What is needed to enable the coming impact of Quantitative MRI?

Kathryn Keenan, PhD
Project Leader, Quantitative MRI



National Institute of Standards and Technology
U.S. Department of Commerce

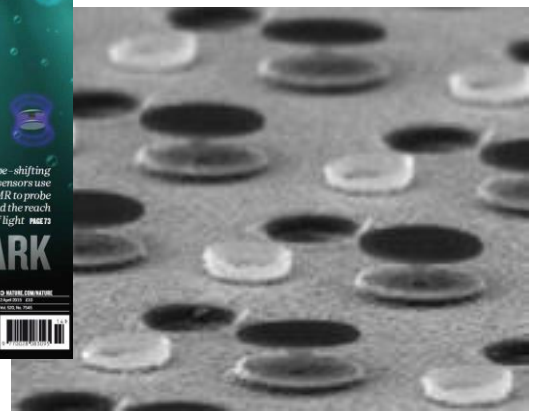
NISTIR 7434

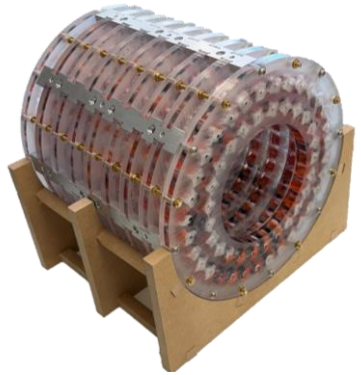
Imaging as a Biomarker: Standards for Change Measurements in Therapy Workshop Summary

September 14-16, 2006
National Institute of Standards and Technology
Gaithersburg, MD 20899

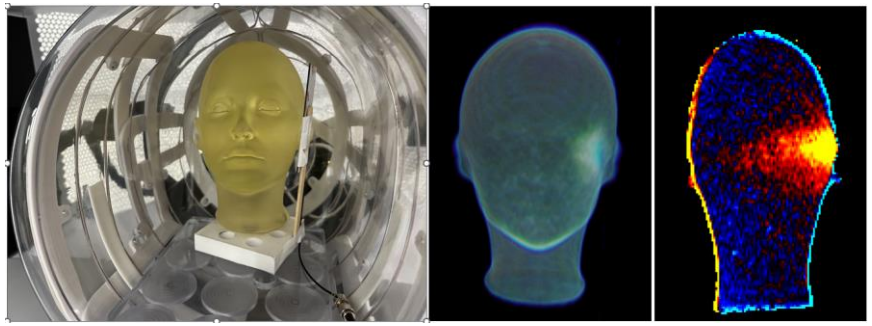
Laurence Clarke
Ram D. Sriram



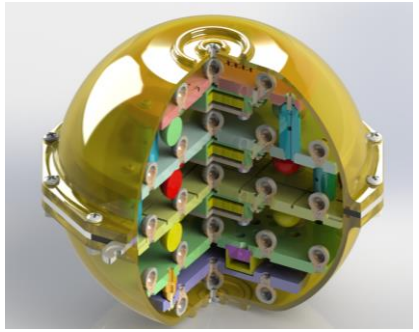






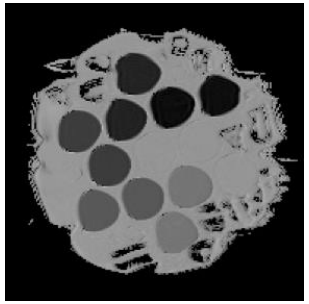


Are phantoms being used today?



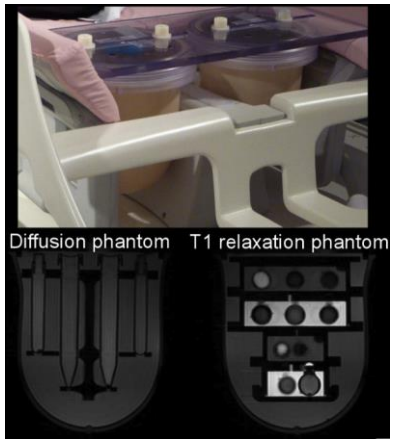
ISMRM ONE COMMUNITY FOR CLINICIANS AND SCIENTISTS





NIH National Institute of Biomedical Imaging and Bioengineering
Creating Biomedical Technologies to Improve Health

Quantitative Imaging Biomarkers Alliance RSNA

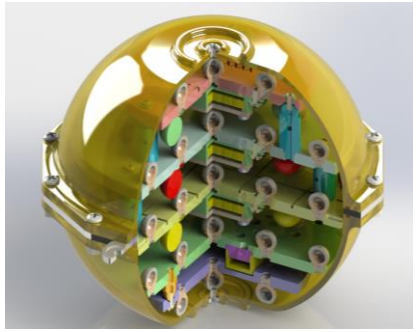


NIH NATIONAL CANCER INSTITUTE

UCSF
University of California
San Francisco

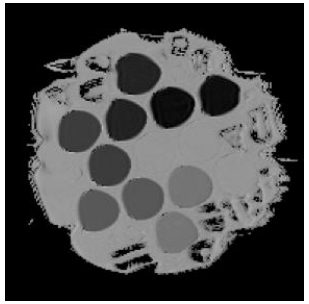
Are phantoms being used today?

YES



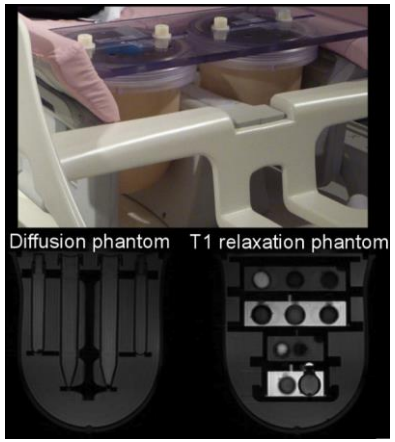
ISMRM ONE COMMUNITY FOR CLINICIANS AND SCIENTISTS





NIH National Institute of Biomedical Imaging and Bioengineering
Creating Biomedical Technologies to Improve Health

Quantitative Imaging Biomarkers Alliance RSNA

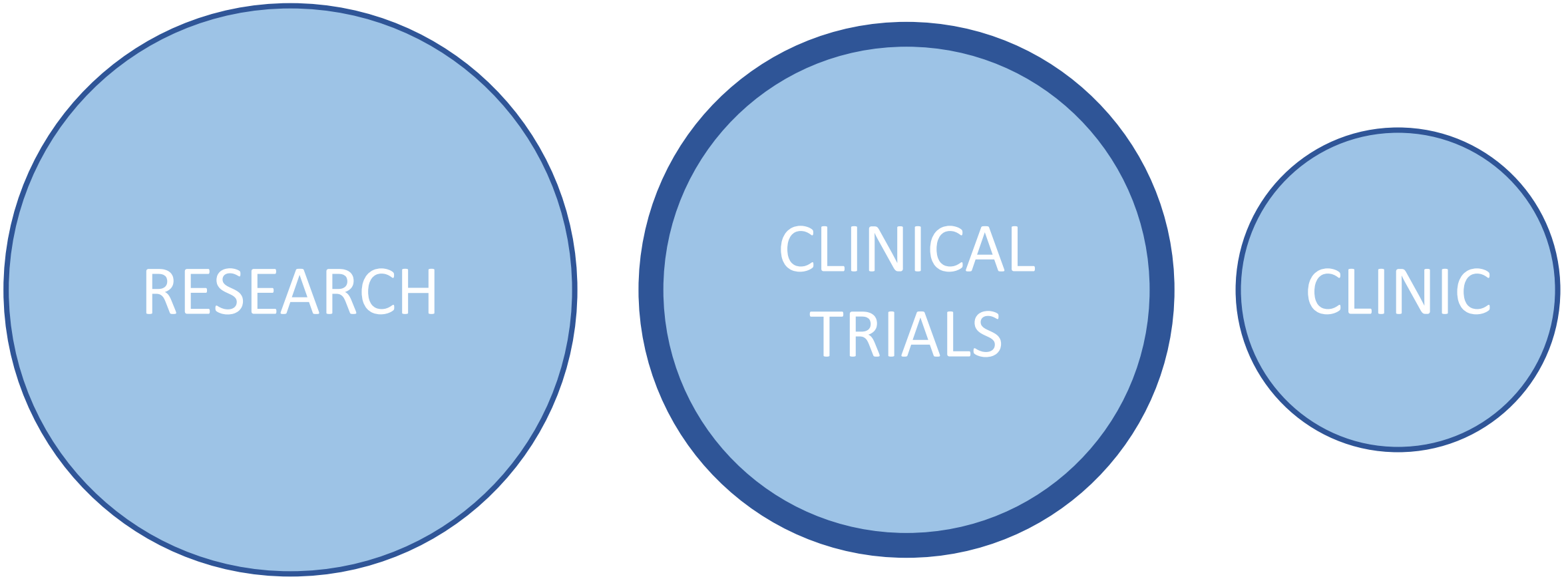


NIH NATIONAL CANCER INSTITUTE

UCSF
University of California
San Francisco

Are phantoms being used today?

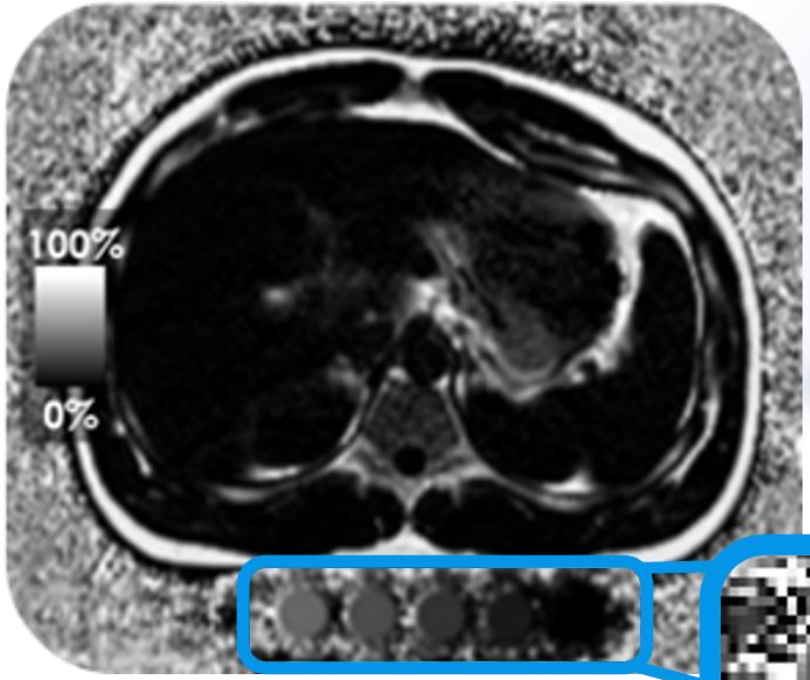
YES

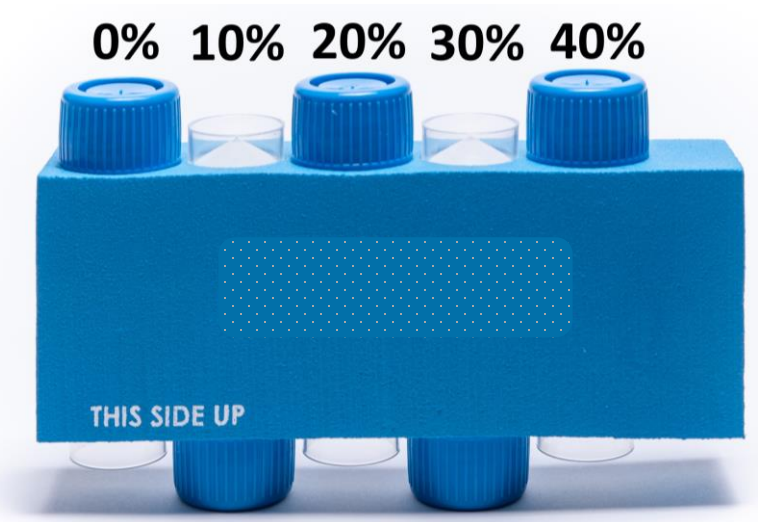


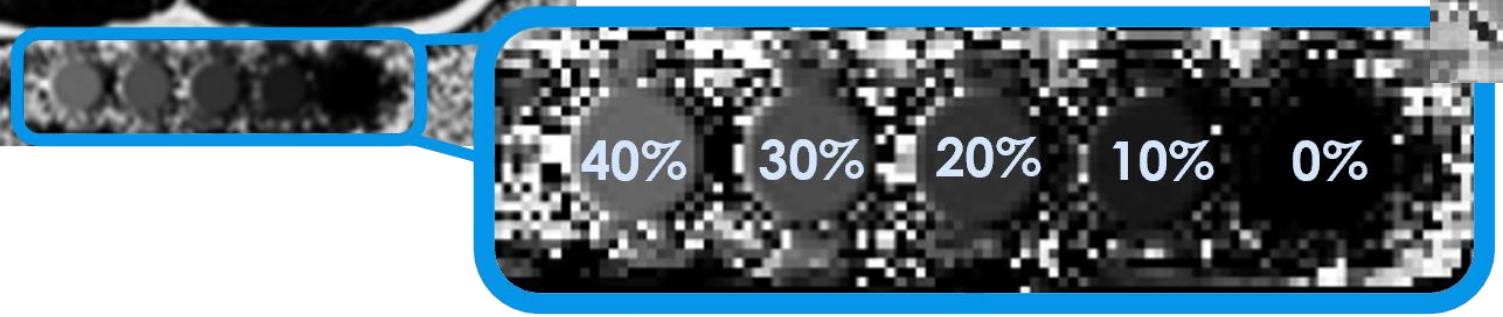
*Circle sizes are approximate. Do not have actual data.

Clinical trials use phantoms

Liver Fat Fraction

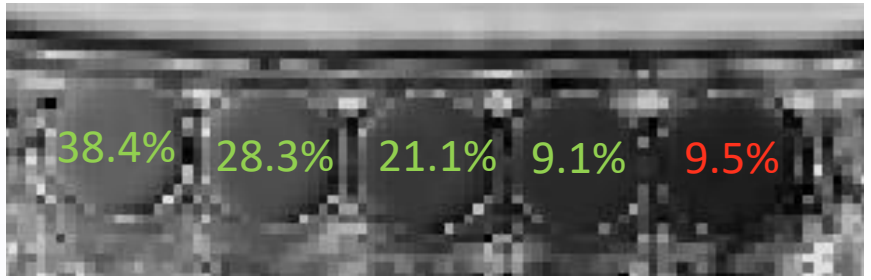




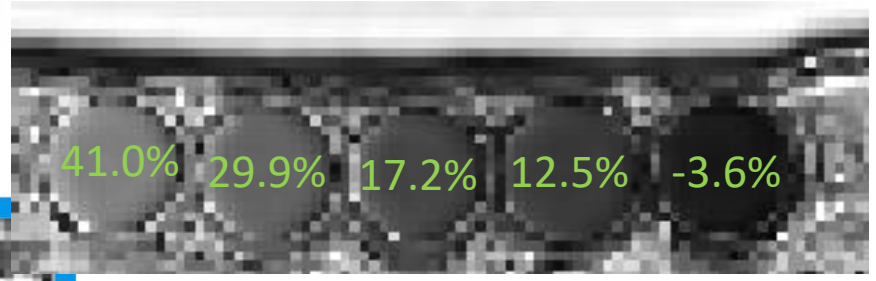


Nominal Values

Inadequate acquisition (failed)



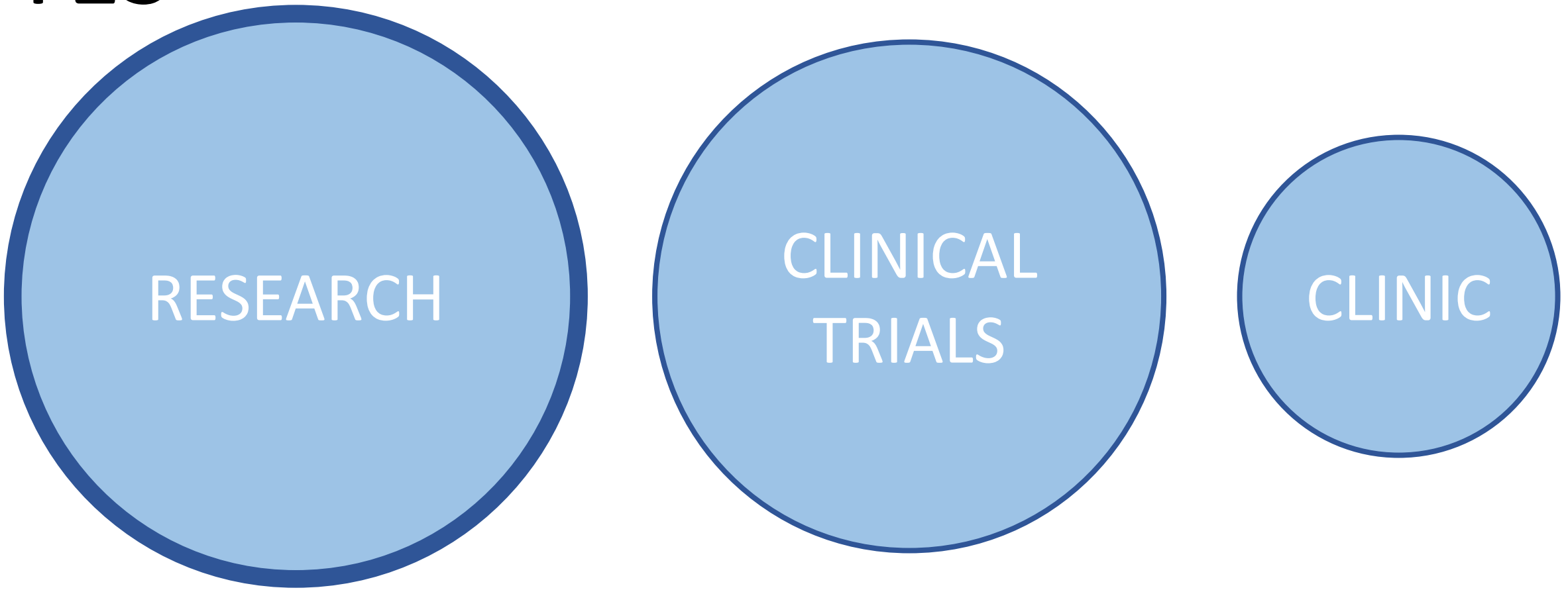
Correct acquisition (passed)



Keenan et al, MAGMA 2024

Are phantoms being used today?

YES

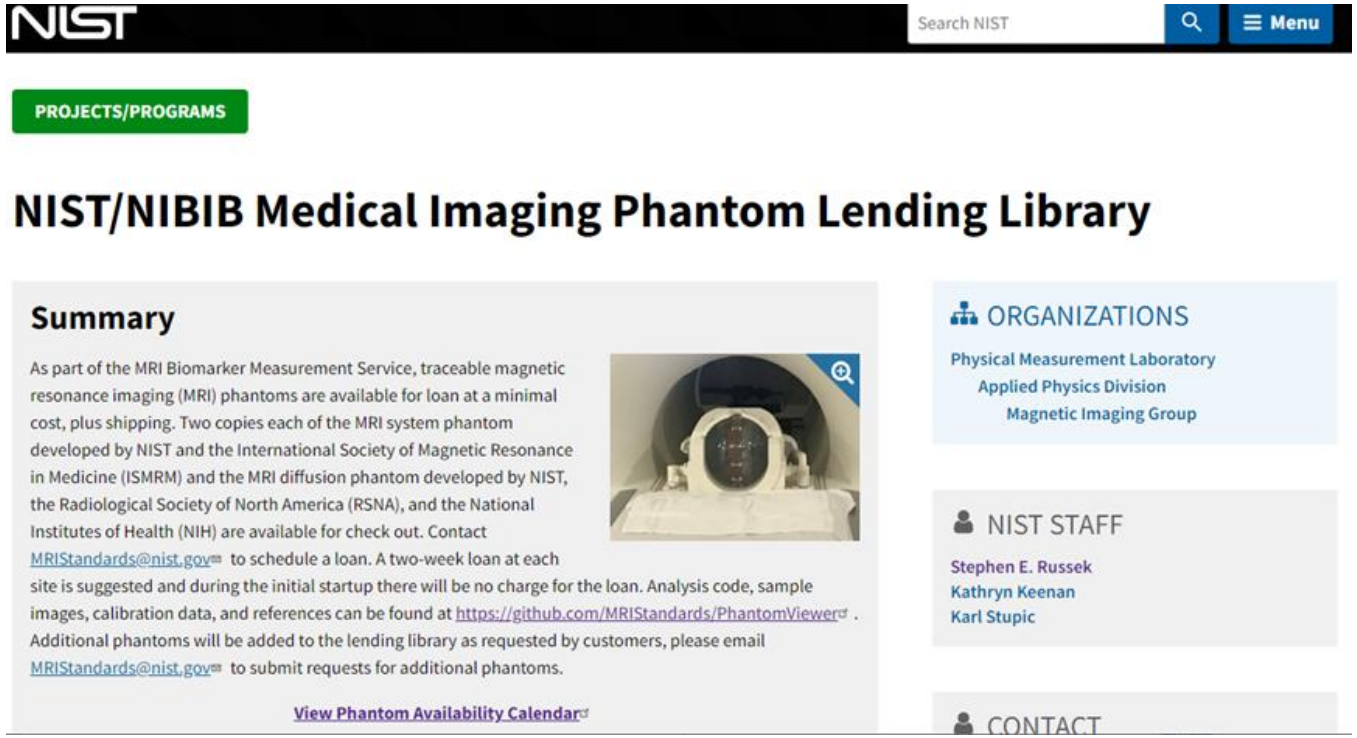


*Circle sizes are approximate. Do not have actual data.

National Medical Phantom Library (NMPL)

How the NMPL works:

- Easy to use: go to web site, check availability calendar, submit request for review by NIST.
- 2-to-6-week loans recommended
- Sharing data to common database encouraged
- Currently only ship within North America



Contact: stephen.russek@nist.gov

National Institute of Biomedical Imaging and Bioengineering

NIST NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY U.S. DEPARTMENT OF COMMERCE

https://www.nist.gov/programs-projects/nistnibib-medical-imaging-phantom-lending-library

National Medical Phantom Library (NMPL)

Site 1: NIBIB/NIST Medical Imaging Phantom Lending Library
(Mainly MRI Phantoms)

Site 2: NIBIB BETA Center
(Other imaging modalities, e.g., Ultrasound, Optical, etc.)

National Institute of Biomedical Imaging and Bioengineering

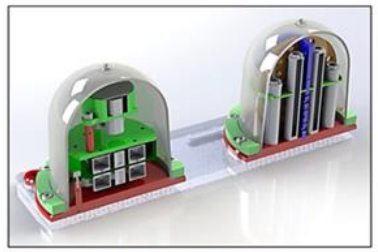
NIH NATIONAL CANCER INSTITUTE

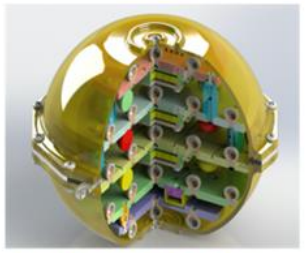
NIST

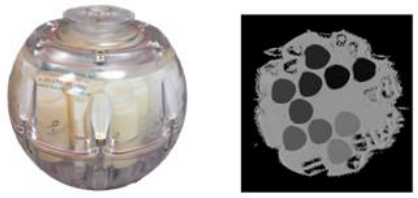
FDA

NSF

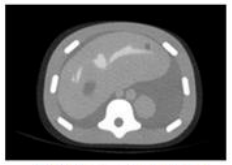
Early Stage → Expanding to Optical, Acoustic, CT, PET/SPECT/NucMed


MRI Breast Phantom

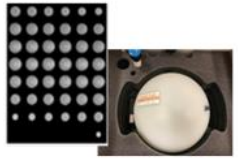

MRI System Phantom

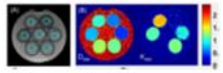

MRI Diffusion Phantom


Cardiac T1 Phantom


Triple modality abdomen


Brain Health Phantom


fMRI


Kurtosis Phantom

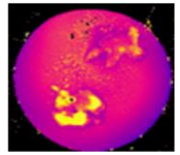

MRS Phantom


MSK Phantom

PET/SPECT Cone Beam CT Phantom

AO Lateral Resolution Phantom

OCT Phantom


Biomimetic Tumor Mimic


Retina Phantom

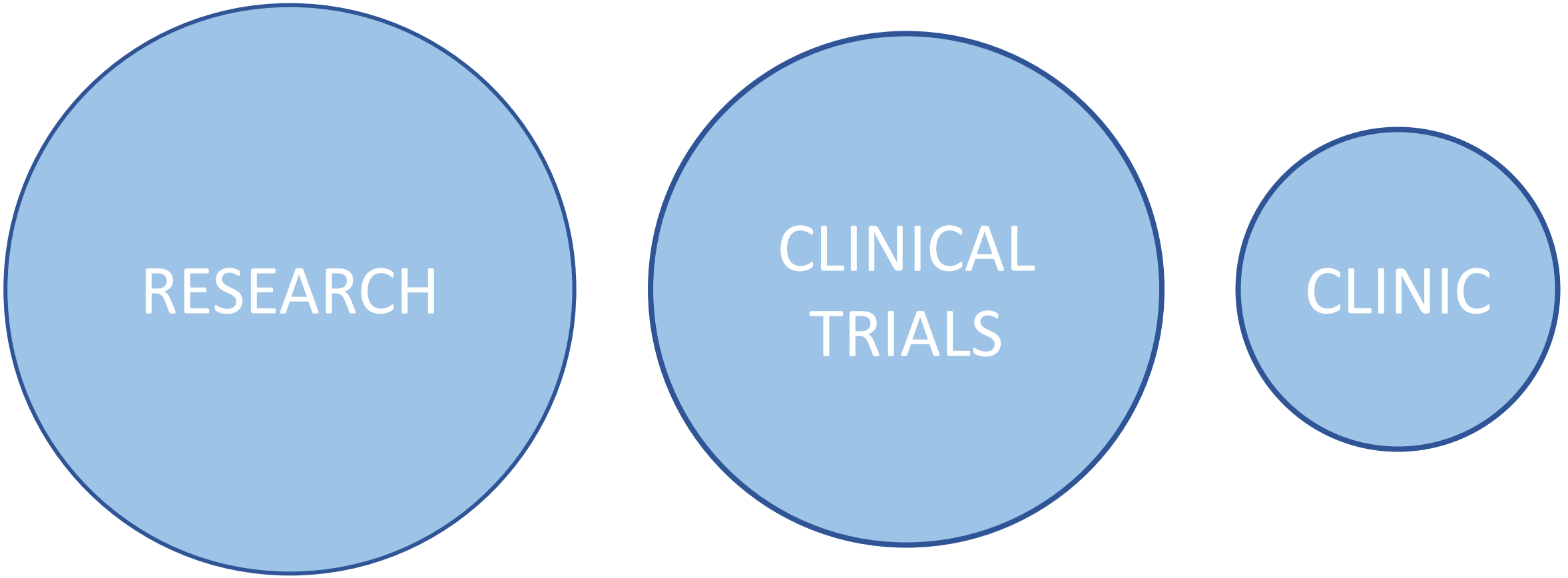
COMMUNITY Requested Phantoms !!!

2021 → 2026

https://www.nist.gov/programs-projects/nistnibib-medical-imaging-phantom-lending-library
https://www.nibib.nih.gov/labs-at-nibib/center-for-biomedical-engineering-technology-acceleration-beta/national-phantom-library-npl

Are phantoms being used today?

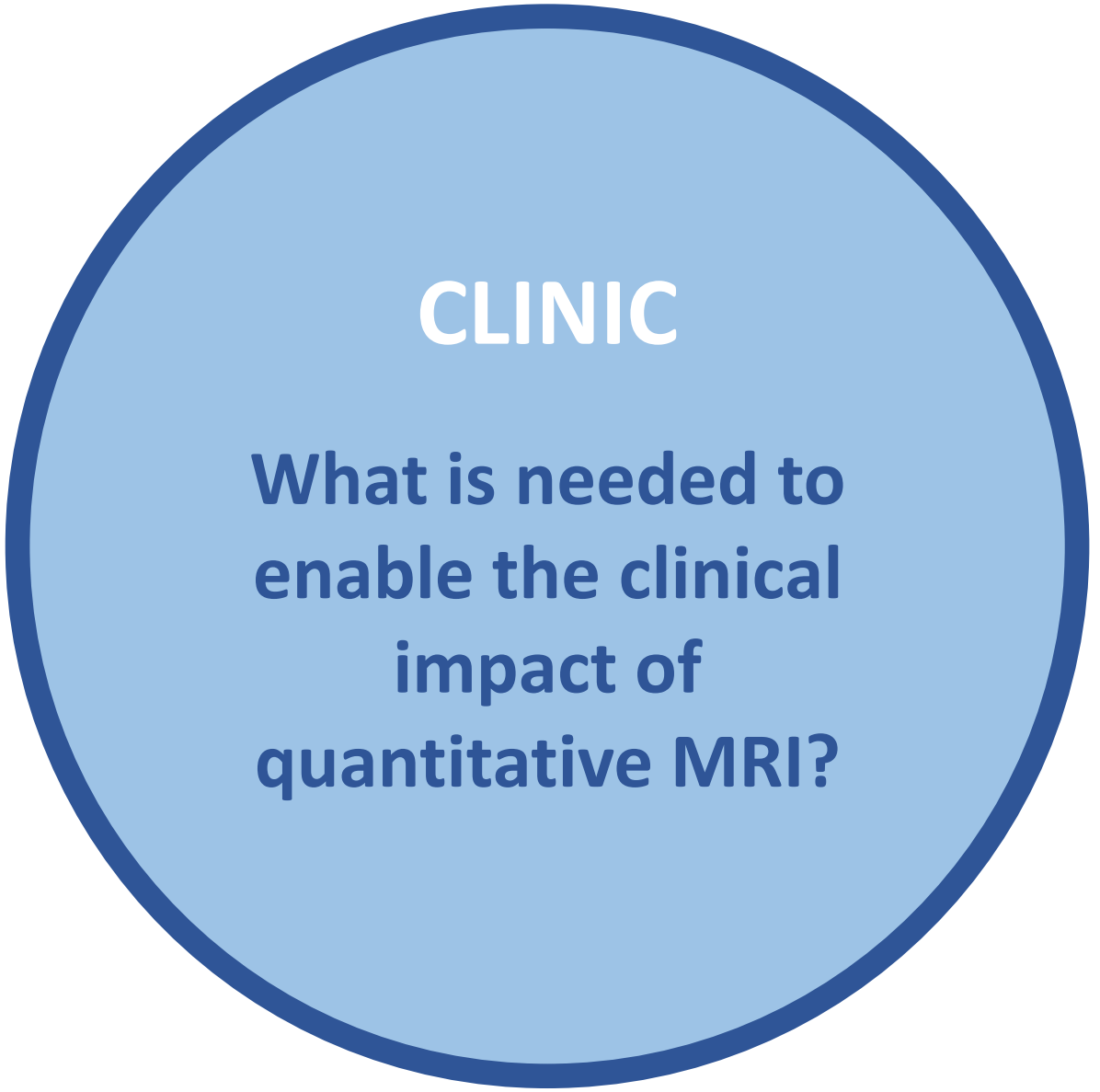
YES



*Circle sizes are approximate. Do not have actual data.


RESEARCH

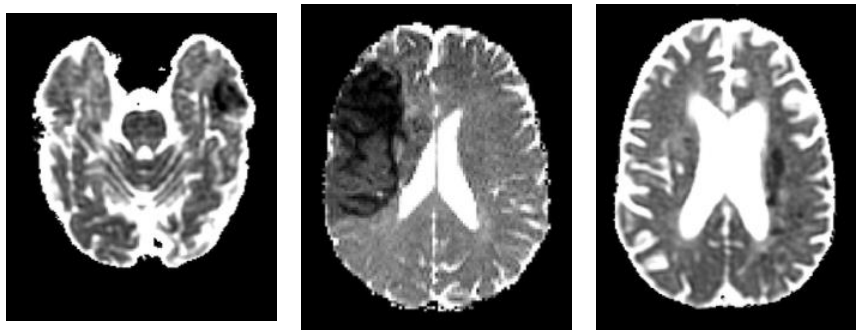

CLINICAL
TRIALS


CLINIC
What is needed to enable the clinical impact of quantitative MRI?

*Goal

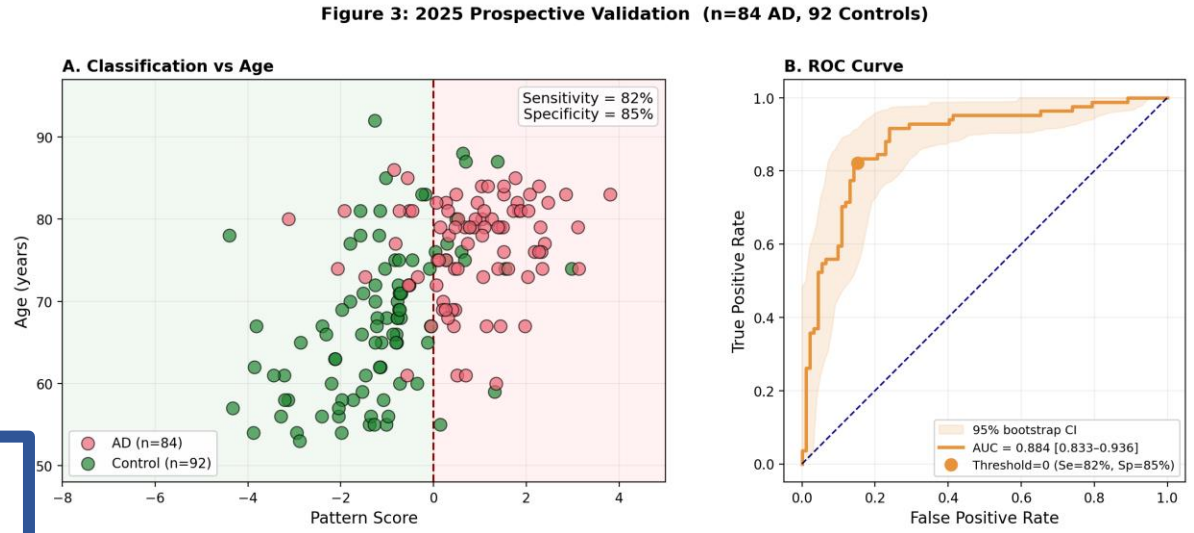
The clinical promise of qMRI

Apparent Diffusion Coefficient



Sorby-Adams et al Stroke 2026

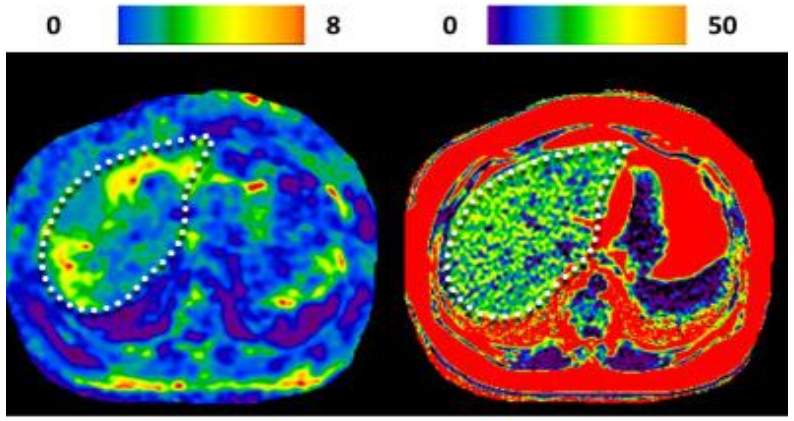
Prediction of Alzheimer's Disease Using T1, T2



Dupuis et al ISMRM 2026 Abstract 409-03-009

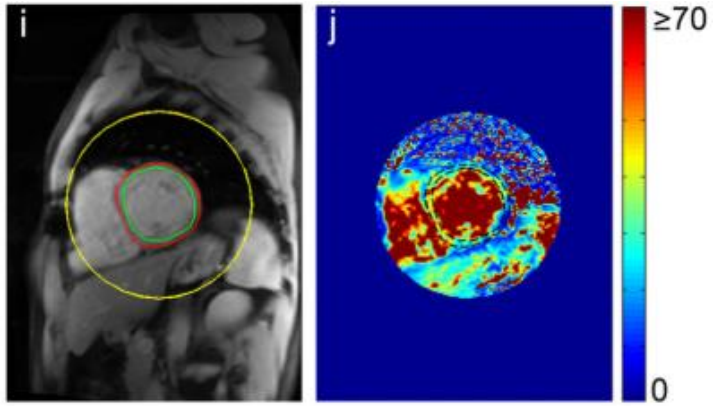
What is needed to enable the clinical impact of qMRI?

Liver stiffness / Fat fraction



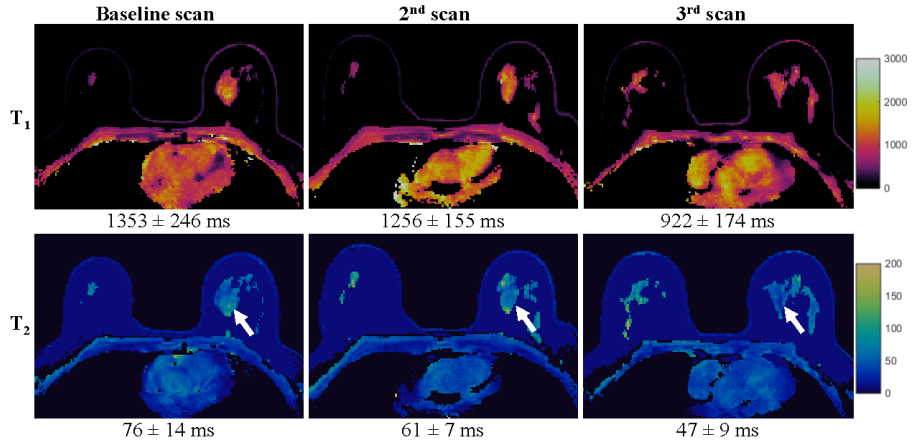
Cunha et al British Journal of Radiology 2021

Cardiac T2*



Triadyaksa et al JMRI 2020

Prediction of Treatment Response



Marshall et al ISMRM 2026, Abstract 502-04-005