

Cognitive testing, self-reports of cognitive functioning and exploratory plasma pTau-217 data relate to performance on novel smartphone app: Assessment of Smartphone Everyday Tasks (ASSET)

Kira J. Schaefer¹, Kailee A. Palmgren¹, Claudia R. Aibel¹, Madeline A. Yu¹, Alexa C. Coussoule^{1,3}, Hyun-Sik Yang^{1,2,3}, Reisa A. Sperling^{1,2,3}, Dorene M. Rentz^{1,2,3}, Kathryn V. Papp^{1,2,3}, Rebecca E. Amariglio^{1,2,3}, Gad A. Marshall^{1,2,3}, Mark A. Dubbelman^{1,2,3}

¹Massachusetts General Hospital, Boston, MA, ²Harvard Medical School, Boston, MA, ³Brigham and Women's Hospital, Boston, MA



Background

- The earliest changes in instrumental activities of daily living (IADL) emerge before overt cognitive impairment but are difficult to capture with questionnaires.
- Performance-based digital assessments offer a potential avenue for measuring subtle changes in everyday functioning in early Alzheimer's disease (AD).
- The "Assessment of Smartphone Everyday Tasks" (ASSET) was administered in cognitively unimpaired (CU) older adults as a potentially sensitive measure of everyday functioning.
- ASSET tracks response time and accuracy for Patient Portal and Calendar tasks, where participants navigate a patient portal to renew prescriptions and make payments, and use a calendar to schedule one-time and recurring appointments.

Aims

- Evaluate the association between performance on ASSET tasks and Preclinical Alzheimer's Cognitive Composite (PACC5) scores and self-reported Cognitive Function Instrument (CFI) scores.
- Preliminarily evaluate the association between performance on ASSET tasks and biomarker presence, specifically plasma pTau-217.

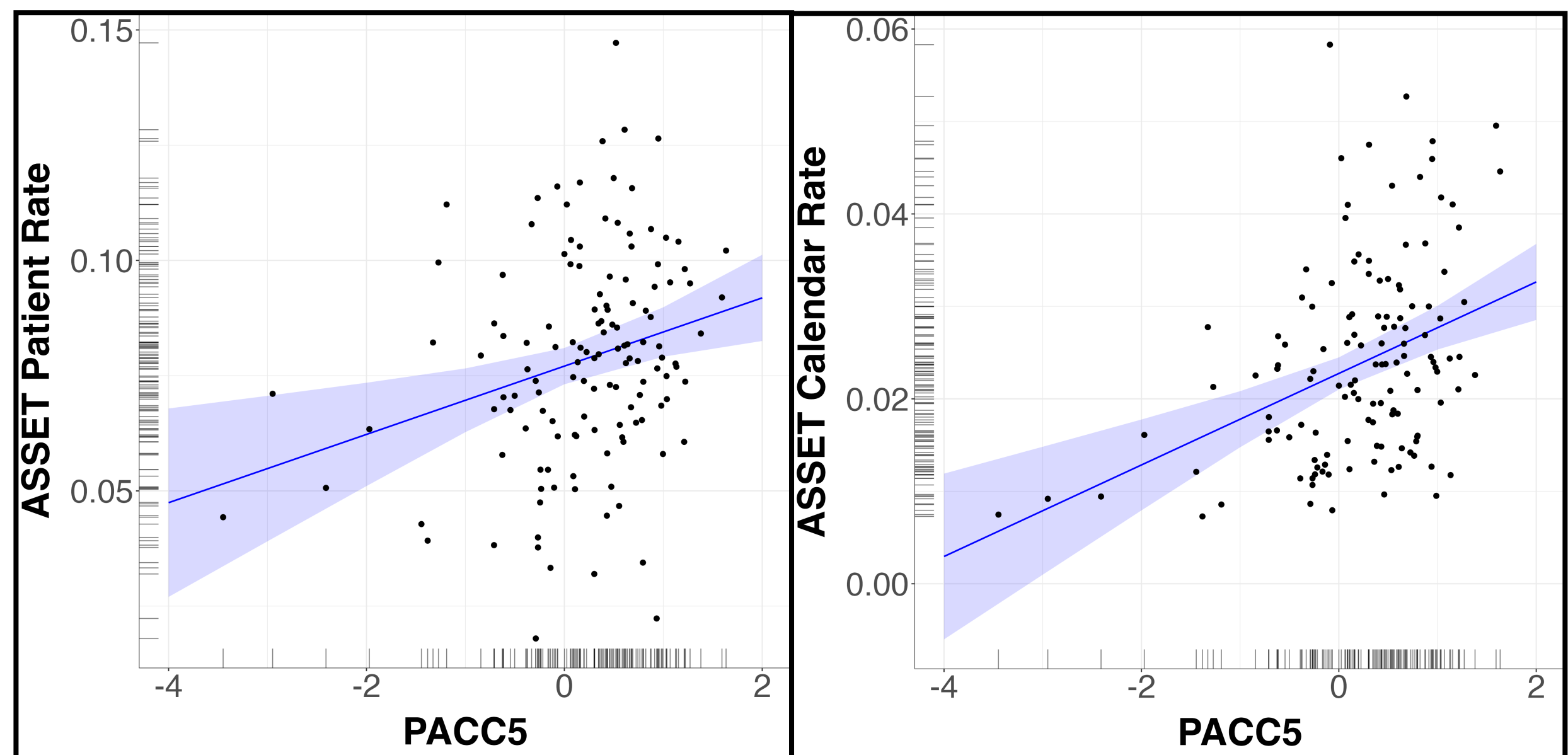
Methods

- 138 CU participants (75±7 years, 64% female, median 16 years of education) completed ASSET within 7 days of completing the PACC5 and the CFI.
- PACC5: a composite cognitive test, based on a z-score with a mean of 0 and standard deviation of 1. Higher scores represent better global cognitive performance.
- CFI (self-report): a 15-item questionnaire that is a hybrid measure of subjective cognitive concerns and IADL, with higher CFI scores indicating greater subjective cognitive complaints.
- Accuracy rates (correct responses/task duration) were calculated for Patient Portal (0.078±0.023) and Calendar tasks (0.024±0.011), with higher scores indicating better performance.
- Linear regression models run, with PACC5 scores then with CFI scores as the independent variable, using both ASSET task accuracy rates as dependent variables.
- PACC5 and CFI models were adjusted for age, sex, and years of education.
- A subset of participants underwent blood draws that measured plasma pTau-217 concentration within 3 years of completing ASSET (n=25).
- Linear regression models were run with log-transformed plasma pTau-217 concentration as the independent variable, using both Patient Portal and Calendar task accuracy rates as dependent variables.

Results

PACC5 Model	n	B[95% CI]	T	P	R ² /R ² adjusted
Patient Portal Rate	137	0.007 [0.002 – 0.012]	2.615	0.009	0.173/0.148
Calendar Rate	135	0.003 [0.002 – 0.006]	3.710	<0.001	0.298/0.276

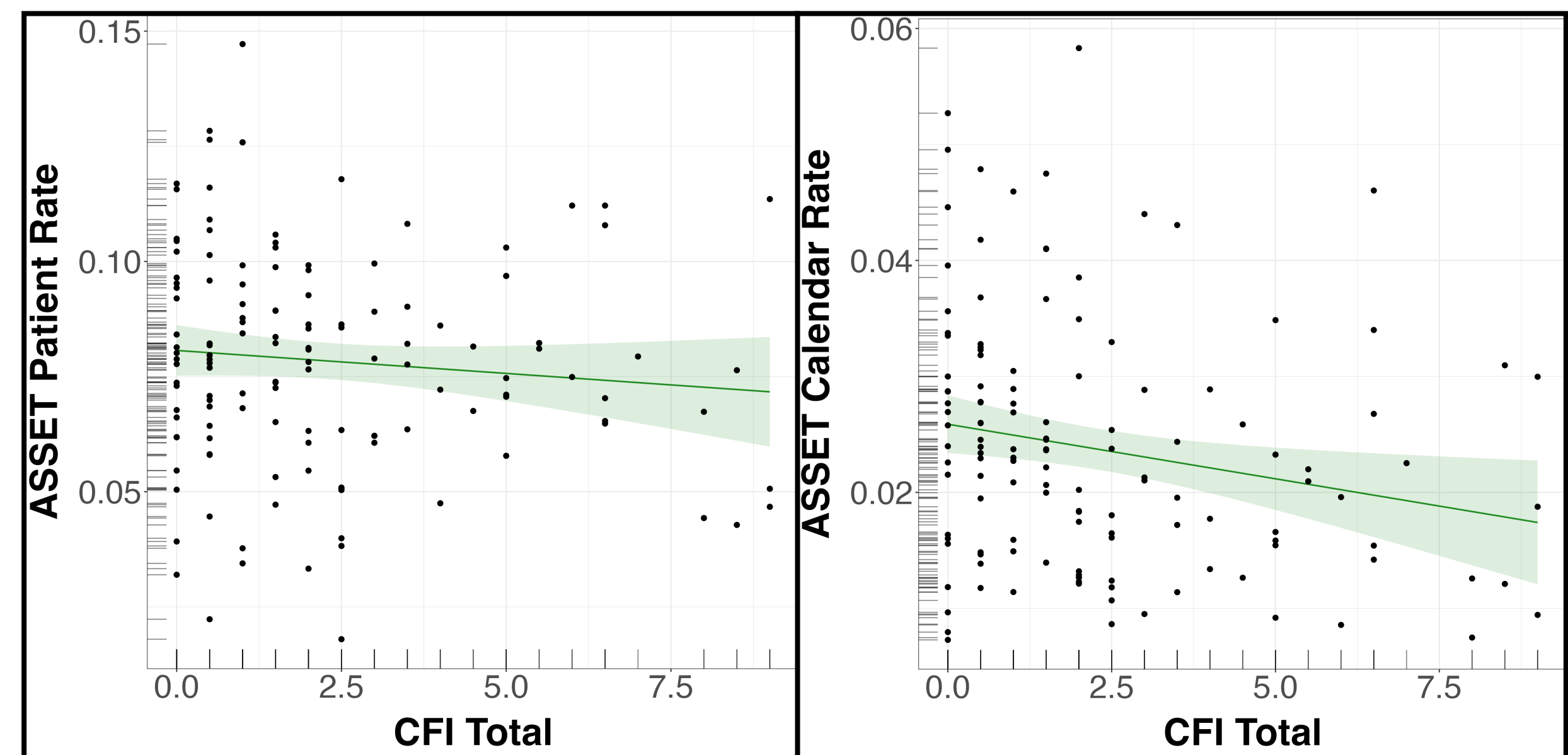
Table 1: Linear regression models show higher Preclinical Alzheimer's Cognitive Composite (PACC5) scores are associated with better performance on ASSET tasks (adjusted for age, sex, years of education)



Figures 1a-b: Positive associations between PACC5 scores and Patient Portal Rate (left), and between PACC5 scores and Calendar Rate (right)

CFI Model	n	B[95% CI]	T	P	R ² /R ² adjusted
Patient Portal Rate	138	-0.001 [-0.003 – 0.000]	-1.393	0.166	0.145/ 0.119
Calendar Rate	136	-0.001 [-0.002 – 0.000]	-2.805	0.006	0.269 / 0.247

Table 2: Linear regression models show lower self-report Cognitive Function Instrument (CFI) scores are associated with better performance on ASSET Calendar task (adjusted for age, sex, years of education)

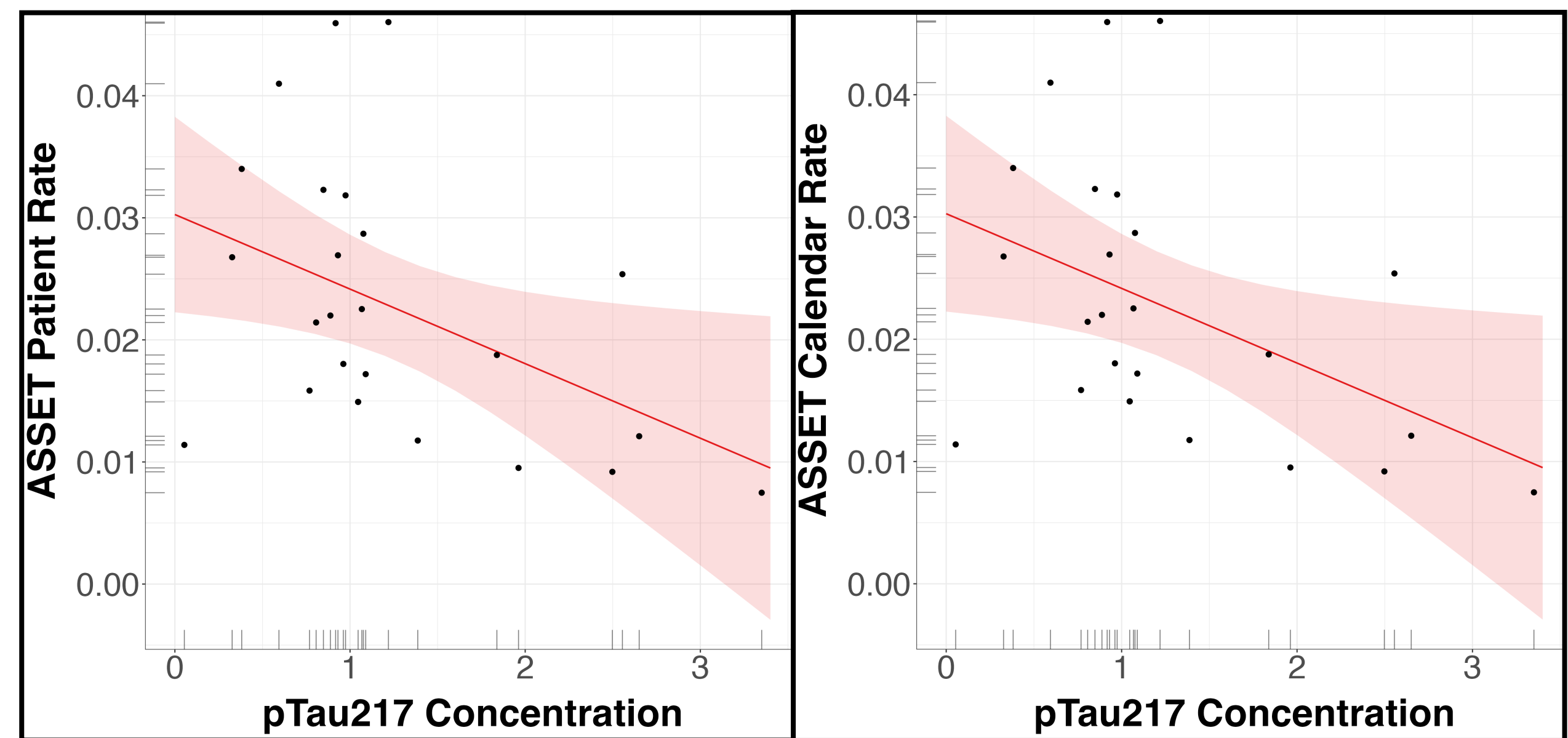


Figures 2a-b: Negative associations between CFI scores and Patient Portal Rate (left), and between CFI scores and Calendar Rate (right)

Exploring Plasma pTau-217 and ASSET

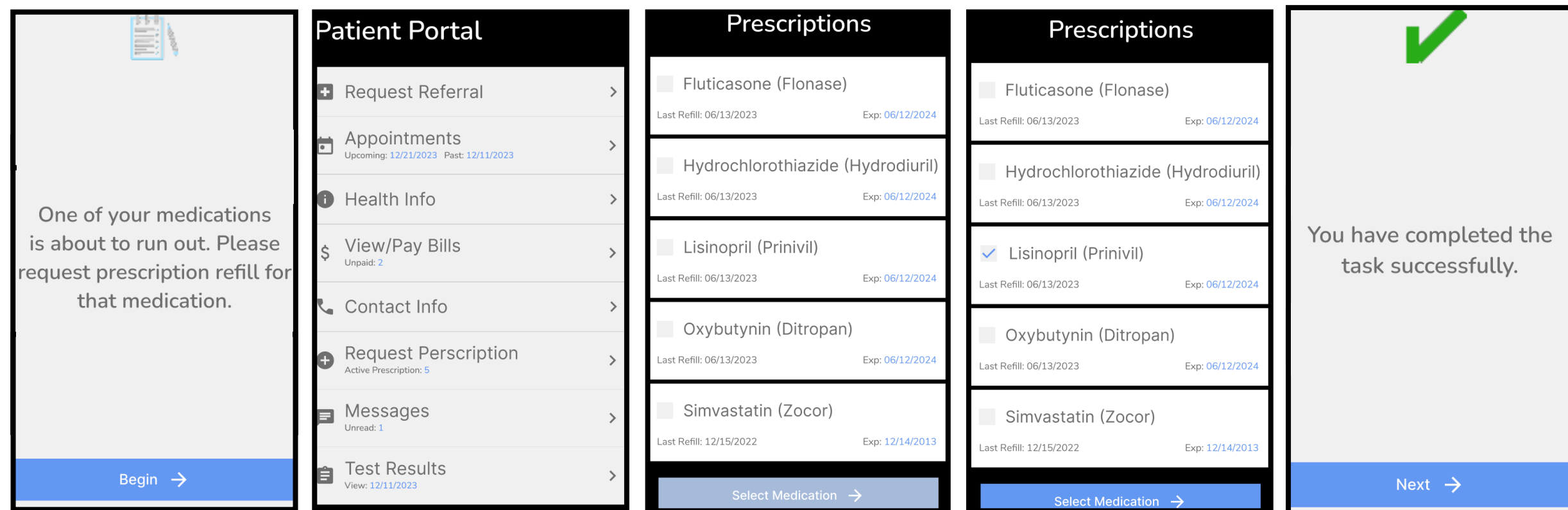
Plasma pTau-217 Concentration Model	n	B[95% CI]	T	P	R ² /R ² adjusted
Patient Portal Rate	25	-0.013 [-0.026 – -0.001]	-2.195	0.038	0.173/ 0.137
Calendar Rate	25	-0.007 [-0.017 – 0.003]	-2.326	0.029	0.190 / 0.155

Table 3: Linear regression models show increased log-transformed plasma pTau-217 concentrations are associated with better performance on ASSET tasks, limited to 3 years or less between measures (unadjusted)



Figures 3a-b: Negative associations between log-transformed plasma pTau-217 concentration and Patient Portal Rate (left), and between log-transformed plasma pTau-217 concentration and Calendar Rate (right)

ASSET Patient Portal Task Example



Figures 4a-e: ASSET Patient Portal prescription refill task sequence

Conclusions

- Higher PACC5 scores are associated with better Patient Portal task performance (b=0.007, 95%CI=[0.002,0.012], p<0.05) and better Calendar task performance (b=0.003, 95%CI=[0.002,0.006], p<0.05).
- Higher self-reported CFI scores are associated with worse Calendar task performance (b=-0.001, 95%CI=[-0.002,0.000], p<0.05).
- Preliminary analyses show decreased plasma pTau-217 is associated with higher ASSET scores, offering a promising future direction.

These results show that better performance on ASSET tasks is associated with better global cognition, fewer subjective cognitive complaints, and lower concentrations of plasma pTau-217 in CU older adults. Therefore, ASSET may provide a way to measure very early functional changes that track with subtle changes in cognition.