

Supplemental digital content 1.

Supplementary Table 1A: Baseline Participant Characteristics by 24-Month Follow-Up								
	CN				EMCI			
	With 24 mo Visit	No 24 mo Visit	F or χ^2	p-value	With 24 mo Visit	No 24 mo Visit	F or χ^2	p-value
N	363	55	-	-	242	66	-	-
Age (years)	74.9±5.8	73.7±5.3	1.803	0.180	71.0±7.3	72.0±8.1	0.882	0.348
Sex (% male)	53.0	30.9	9.233	0.002*	55.6	51.5	0.545	0.460
Education (years)	16.4±2.7	15.7±3.0	2.605	0.107	16.1±2.6	15.4±2.7	3.162	0.076
APOE Genotype (%)	-	-	0.322	0.851	-	-	3.421	0.181
<i>$\epsilon 4 -$</i>	72.1	75.5	-	-	56.0	59.7	-	-
<i>$\epsilon 4 +$</i>	25.1	22.6	-	-	35.7	38.7	-	-
<i>$\epsilon 4/\epsilon 4 +$</i>	2.8	1.9	-	-	8.3	1.6	-	-
PSD (%)	10.9	16.5	1.135	0.287	33.3	39.7	0.881	0.348
Sedative/Hypnotic before conversion (%)	7.4	9.1	0.185	0.667	14	11	0.421	0.516
CDRsb	0.0±0.13	0.0±0.15	0.422	0.516	1.2±0.7	1.5±0.8	4.679	0.031*
ADAS-11	5.9±2.9	6.8±3.6	4.563	0.033*	7.8±3.3	8.2±4.2	0.628	0.429
Comorbid Diagnoses								
Hypertension(%)	43.8	56.4	3.040	0.081	48.3	48.5	0.000	0.984
Diabetes(%)	6.6	12.7	2.602	0.107	11.2	9.1	0.231	0.630
CAD (%)	2.8	5.5	1.155	0.282	3.3	3.0	0.013	0.911
GDS	0.8±1.1	0.8±1.1	0.005	0.943	1.8±1.5	1.9±1.6	2.410	0.121

mo = month, PSD = positive sleep disturbance, CDRsb = Clinical Dementia Rating Scale - Sum of Boxes Score, ADAS-11 = Alzheimer's Disease Assessment Scale-Cognitive Subscale, CAD = Coronary Artery Disease, GDS = Geriatric Depression Scale, continuous outcomes presented as mean±standard deviation, F-value from ANOVA, χ^2 from chi-square test, *p < .05

Supplementary Table 1B: Baseline Participant Characteristics by 24-Month Follow-Up								
	LMCI				AD			
	With 24 mo Visit	No 24 mo Visit	F or χ^2	p-value	With 24 mo Visit	No 24 mo Visit	F or χ^2	p-value
N	430	131	-	-	171	171	-	-
Age (years)	73.8±7.6	74.5±7.7	0.877	0.349	75.3±7.7	74.6±7.8	0.737	0.391
Sex (% male)	60.5	63.4	0.354	0.552	53.8	56.7	0.296	0.587
Education (years)	16.0±2.8	15.4±3.2	3.712	0.055	14.8±3.1	15.6±2.8	6.249	0.013*
APOE Genotype (%)	-	-	0.067	0.967	-	-	4.115	0.125
<i>$\epsilon 4 -$</i>	45.6	45.7	-	-	28.7	38.9	-	-
<i>$\epsilon 4 +$</i>	41.2	41.9	-	-	51.5	42.5	-	-
<i>$\epsilon 4/\epsilon 4 +$</i>	13.3	12.4	-	-	19.9	18.6	-	-
PSD (%)	30.5	34.9	0.848	0.357	38.6	50.9	5.216	0.022*
Sedative/Hypnotic before conversion (%)	6.7	3.8	1.511	0.219	6.4	5.8	0.051	0.822
CDRsb	1.7±0.9	1.6±0.9	0.054	0.8	4.3±1.6	4.5±1.7	0.634	0.4
ADAS-11	11.3±4.5	12.1±4.9	2.425	0.120	18.5±6.1	20.3±7.5	5.795	0.017*
Comorbid Diagnoses								
Hypertension(%)	48.1	50.4	0.202	0.653	51.5	49.1	0.187	0.665
Diabetes(%)	7.9	9.2	0.210	0.647	6.4	12.9	4.058	0.044*
CAD (%)	4.0	3.8	0.005	0.944	2.9	2.3	0.114	0.736
GDS	1.6±1.3	1.8±1.5	1.915	0.167	1.7±1.4	1.6±1.5	0.069	0.793

mo = month, PSD = positive sleep disturbance, CDRsb = Clinical Dementia Rating Scale - Sum of Boxes Score, ADAS-11 = Alzheimer's Disease Assessment Scale-Cognitive Subscale, CAD = Coronary Artery Disease, GDS = Geriatric Depression Scale, continuous outcomes presented as mean±standard deviation, F-value from ANOVA, χ^2 from chi-square test, *p < .05

Supplemental Table 2: Significant Contributors to Variance in Cognition over Time					
	Main Explanatory Variable	Covariate	Parameter Estimate	p-value	Interpretation
CN	EF	Education x Time	0.001	0.048	Higher education had a slower ADNI-EF decline.
EMCI	Memory	APOE genotype x Time	-0.009	0.044	Increasing APOE ϵ 4 allele number had a faster ADNI-Mem decline.
	Memory	Age x Time	-0.001	< 0.005	Increasing age had a faster ADNI-Mem decline.
	EF	APOE genotype x Time	-0.012	0.044	Increasing APOE ϵ 4 allele number had a faster ADNI-EF decline.
LMCI	Memory	APOE genotype x Time	-0.014	<0.005	Increasing APOE ϵ 4 allele number had a faster ADNI-Mem decline.
	Memory	Sex x Time	0.002	0.031	Men had a slower ADNI-Mem decline compared to women.
	EF	APOE genotype x Time	-0.009	<0.005	Increasing APOE ϵ 4 allele number had a faster ADNI-EF decline.
	ADAS11	APOE genotype x Time	0.114	<0.005	Increasing APOE ϵ 4 allele number had a faster ADAS-11 increase.
	ADAS11	Sex x Time	0.05	0.010	Men had a slower ADAs-11 increase compared to women.
AD-dementia	Memory	Age x Time	0.001	<0.005	Increasing age had a slower ADNI-Mem decline.
	EF	Age x Time	0.001	<0.005	Increasing age had a slower ADNI-EF decline.
	ADAS11	Age x Time	-0.012	<0.005	Increasing age had a slower ADAS-11 increase.
	ADAS11	Sedative/hypnotic use x Time	0.253	0.008	Use of a sedative/hypnotic had a faster ADAS-11 increase.

CN = cognitively normal, EMCI = early Mild Cognitive Impairment, LMCI = late Mild Cognitive Impairment, AD = Alzheimer's disease, EF = executive function, ADAS-11 = Alzheimer's Disease Assessment Scale-Cognitive Subscale, Parameter estimates and p-values are for the listed covariate that was used in the repeated measures linear mixed model.

Supplemental Table 3A: Effect of Sleep Disturbance on Outcomes of Change in Cognition over Time in Participants without Dementia		
Outcome	Parameter Estimate	<i>p</i>-value
Memory	-0.001	0.221
EF	-0.002	0.417
ADAS-11	0.125	0.119
Supplemental Table 3B: Effect of Sleep Disturbance on Risk of Conversion in Participants without Dementia		
Outcome	HR (95% CI)	<i>p</i>-value
Conversion	0.92 (0.70,1.20)	0.917

ADAS-11 = Alzheimer's Disease Assessment Scale-Cognitive Subscale, EF = Executive Function, PE = parameter estimate, HR = Hazard Ratio, CI = Confidence Interval, PEs are for a repeated measures linear mixed effects model, HRs and 95% CIs are for a Cox proportional hazards model

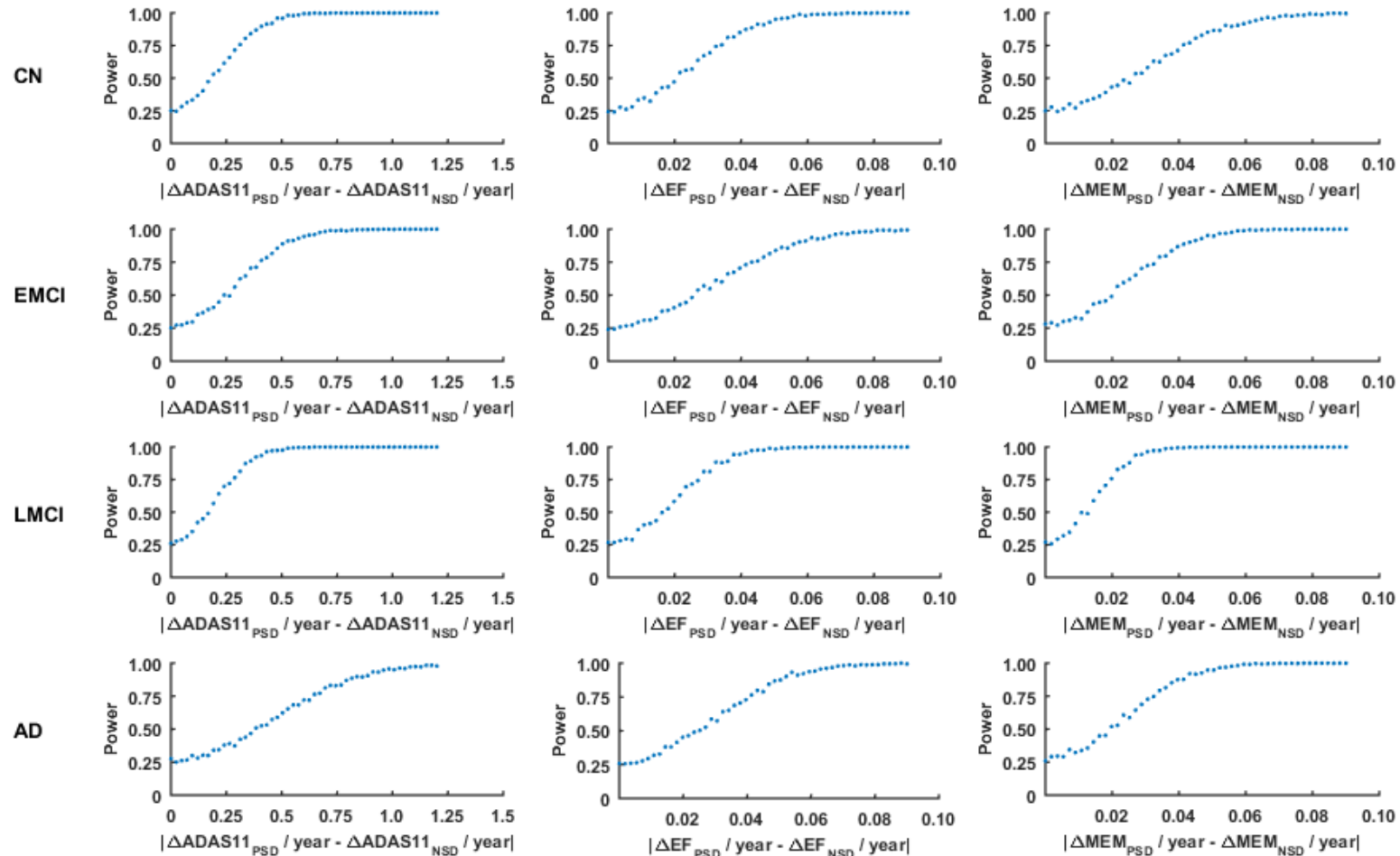
	Covariate	HR (95% CI)	p-value	Interpretation
CM	APOE <i>e4</i>	1.51 (1.10-2.08)	0.011	Increasing APOE ϵ 4 allele number had increased risk of conversion.
	APOE <i>e4e4</i>	4.94 (1.37-17.74)	0.014	Increasing APOE ϵ 4 allele number had increased risk of conversion.
	ADAS-11 Baseline	1.18 (1.05-1.34)	0.005	Higher baseline ADAS-11 score had increased risk of conversion.
EMCI	APOE <i>e4</i>	12.96 (1.64-102.16)	0.015	Increasing APOE ϵ 4 allele number had increased risk of conversion.
	APOE <i>e4e4</i>	19.00 (2.13-169.96)	0.008	Increasing APOE ϵ 4 allele number had increased risk of conversion.
	ADAS-11 Baseline	1.19 (1.02-1.38)	0.032	Higher baseline ADAS-11 score had increased risk of conversion.
LMCI	APOE <i>e4</i>	1.51 (1.10-2.08)	0.011	Increasing APOE ϵ 4 allele number had increased risk of conversion.
	ADAS-11 Baseline	1.12 (1.08-1.15)	<0.005	Higher baseline ADAS-11 score had increased risk of conversion.

CN = cognitively normal, EMCI = early Mild Cognitive Impairment, LMCI = late Mild Cognitive Impairment, AD = Alzheimer's disease, EF = executive function, ADAS-11 = Alzheimer's Disease Assessment Scale-Cognitive Subscale, Parameter estimates and p-values are for the listed covariate that was used in the repeated measures linear mixed model.

	Outcome	90% Power	80% Power	70% Power
CN	Δ ADAS11/year	0.41	0.33	0.28
	Δ EF/year	0.044	0.036	0.031

	Δ Memory/year	0.054	0.045	0.039
EMCI	Δ ADAS11/year	0.52	0.44	0.36
	Δ EF/year	0.057	0.048	0.039
	Δ Memory/year	0.043	0.036	0.029
LMCI	Δ ADAS11/year	0.37	0.31	0.24
	Δ EF/year	0.036	0.029	0.024
	Δ Memory/year	0.026	0.021	0.018
AD-dementia	Δ ADAS11/year	0.87	0.69	0.59
	Δ EF/year	0.052	0.045	0.037
	Δ Memory/year	0.042	0.035	0.029

CN = cognitively normal, EMCI = early Mild Cognitive Impairment, LMCI = late Mild Cognitive Impairment, AD = Alzheimer's disease, EF = executive function, ADAS11 = Alzheimer's Disease Assessment Scale-Cognitive Subscale



Supplemental Figure 1: Power analyses performed with simulation for various cognitive outcomes. Simulations were performed to estimate power over a range of change in cognitive scores per year. CN = cognitively normal, EMCI = early MCI, LMCI = late MCI, AD = Alzheimer's disease, MEM = ADNI memory score, EF = ADNI EF score, ADAS11 = Alzheimer's disease assessment scale-cognitive subscale, PSD = positive sleep disturbance, NSD = negative sleep disturbance