Measuring Cognitive and Functional Change Where It Matters



Remote Self-Administered Assessments for the Smartphone



mobiletoolbox.org

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 noncognitive 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

2018

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

2019

Developed smartphone compatible, self administered analogues of many of the NIH





2021

Validated and determined using 1,000+ community dwelling participants and gold standard

2022

Data collection began across five clinical studies.



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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-scal studies. Developed and validated by content experts, our growing library of digital measures is derived from well-established measurement systems such as the NI Toolbox[®], Patient Reported Outcomes Measurement Information System (PROMIS®) and the International Cognitive Ability Resource (ICAR). Through our partner ship and integration with REDCap and their companior MyCap App, the Mobile Toolbox assessment library is further elevated by a widely accessible study management and administration system. Together, users will fir an easy-to-navigate system, allowing for ready selection

2024

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



	used across diverse study designs and populations.
e	During its development, we completed four pilot studies, two pre-calibration studies, three validation studies, as
ı 👘	well as five clinical studies, which together tested over
Н	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
n	Dementia, adults diagnosed with cognitive impairment,
	those with Parkinson's disease, and individuals with
	HIV-Associated Neurocognitive Disorders. Convergent
d	validity studies were performed using gold standard
า	external measures and the NIH Toolbox V3.

and administration of remote measures which can be

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.

(7) 5 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 leftright 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

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

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)

from the following assessment systems.

Mental Rotation

Block Rotation

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

 $\overline{(7)}$ 15 min $\Sigma - \Sigma$ Validation in progress

Fluid Reasoning

Puzzle Completion

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

(\checkmark) 15 min $\Sigma \Sigma$ Validation in progress

General Knowledge and Verbal Reasoning

Word Problems

This task assesses verbal reasoning and acquired knowledge.

 $\overline{(2)}$ 10 min $\overline{\sqrt{2}}$ 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.

(\checkmark) 15 min $\Sigma \Sigma$ Validation in progress

Fluid Reasoning

Letters and Numbers

This task assesses pattern recognition and quantitative reasoning.

 $\overline{(2)}$ 7 min $\Sigma \overline{\Sigma}$ Validation in progress







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.

Neuro QoL

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.

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.

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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

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National Institute on Aging | National Institutes of Health

Sponsors

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Scan to Demo the Mobile Toolbox:



MTB Trainee & Early Career Award Now Accepting Applications

We are pleased to announce the first annual MTB Trainee & Early Career Award, providing up to **\$4,000** to support the dissemination of research utilizing the **Mobile Toolbox (MTB)**. Funds may be used for conference travel to present MTB-related work or open-access publication fees.

<u>Eligibility</u>

•Trainees: Must be pursuing a graduate degree (MA/MS, Phd, Medical Students, etc). •Early Career Researchers: Must be within six years of their terminal degree.

Minimum Requirement •Studies must include at least one MTB measure in the study protocol.

Selection Criteria

Priority will be given to studies that use multiple MTB measures and/or have MTB as a central focus.
Awards will be given as reimbursement for eligible costs accrued between June 1, 2025 and May 30, 2026.

Application & Award Details

Applications will be considered on a rolling basis. Decisions will be announced within 30 days of application.
Awardees will be invited to present their findings to the Mobile Toolbox team virtually within six months of their publication or presentation.

•Submit your application <u>online</u>

Questions? Contact <u>MTBTraineeAward@northwestern.edu</u> Visit <u>mobiletoolbox.org</u> to learn more about the MTB



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