　▭ Validation in progress

Fluid Reasoning

Puzzle Completion

This task assesses the ability to identify patterns and solve novel problems.

🕐 15 min　　▭ Validation in progress

General Knowledge and Verbal Reasoning

Word Problems

This task assesses verbal reasoning and acquired knowledge.

🕐 10 min　　▭ Validation in progress

Overall Cognitive Ability

Variety Test

Also known as the ICAR16 Sample Test, this task assesses a range of cognitive abilities including verbal and nonverbal reasoning, mental rotation, and acquired knowledge.

🕐 15 min　　▭ Validation in progress

Fluid Reasoning

Letters and Numbers

This task assesses pattern recognition and quantitative reasoning.

🕐 7 min　　▭ Validation in progress

The Mobile Toolbox will soon include measures from the following assessment systems.

Patient Reported Outcomes Measurement Information System (PROMIS®)

A set of self-reported measures of global, physical, mental, and social health for adults in the general population and those living with a chronic condition.

NIH Toolbox® Emotion

A set of self-reported measures assessing critical domains of emotional health including psychological well-being, stress and self-efficacy, social relationships and negative affect for use with adults.

Quality of Life in Neurological Disorders (Neuro-QoL™)

A self-report measurement system that evaluates and monitors the physical, mental, and social effects experienced by those living with neurological conditions.

MOBILE TOOLBOX

mobiletoolbox.org | help@mobiletoolbox.org

The Mobile Toolbox team includes measurement scientists, clinicians, cognition researchers, and technical experts with a proven history of success in multiple large-scale validation and development projects.

Principal Investigator

Richard C. Gershon, PhD
Chief of Outcome and Measurement Science,

Department of Medical Social Sciences | Feinberg School of Medicine | Northwestern University

NIH Program Officer:

Melissa Treviño, PhD
Division of Behavioral and Social Research (DBSR)

National Institute on Aging | National Institutes of Health

Sponsors

NIH Blueprint
for Neuroscience Research

NATIONAL INSTITUTES OF HEALTH

DEPARTMENT OF HEALTH & HUMAN SERVICES·USA