**Results**

**Prediction of Cognitive Decline**

In the complete samples of CN, higher PET-BPAD significantly predicted CD in sample 1 (OR = 1.46, 95% CI [1.101, 2.106], p = .018), whereas a positive amyloid status significantly predicted CD (OR = 4.704, 95% CI [1.135, 23.604], p = .041) in sample 2. Classification of CD from only PET-BPAD yielded an AUC of 78% in sample 1. Here, 50% disease probability corresponded to a PET-BPAD of -0.1 years.

Results in the complete samples compared well to those found in the whole samples. Individuals in both stable and the decliner groups, were on average 75 years old (not significantly different between each stable-decliner pair with α = 0.05), and 39 – 41% were female (not significantly different between each stable-decliner pair with α = 0.05), respectively. Importantly, logistic regression models were trained to predict cognitive decline in these samples without access to information or knowledge obtained from the whole samples. Across the two matched sub-samples, FDG-PET- and MRI-BAG were correlated (r­sample1 = .448; psample1 < .0001; rsample2 = .501; psample2 < .0001). In both samples, higher MRI-BAG very significantly predicted CD (sample 1: OR = 1.515, 95% CI [1.276, 1.804], p < 0.0001; sample 2: OR = 1.384, 95% CI [1.180, 1.650], p < 0.0001) together with APOE-ε4 carriership (sample 1: OR = 2.988, 95% CI [1.322, 6.896], p < 0.001; sample 2: OR = 4.706, 95% CI [2.114, 10.957], p < 0.0001). Note that these analyses were conducted on a subset of the whole samples presented in the main manuscript. An MRI-BAG of 1.96 and 2.13 years corresponded to 50.3 and 50% probability of cognitive decline as estimated by the logistic regression model. Stratified by APOE-ε4 carriership, we again observed that APOE-ε4 non-carriers had a higher threshold of MRI-BAG for cognitive decline (sample 1: 3.65 years ≙ 50.8%; sample 2: 4.60 years ≙ 50.2%) compared to APOE-ε4 carriers (sample 1: 0.66 years ≙ 50.8%, -0.23 years ≙ 49.8%).

**FIGURE**

**Fig. S1. Odds ratios of whole sample classification of CD in MCI in sample 1 and 2.** Only predictors marked in orange were significant.

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| Table S2. Estimates (p-values) of logistic regression for prediction of cognitive decline without PET-BPAD in whole samples. | | |
|  | MCI | |
|  | Sample 1  (n = 200) | Sample 2  (n = 200) |
| MRI-BPAD [Years] | .463 (<.0001) | .406 (<.0001) |
| Aβ+ | 1.173 (.03) | .794 (.15) |
| APOE-ε4+ | 1.215 (<.01) | 1.452 (<.0001) |
| Education [Years] | -.067 (.60) | -.058 (.38) |

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| Table S3. Estimates (p-values) of logistic regression for prediction of cognitive decline without MRI-BPAD in whole samples. | | |
|  | MCI | |
|  | Sample 1  (n = 198) | Sample 2  (n = 198) |
| PET-BPAD [Years] | .322 (<.001) | .250 (<.01) |
| Aβ+ | 1.576 (<.01) | 1.045 (<.05) |
| APOE-ε4+ | 1.119 (<.01) | 1.309 (<.001) |
| Education [Years] | -.029 (.658) | -.043 (.48) |

**Methods**

Bias-correction procedure without CA proposed by Cole et al. 31, which Beheshti et al. compared their proposed algorithm to. In this method, a linear regression model is fit on BPA versus CA. Without CA, bias-free brain age is then calculated as:

ADD TABLE FOR BIAS CORRECTION; ADD GRAPHIC OF BIAS CORRECTION; ADD