SUPPLEMENTARY MATERIALS

A. Supplementary Tables 1-12

Supplementary Table 1. Psychometric Testing of Cognitively Normal (CDR = 0) Group

	Baseline Assessment (*n* = 88)	Final Assessment (*n* = 88)
PACC, z score (SD)	-0.0962 (0.521)	-0.00995 (0.721)
Free & Cued Selective Reminding Test	-0.227 (0.764)	-0.0227 (1.02)
Delayed Recall Assessment	-0.0796 (0.822)	0.133 (0.9)
Digit Symbol Substitution Test	-0.0557 (1.02)	-0.0922 (1.07)
MMSE	-0.0225 (0.802)	0.0379 (0.861)

Clinical Dementia Rating: CDR; PACC: Preclinical Alzheimer Cognitive Composite; SD: standard deviation; MMSE: Mini-mental state examination

Supplementary Table 2. Psychometric Testing of Cognitively Impaired (CDR > 0) Group

	Baseline Assessment (*n* = 12)	Final Assessment (*n* = 12)
PACC, z score (SD)	-1.11 (1.06)	-1.62 (1.61)
Free & Cued Selective Reminding Test	-1.42 (1.62)	-1.42 (1.73)
Delayed Recall Assessment	-1.34 (1.18)	-1.41 (1.32)
Digit Symbol Substitution Test	-0.867 (1.26)	-1.11 (1.52)
MMSE	-0.678 (1.55)	-2.12 (2.76)

Clinical Dementia Rating: CDR; PACC: Preclinical Alzheimer Cognitive Composite; SD: standard deviation; MMSE: Mini-mental state examination

Supplementary Table 3: Generalized linear mixed models of the relationship between longitudinal PACC scores and total sleep time, sleep efficiency, NREM stage 2 and stage 3, and REM

Generalized Linear Mixed Models

DV: PACC

N=100

Covariate	Time Sleep Time Estimate	Time Sleep Time 95% CI	Sleep Efficiency Estimate	Sleep Efficiency 95% CI	NREM Stage 2 and 3 Estimate	NREM Stage 2 and 3 95% CI	REM Estimate	REM 95% CI
Sleep Parameter	-0.194*	-0.353, -0.035	-0.003	-0.017, 0.012	-0.001	-0.004, 0.001	-0.005	-0.011, 0.0002
CDR	-2.022***	-2.696, -1.349	-2.087***	-2.783, -1.390	-2.093***	-2.786, -1.401	-1.984***	-2.670, -1.298
CSF t-tau/Aβ42	-1.427***	-2.218, -0.635	-1.314**	-2.124, -0.503	-1.336**	-2.145, -0.526	-1.369**	-2.166, -0.573
Age at Sleep Study	-0.008	-0.034, 0.019	-0.016	-0.042, 0.011	-0.012	-0.040, 0.015	-0.016	-0.042, 0.010
Age at PACC	-0.002	-0.013, 0.009	-0.002	-0.013, 0.009	-0.002	-0.013, 0.009	-0.002	-0.013, 0.009
ApoEε4+	0.247	-0.023, 0.517	0.240	-0.038, 0.519	0.242	-0.036, 0.519	0.238	-0.035, 0.511
Sex (male effect)	-0.341**	-0.592, -0.089	-0.278*	-0.533, -0.023	-0.303*	-0.564, -0.042	-0.292*	-0.541, -0.043
Education (years)	0.021	-0.034, 0.075	0.021	-0.035, 0.077	0.021	-0.035, 0.077	0.024	-0.031, 0.078
Intercept	2.050	-0.056, 4.157	1.534	-0.781, 3.848	1.414	-0.676, 3.503	1.761	-0.331, 3.853

DV: Dependent Variable; PACC: Preclinical Alzheimer Cognitive Composite; NREM: non-rapid eye movement; REM: rapid eye movement; CDR: Clinical Dementia Rating; CSF: cerebrospinal fluid; Aβ: amyloid-β; t-tau: total tau; ApoEε4+: apolipoprotein E ε4-positive status; CI: confidence intervals
*p<0.05; **p<0.01; ***p<0.001

Supplementary Table 4: Generalized linear mixed models of the relationship between longitudinal PACC scores and <1 Hz NREM SWA and 1-4.5 Hz NREM SWA

Generalized Linear Mixed Models

DV: PACC

N=100

Covariate	Ln (<1 Hz NREM SWA)		Ln (1-4.5 Hz NREM SWA)	
	Estimate	95% CI	Estimate	95% CI
Sleep Parameter	-0.098	-0.304, 0.107	-0.090	-0.341, 0.161
CDR	-1.878***	-2.557, -1.200	-1.897***	-2.575, -1.218
CSF t-tau/Aβ42	-1.082*	-1.895, -0.269	-1.064*	-1.877, -0.251
Age at Sleep Study	-0.013	-0.039, 0.013	-0.013	-0.039, 0.013
Age at PACC	-0.001	-0.012, 0.010	-0.001	-0.012, 0.010
ApoEε4+	0.161	-0.112, 0.435	0.168	-0.106, 0.441
Sex (male effect)	-0.357*	-0.630, -0.084	-0.346*	-0.624, -0.068
Education (years)	0.019	-0.036, 0.073	0.018	-0.037, 0.072
Intercept	1.495	-0.588, 3.577	1.394	-0.668, 3.456

DV: Dependent Variable; PACC: Preclinical Alzheimer Cognitive Composite; NREM: non-rapid eye movement; SWA: slow wave activity; CDR: Clinical Dementia Rating; CSF: cerebrospinal fluid; Aβ: amyloid-β; t-tau: total tau; ApoEε4+: apolipoprotein E ε4-positive status; CI: confidence intervals
*p<0.05; **p<0.01; ***p<0.001

Supplementary Table 5. Generalized additive models of the relationship between longitudinal MMSE scores and total sleep time and <1 Hz NREM SWA

Generalized Additive Models

DV: MMSE

N=100

	Total Sleep Time		ln (<1 Hz NREM SWA)	
Spline Fit	*EDF*		*EDF*	
Sleep Parameter	2.0184***		1.0006	
Age at PACC	2.2605***		1.7961**	
Participant ID	7.522e-01*		0.7778*	
Covariate	*Estimate*	*95% CI*	*Estimate*	*95% CI*
CDR	-1.683***	-2.127, -1.238	-1.379***	-1.810, -0.949
CSF t-tau/Aβ42	-1.125***	-1.596, -0.654	-0.611*	-1.076, -0.146
Age at Sleep Study	0.026*	0.002, 0.050	0.007	-0.015, 0.030
ApoEε4+	0.141	-0.029, 0.311	0.105	-0.058, 0.269
Sex (male effect)	-0.165*	-0.318, -0.012	-0.125	-0.288, 0.038
Education (years)	0.032	-0.003, 0.067	0.023	-0.011, 0.057
Intercept	-1.796	-3.762, 0.171	-0.344	-2.237, 1.549

DV: Dependent Variable; MMSE: Mini-Mental State Examination; EDF: Effective Degrees of Freedom; NREM: non-rapid eye movement; SWA: slow wave activity; CDR: Clinical Dementia Rating; CSF: cerebrospinal fluid; Aβ: amyloid-β; t-tau: total tau; *ApoEε4+*: apolipoprotein E ε4-positive status; CI: confidence intervals
*p<0.05; **p<0.01; ***p<0.001

Supplementary Table 6. Generalized additive models of the relationship between longitudinal FCSRT scores and total sleep time and <1 Hz NREM SWA

Generalized Additive Models

DV: FCSRT

N=100

	Total Sleep Time		ln (<1 Hz NREM SWA)	
Spline Fit	*EDF*		*EDF*	
Sleep Parameter	2.5717***		1.0004*	
Age at PACC	2.8192***		2.8013***	
Participant ID	6.946e-01		0.7302	
Covariate	*Estimate*	*95% CI*	*Estimate*	*95% CI*
CDR	-1.776***	-2.302, -1.251	-1.505***	-2.046, -0.963
CSF t-tau/Aβ42	-1.225***	-1.740, -0.710	-1.035***	-1.573, -0.498
Age at Sleep Study	0.040**	0.015, 0.066	0.029*	0.002, 0.055
ApoEε4+	0.118	-0.066, 0.302	0.130	-0.058, 0.319
Sex (male effect)	-0.241**	-0.405, -0.078	-0.323***	-0.513, -0.134
Education (years)	0.040*	-0.077, -0.002	-0.036	-0.075, 0.004
Intercept	-1.715	-3.789, 0.360	-0.865	-3.026, 1.296

DV: Dependent Variable; FCSRT: Free and Cued Selective Reminding Test; EDF: Effective Degrees of Freedom; NREM: non-rapid eye movement; SWA: slow wave activity; CDR: Clinical Dementia Rating; CSF: cerebrospinal fluid; Aβ: amyloid-β; t-tau: total tau; *ApoEε4+*: apolipoprotein E ε4-positive status; CI: confidence intervals
*p<0.05; **p<0.01; ***p<0.001

Supplementary Table 7. Generalized additive models of the relationship between longitudinal DSST scores and total sleep time and <1 Hz NREM SWA

Generalized Additive Models

DV: DSST

N=100

	Total Sleep Time		ln (<1 Hz NREM SWA)	
Spline Fit	*EDF*		*EDF*	
Sleep Parameter	1.6736		2.8362***	
Age at PACC	2.7436***		2.7630***	
Participant ID	8.389e-01*		0.8152*	
Covariate	*Estimate*	*95% CI*	*Estimate*	*95% CI*
CDR	-0.731**	-1.191, -0.271	-0.592*	-1.047, -0.137
CSF t-tau/Aβ42	-1.005***	-1.494, -0.516	-1.034***	-1.529, -0.539
Age at Sleep Study	0.045***	0.020, 0.070	0.044***	0.019, 0.068
ApoEε4+	0.327***	0.152, 0.502	0.280**	0.108, 0.453
Sex (male effect)	-0.303***	-0.461, -0.145	-0.440**	-0.611, -0.269
Education (years)	0.014	-0.023, 0.051	0.017	-0.019, 0.054
Intercept	-3.794***	-5.839, -1.750	-3.593***	-5.605, -1.580

DV: Dependent Variable; DSST: Digit Symbol Substitution Test; EDF: Effective Degrees of Freedom; NREM: non-rapid eye movement; SWA: slow wave activity; CDR: Clinical Dementia Rating; CSF: cerebrospinal fluid; Aβ: amyloid-β; t-tau: total tau; *ApoEε4+*: apolipoprotein E ε4-positive status; CI: confidence intervals
*p<0.05; **p<0.01; ***p<0.001

Supplementary Table 8. Generalized additive models of the relationship between longitudinal Logical Memory test scores and total sleep time and <1 Hz NREM SWA

Generalized Additive Models

DV: LM

N=100

	Total Sleep Time		ln (<1 Hz NREM SWA)	
Spline Fit	*EDF*		*EDF*	
Sleep Parameter	1.765***		2.5033849***	
Age at PACC	2.622***		2.6707195***	
Participant ID	6.529e-04		2.612e-04	
Covariate	*Estimate*	*95% CI*	*Estimate*	*95% CI*
CDR	-2.282***	-2.762, -1.801	-2.088***	-2.579, -1.597
CSF t-tau/Aβ42	-1.045***	-1.568, -0.521	-0.625*	-1.176, -0.075
Age at Sleep Study	0.030*	0.001, 0.058	0.009	-0.020, 0.038
ApoEε4+	-0.012	-0.202, 0.178	0.009	-0.185, 0.203
Sex (male effect)	-0.244**	-0.413, -0.074	-0.001	-0.194, 0.192
Education (years)	0.029	-0.009, 0.068	0.014	-0.026, 0.054
Intercept	-2.245	-4.560, 0.069	-0.666	-3.042, 1.709

DV: Dependent Variable; LM: Logical Memory test; EDF: Effective Degrees of Freedom; NREM: non-rapid eye movement; SWA: slow wave activity; CDR: Clinical Dementia Rating; CSF: cerebrospinal fluid; Aβ: amyloid-β; t-tau: total tau; *ApoEε4+*: apolipoprotein E ε4-positive status; CI: confidence intervals
*p<0.05; **p<0.01; ***p<0.001

Supplementary Table 9: Generalized linear mixed models of the relationship between longitudinal MMSE scores and total sleep time and <1 Hz NREM SWA

Generalized Linear Mixed Models

DV: MMSE

N=100

Covariate	Time Sleep Time		ln (<1 Hz NREM SWA)	
	Estimate	95% CI	Estimate	95% CI
Sleep Parameter	-0.163	-0.346, 0.019	0.067	-0.147, 0.280
CDR	-2.126***	-2.914, -1.339	-1.826***	-2.546, -1.107
CSF t-tau/Aβ42	-1.685***	-2.592, -0.779	-1.000*	-1.838, -0.161
Age at Sleep Study	-0.007	-0.040, 0.027	-0.013	-0.043, 0.017
Age at PACC	-0.017	-0.038, 0.005	-0.013	-0.034, 0.008
ApoEε4+	0.237	-0.075, 0.549	0.135	-0.150, 0.421
Sex (male effect)	-0.241	-0.530, 0.049	-0.186	-0.470, 0.098
Education (years)	0.041	-0.022, 0.103	0.025	-0.031, 0.082
Intercept	2.619*	0.196, 5.042	1.641	-0.510, 3.791

DV: Dependent Variable; MMSE: Mini-Mental State Examination; NREM: non-rapid eye movement; SWA: slow wave activity; CDR: Clinical Dementia Rating; CSF: cerebrospinal fluid; Aβ: amyloid-β; t-tau: total tau; ApoEε4+: apolipoprotein E ε4-positive status; CI: confidence intervals
*$p<0.05$; **$p<0.01$; ***$p<0.001$

Supplementary Table 10: Generalized linear mixed models of the relationship between longitudinal FCSRT scores and total sleep time and <1 Hz NREM SWA

Generalized Linear Mixed Models

DV: FCSRT

N=100

Covariate	Time Sleep Time		ln (<1 Hz NREM SWA)	
	Estimate	95% CI	Estimate	95% CI
Sleep Parameter	-0.263*	-0.481, -0.045	-0.169	-0.457, 0.119
CDR	-2.323***	-3.312, -1.334	-2.281***	-3.297, -1.265
CSF t-tau/Aβ42	-1.286*	-2.398, -0.174	-1.172*	-2.309, -0.034
Age at Sleep Study	0.001	-0.036, 0.038	-0.007	-0.044, 0.030
Age at PACC	0.007	-0.012, 0.026	0.008	-0.011, 0.027
ApoEε4+	0.148	-0.225, 0.520	0.094	-0.293, 0.481
Sex (male effect)	-0.306	-0.646, 0.035	-0.320	-0.704, 0.064
Education (years)	-0.037	-0.110, 0.037	-0.030	-0.106, 0.046
Intercept	2.026	-0.827, 4.880	1.481	-1.427, 4.388

DV: Dependent Variable; FCSRT: Free and Cued Selective Reminding Test; NREM: non-rapid eye movement; SWA: slow wave activity; CDR: Clinical Dementia Rating; CSF: cerebrospinal fluid; Aβ: amyloid-β; t-tau: total tau; ApoEε4+: apolipoprotein E ε4-positive status; CI: confidence intervals
*p<0.05; **p<0.01; ***p<0.001

Supplementary Table 11: Generalized linear mixed models of the relationship between longitudinal DSST scores and total sleep time and <1 Hz NREM SWA

Generalized Linear Mixed Models

DV: DSST

N=100

	Time Sleep Time		ln (<1 Hz NREM SWA)	
Covariate	*Estimate*	*95% CI*	*Estimate*	*95% CI*
Sleep Parameter	-0.101	-0.353, 0.151	-0.311	-0.634, 0.012
CDR	-1.161*	-2.222, -0.100	-1.047	-2.111, 0.018
CSF t-tau/Aβ42	-0.987	-2.240, 0.265	-0.997	-2.278, 0.283
Age at Sleep Study	-0.011	-0.053, 0.030	-0.010	-0.050, 0.030
Age at PACC	-0.019**	-0.032, -0.007	-0.019**	-0.032, -0.007
ApoEε4+	0.468*	0.041, 0.895	0.381	-0.049, 0.812
Sex (male effect)	-0.482*	-0.880, -0.084	-0.641**	-1.070, -0.212
Education (years)	0.024	-0.061, 0.110	0.035	-0.051, 0.120
Intercept	2.790	-0.540, 6.121	3.206	-0.075, 6.488

DV: Dependent Variable; DSST: Digit Symbol Substitution Test; NREM: non-rapid eye movement; SWA: slow wave activity; CDR: Clinical Dementia Rating; CSF: cerebrospinal fluid; Aβ: amyloid-β; t-tau: total tau; *ApoEε4+*: apolipoprotein E ε4-positive status; CI: confidence intervals
*p<0.05; **p<0.01; ***p<0.001

Supplementary Table 12: Generalized linear mixed models of the relationship between longitudinal Logical Memory Test scores and total sleep time and <1 Hz NREM SWA

Generalized Linear Mixed Models

DV: LM

N=100

Covariate	Time Sleep Time		ln (<1 Hz NREM SWA)	
	Estimate	*95% CI*	*Estimate*	*95% CI*
Sleep Parameter	-0.235*	-0.438, -0.031	0.053	-0.219, 0.324
CDR	-2.514***	-3.380, -1.648	-2.444***	-3.342, -1.546
CSF t-tau/Aβ42	-1.278*	-2.285, -0.271	-0.889	-1.956, 0.178
Age at Sleep Study	-0.007	-0.044, 0.029	-0.017	-0.053, 0.020
Age at PACC	0.029**	0.008, 0.049	0.030**	0.009, 0.051
ApoEε4+	0.071	-0.277, 0.418	0.026	-0.336, 0.388
Sex (male effect)	-0.283	-0.605, 0.040	-0.190	-0.551, 0.171
Education (years)	0.046	-0.023, 0.116	0.039	-0.033, 0.111
Intercept	-0.337	-3.042, 2.369	-1.408	-4.144, 1.328

DV: Dependent Variable; LM: Logical Memory Test; NREM: non-rapid eye movement; SWA: slow wave activity; CDR: Clinical Dementia Rating; CSF: cerebrospinal fluid; Aβ: amyloid-β; t-tau: total tau; *ApoEε4+*: apolipoprotein E ε4-positive status; CI: confidence intervals
*p<0.05; **p<0.01; ***p<0.001

Supplementary Figure 1: Histogram of follow-up intervals for all participants.