SMARTME&YOU HOME PLATFORM FOR MULTIMODAL MONITORING: INTEGRATING MOTOR ACTIVITY, SERIOUS GAMES, AND RESTING EEG IN OLDER ADULTS WITH COGNITIVE IMPAIRMENT DUE TO ALZHEIMER'S AND PARKINSON'S DISEASES

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Background

Sedentariness is a known **risk factor for cognitive decline in aging**, and home-based monitoring of daily steps and serious game performance may serve, ecologically valid proxies of cognitive health. This study used the **SmartMe&You home telemonitoring platform** (https://smartme.cloud.garr.it/) to assess daily motor activity[1], cognitive performance, and resting-state EEG in older adults with and without cognitive impairment[2,3].

Methods

As part of eBRAIN-Health (European Commission Horizon grant), PREDICT-NEURODEGEN (Italian Ministry of Health grant), and TELEMAIA (Regione Lazio Innova grant) projects, a cohort of 45 older adults with cognitive decline due to Alzheimer's disease (AD, n=20) or Parkinson's disease (PD, n=25), and 15 cognitively unimpaired healthy controls (HC) underwent **multimodal home-based monitoring** and **32-channel in-laboratory EEG recording**. Participants completed one week of unsupervised monitoring, including: **(1) accelerometer-derived daily step counts** (Samsung Galaxy Watch6), and **(2) cognitive performance on seven SmartMe&You serious games** assessing visuomotor and attentional functions. Resting-state EEG (~5 min, eyes closed) was analyzed using MATLAB and eLORETA to identify individual alpha frequency (IAF) and extract source-level current density across delta to alpha 3 bands globally and in selected regions of interest.

Mean step counts and accuracy across the seven SmartMe&You serious game tasks were computed. Group comparisons were conducted with ANCOVAs controlling for age, sex, and education, and bivariate associations were examined with Pearson's correlation.

Table1. Demographic information and clinical data of Nold, PD, and AD participants.

	AD (n=20)	PD (n=25)	HC (n=15)	Statistical test
Age (years)	75.6 ± 5.6	75.0 ± 7.3	69.4 ± 5.8	ANOVA: p<.05 (HC < AD; HC < PD)
Sex (M/F)	12/8	18/7	7/8	Fisher test: n.s.
Education (years)	11.2 ± 4.5	11.9 ± 4.9	14.3 ± 5.1	ANOVA: n.s.
MMSE score	23.0 ± 5.4	25.9 ± 3.4	29.1 ± 1.0	Kruskall-Wallis test: p<.001 (HC > PD; HC > AD)

Results

Compared to HC (mean age 69,4±5.8, 8 women), **AD** (mean age 75.6 ± 5.6, 8 women) **and PD participants** (mean age =75.0 ± 7.3, 7 women) **showed lower step counts** (HC: 6185.2, AD: 4292.4, PD: 3153.6; p<.05), **serious games cognitive accuracy** (p<.01), **EEG delta band source activity** (p<.05), **and IAF** (p<.05) (*Figure 1*). Step count was significantly correlated with cognitive accuracy (r=.54, p<.001), EEG global delta (r=-.50, p<.001), and individual alpha frequency (r=.53, p<.001) in the AD+PD group (*Figure 2*).

Figure 1. Group mean values of (A) step count, (B) SmartMe&You cognitive accuracy, (C) EEG global delta source activity, and (D) individual alpha frequency in the three groups.

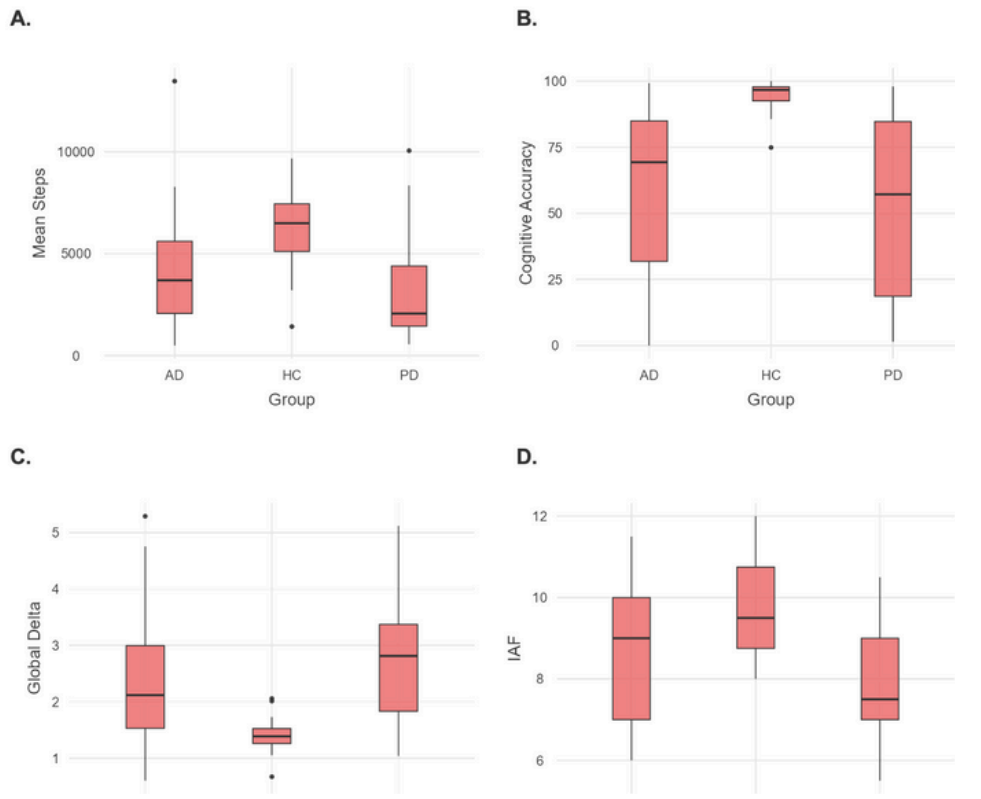
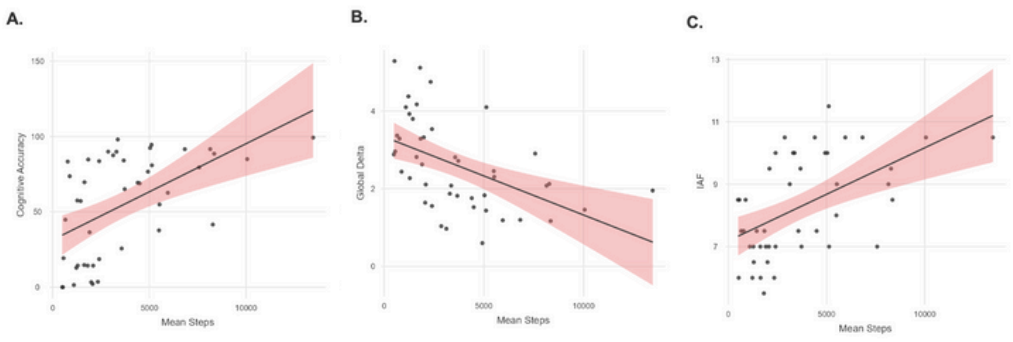


Figure 2. Scatterplots showing the association between mean daily steps and (A) SmartMe&You cognitive accuracy, (B) EEG global delta source activity, and (C) individual alpha frequency (IAF).



Conclusions

This exploratory study highlights **behavioral and neurophysiological alterations** in older adults with cognitive decline due to neurodegenerative diseases, exploiting **home telemonitoring measures.** Reduced mobility is associated with cognitive performance and slowing of EEG rhythms in quiet wakefulness, suggesting **early disruptions in cortical arousal regulation in both AD and PD patients with cognitive impairment.**

In this context, SmartMe&You home telemonitoring is a **feasible home-based approach to simultaneously assess motor and cognitive markers of aging**, capturing alterations consistent with neurophysiological EEG disruption of prodromal and mild AD and PD. These preliminary findings support its potential as a scalable tool for **early detection and monitoring of cognitive decline.**

References

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