

Cognitive Fitness in Aging (COFITAGE): A BIDS-compliant, Multimodal and Longitudinal Neuroscience Dataset

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Abstract
& Poster

Introduction

Understanding the early mechanisms of brain aging requires the integration of molecular, structural, physiological and cognitive measures within the same individuals. In midlife and early late adulthood, subtle alterations in amyloid deposition, hippocampal structure, cortical microstructure and sleep-wake regulation may precede overt cognitive decline by years. However, few open-access resources combine positron emission tomography (**PET**), magnetic resonance imaging (**MRI**), sleep phenotyping and extensive neuropsychological assessment within the same individuals.

COFITAGE was designed to address this gap by providing a multimodal, longitudinal dataset, enabling the investigation of interactions between amyloid and tau burden, cerebral metabolism, brain macro- and micro-structure, sleep physiology, cognitive reserve and longitudinal cognitive trajectories in healthy late middle-aged adults.

Objective #1: Provide a multimodal, phenotyped and longitudinal dataset collected in healthy late middle-aged adults.

Objective #2: Release harmonized PET, MRI and phenotypic data organized according to the "Brain Imaging Data Structure" (BIDS) standard, ensuring reproducibility and interoperability [1,2].

Objective #3: Progressively share advanced derivatives and extend the dataset with additional modalities, as well as two- and seven-year follow-up assessments.

Methods

The cohort comprised 101 healthy participants (33M/68W) aged between 50 and 69 years (mean age 59.4 years, SD = 5.28).

PHENOTYPE DATA (Baseline)

- **Demographic and genetic** variables include age, sex, education, body mass index, APOE risk score.
- **Sleep-related** metrics include apnoea indices, periodic limb movements, time in bed, sleep onset latency, wake after sleep onset, total sleep time, sleep efficiency, sleep stages (N1, N2, N3, REM), number of awakenings, awakening index, number of cycles and sleep stage transition metrics.
- **Neuropsychological** assessment (**Baseline + 2-year Follow-Up**) includes 24 tasks and quantitative measures (**Tab. 1**).

MRI ACQUISITION (Baseline)

- **Anatomical:** T1-weighted MPRAGE (resolution $1 \times 1 \times 1$ mm³) and T2-weighted imaging (resolution $0.4 \times 0.4 \times 1.2$ mm³) (**Fig. 1**)
- **Quantitative:** Multi-echo series of MTsat-, PD-, and T1-weighted images, plus B0/B1⁺/B1⁻ field maps (resolution $1 \times 1 \times 1$ mm³) (**Fig. 1**)
- **Diffusion-weighted Imaging (DWI):** Multi-shell NODDI protocol, reverse phase-encoding, dedicated noise acquisitions and GRE field mapping sequence (resolution $2 \times 2 \times 2$ mm³) (**Fig. 1**)

PET IMAGING (Baseline)

- **Amyloid** PET imaging, with either 18F-Florbetapir (97 subjects) or 18F-Flutemetamol tracer (3 subjects) ;
- **Tau-sensitive** PET imaging, with THK tracer (66 subjects).

All data were anonymized through

- defacing of anatomical MRI scans,
- removal of identifying metadata,
- assignment of randomized subject identifiers, and
- implementation of harmonized naming conventions fully compliant with the BIDS standard [1,2].

Table 1: Overview of the phenotypic data collected at baseline, covering episodic memory, executive functions, attention, working memory, processing speed, verbal fluency, mood and cognitive reserve proxies. An asterisk (*) indicates data that were also collected at the 2-year follow-up.

Beck Anxiety Inventory	Free and Cued Selective Reminding Test*
Beck Depression Inventory	Horne-Östberg questionnaire
Choice Reaction Time Task	Logical Memory Task*
Cognitive Difficulties Scale	Mattis*
Cognitive Reserve Hobby	Mill Hill Vocabulary Scale
Cognitive Reserve Occupation	MMSE
Cognitive Reserve Sport	Mnemonic Similarity Task*
D2 Test of Attention	National Adult Reading Test (French)
Digit Symbol Substitution Test*	Nback Visual Task*
Epworth Daytime Sleepiness Scale	Stroop Color Word Test
Fluency Tests*	Trail Making Test*
Forward and Backward Digit Span Task*	Raven's Progressive Matrices

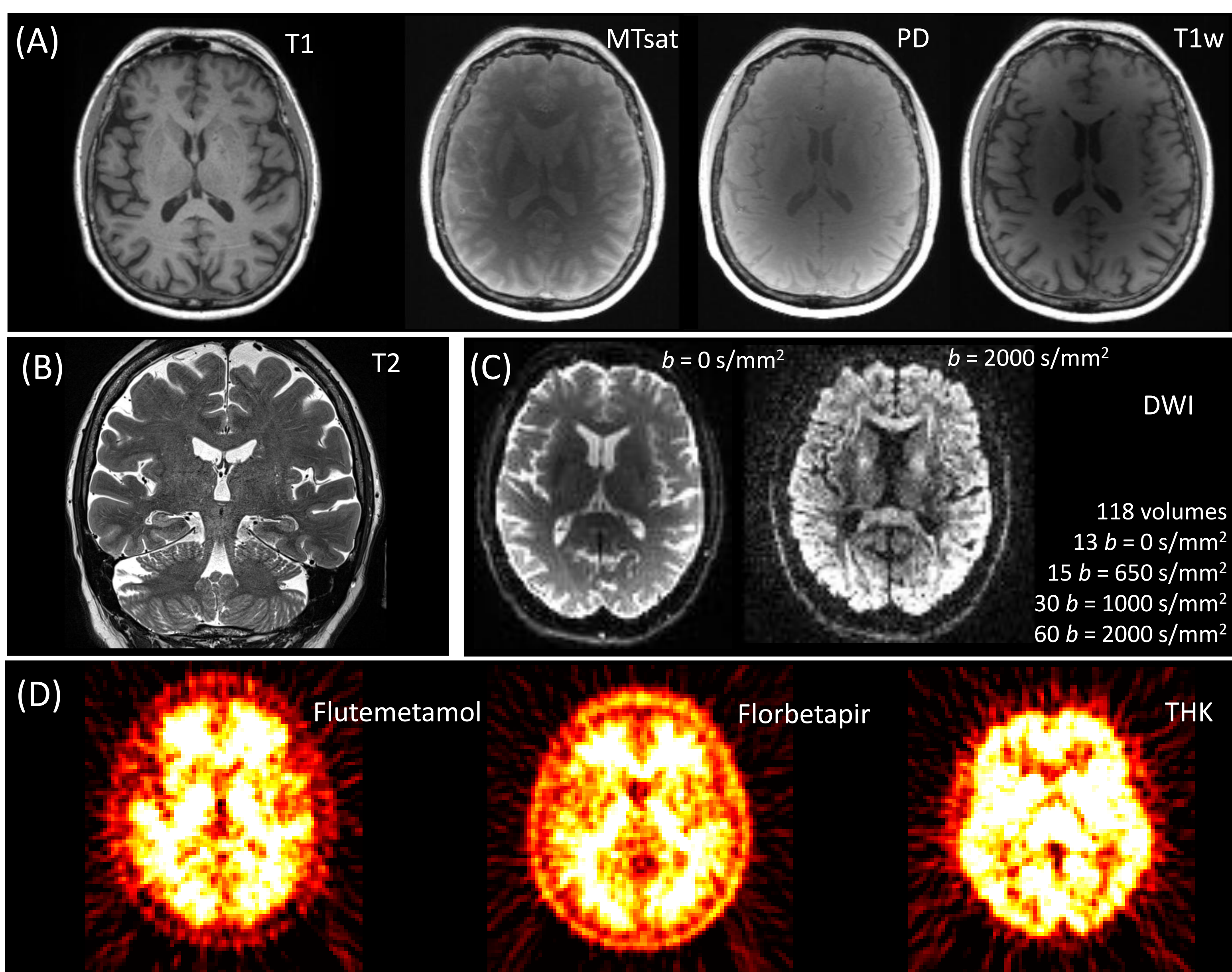


Figure 1: Example of structural T1 and quantitative Mtsat, PD and T1w images (A) at the same slice level, a T2 image (B) and diffusion-weighted images (C) from the same subject. Example of PET images (D) with three different tracers at the same slice level (only the Florbetapir and THK images are from the same subject).

Results

The dataset is structured according to the BIDS standard (version 1.11.0) and was validated using the BIDS Validator (version 3.0.1).

Discussion

COFITAGE uniquely combines amyloid and tau PET, advanced MRI, and extensive cognitive and sleep phenotyping within a narrow age range (50–70 years), enabling the study of early brain aging before clinical impairment.

Its scientific value is supported by numerous publications. Sleep, cortical excitability and Alzheimer's disease biomarkers have been investigated [3-9]. Molecular PET biomarkers and cognitive performance have been characterized across multiple domains [10-12]. Cognitive reserve, lifestyle and structural brain correlates have been explored using the multimodal richness of COFITAGE [13-15].

In brief, *COFITAGE is a publication-proven, open-access dataset for multimodal and longitudinal research on preclinical brain aging.*

References: [1] Gorgolewski, K. et al. (2016), Scientific Data. [2] Belyi, N. et al. (2023), *Journal of Open Source Software*. [3] Van Egroo, M. et al. (2019a), *Communications Biology*. [4] Van Egroo, M. et al. (2019b), *Sleep*. [5] Cardone, P. et al. (2021), *JCI Insight*. [6] Chylinski, D. O. et al. (2021), *JCI Insight*. [7] Chylinski, D. et al. (2022), *eLife*. [8] Mouraux, C. et al. (2023), *Neuropsychology*. [9] Bennis, K. et al. (2023), *Neuroscience*. [10] Rizzolo, L. et al. (2021), *Brain and Cognition*. [11] Ronat, L. et al. (2024), *Journal of Neurology*. [12] Narbutas, J. et al. (2021a), *Frontiers in Aging Neuroscience*. [13] Narbutas, J. et al. (2019), *Aging (Albany NY)*. [14] Narbutas, J. et al. (2021b), *Journal of Alzheimer's Disease*. [15] Gardette, J. et al. (2025), *Cortex*.
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