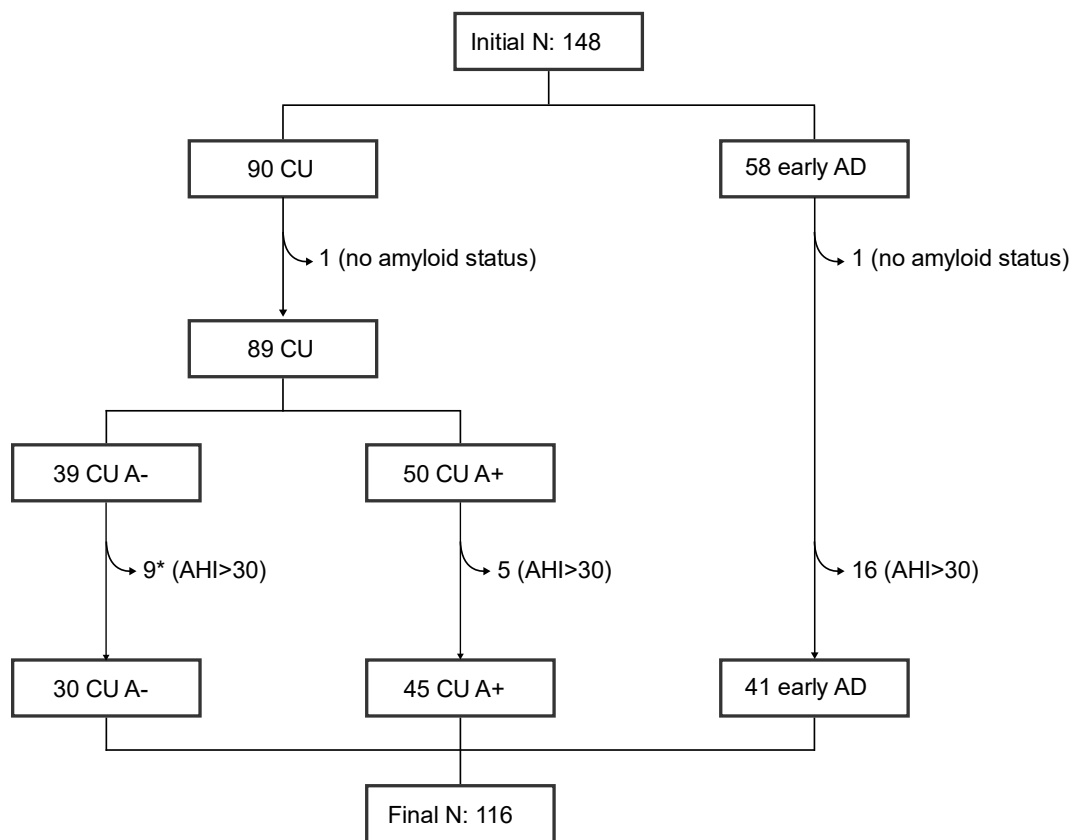


Supplementary material

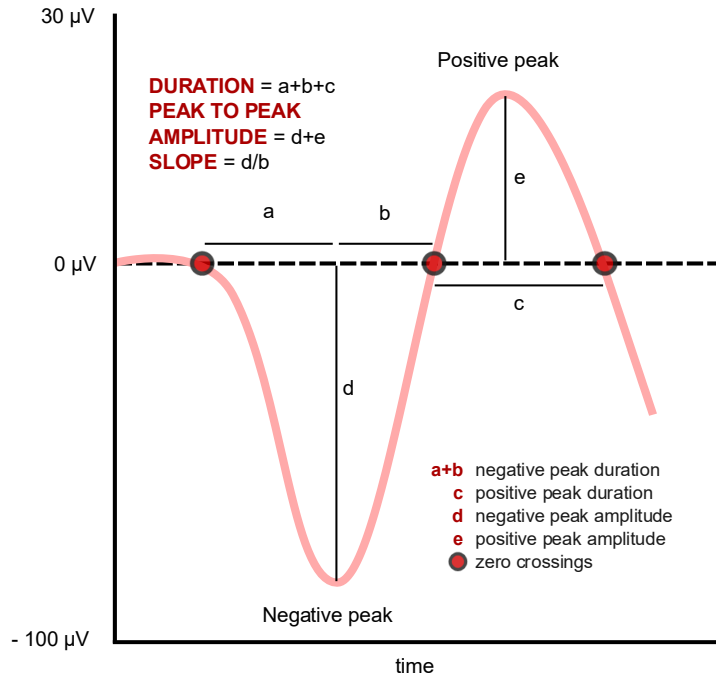
Supplementary figures:

Supplementary Figure 1: flow chart of participants included in the study. CU: cognitively unimpaired, AD: Alzheimer's disease, A-/+: beta-amyloid negative/positive, PSG: polysomnogram



* 1 of them already discarded for having a sweat artifact in the PSG

Supplementary Figure 2: Representation of the slow-wave parameters, adapted from Vallat R. Yet Another Spindles Algorithm (YASA), open-source package released on GitHub under a BSD-3 Clause License. version 0.6.1. Github 2018. <https://github.com/raphaelvallat/yasa> (accessed January 22, 2025).



Supplementary tables:

Supplementary Table 1: Medications taken by 9 early AD patients

	SSRIs	SARIs	NaSSAs	BZDs	AAPs
Patient 1	1	0	0	1	1
Patient 2	1	0	0	1	0
Patient 3	0	1	0	0	1
Patient 4	1	0	0	1	0
Patient 5	1	0	1	0	1
Patient 6	0	0	0	1	0
Patient 7	1	0	1	0	0
Patient 8	0	0	0	1	0
Patient 9	0	0	0	1	0
Total	5	1	2	6	3

SSRIs: Selective serotonin reuptake inhibitors. SARIs: Serotonin antagonist and reuptake inhibitors. NaSSAs: Noradrenergic and specific serotonergic antidepressants. BZDs: Benzodiazepines. AAPs: Atypical Antipsychotics.

Supplementary Table 2: Demographics across AD continuum groups, excluding participants with Prev. TST < 6h

	Descriptive statistics				ANOVA
	Total (n=98)	CU A- (n=26, 26.5%)	CU A+ (n=41, 41.8%)	Early AD (n=31, 31.6%)	P
Age (years)	66.58 ± 5.82	63.91 ± 4.87	66.30 ± 4.42	69.19 ± 7.09	0.002
Sex (female)	58 (59.2)	14 (53.8)	26 (63.4)	18 (58.1)	0.731
APOE (ε4 carrier)	56 (57.1)	11 (42.3)	33 (80.5)	12 (38.7)	0.002
Amyloid (positive)	72 (73.5)	0 (0.0)	41 (100.0)	31 (100.0)	<.001
Education (years)	13.12 ± 3.74	14.62 ± 3.29	13.32 ± 3.85	11.61 ± 3.48	0.008
MMSE (score)	27.44 ± 3.27	28.96 ± 1.25	29.24 ± 1.07	23.67 ± 3.33	<.001
Sleep medication (yes)	7 (7.1)	0 (0.0)	0 (0.0)	7 (22.6)	<.001
Prev. TST (minutes)	433.36 ± 42.46	432.19 ± 43.69	428.50 ± 44.71	440.77 ± 38.50	0.476
Arousal index	17.36 ± 6.92	18.88 ± 6.69	17.69 ± 6.90	15.63 ± 6.99	0.195
Arousal index NREM	18.21 ± 7.74	19.26 ± 7.56	18.19 ± 7.99	17.35 ± 7.69	0.656
AHI (events/h)	11.61 ± 8.03	10.80 ± 8.40	11.67 ± 8.16	12.21 ± 7.74	0.808
- normal (AHI≤5)	25 (25.5)	8 (30.8)	10 (24.4)	7 (22.6)	0.761
- mild OSA (5<AHI≤15)	41 (41.8)	11 (42.3)	16 (39.0)	14 (45.2)	0.871
- moderate OSA (15<AHI≤30)	32 (32.7)	7 (26.9)	15 (36.6)	10 (32.3)	0.712
PLMS index	19.37 ± 30.09	12.21 ± 21.63	19.51 ± 27.65	25.19 ± 37.92	0.270
RBD (cases)	8 (8.2)	3 (11.5)	2 (4.9)	3 (9.7)	0.583

Prev. TST: Previous Total Sleep Time (actigraphy). Continuous measures expressed as mean ± standard deviation. Categorical measures expressed as count (percentage). APOE: Apolipoprotein E, AHI: Apnea-Hypopnea Index, OSA: Obstructive Sleep Apnea, PLMS: Periodic Limb Movements in Sleep, MMSE: Mini-Mental State Examination, RBD: REM sleep Behaviour Disorder. Bold: $p < 0.05$.

Supplementary Table 3: Sleep parameters across AD continuum groups, excluding participants with Prev. TST < 6h

	Descriptive statistics			ANCOVA		Post-hoc comparisons - β [95% CI] p (p-FDR)			Kendall's tau-b			
	Total (n=98)	CU A- (n=26)	CU A+ (n=41)	Early AD (n=31)	p	CU A+ vs CU A-	Early AD vs CU A+	Early AD vs CU A-	τ (p value)			
Macro-architecture												
TST (min)	346.82 $\pm$ 74.14	366.96 $\pm$ 39.36	337.61 $\pm$ 63.75	342.10 $\pm$ 102.82	0.435	-23.00 [-59.76, 13.77]	0.217 (0.650)	13.94 [-21.26, 49.13]	0.434 (0.650)	-9.06 [-49.91, 31.79]	0.661 (0.661)	0.142 (0.964) ^d
WASO (min)	78.37 $\pm$ 57.44	63.12 $\pm$ 28.55	66.43 $\pm$ 39.45	106.95 $\pm$ 81.69	0.013	2.68 [-24.55, 29.92]	0.845 (0.845)	36.09 [10.02, 62.16]	0.007 (0.019)	38.78 [8.52, 69.04]	0.013 (0.019)	0.080 (0.154) ^c
SE (%)	76.69 $\pm$ 15.46	82.63 $\pm$ 8.13	78.26 $\pm$ 12.77	69.63 $\pm$ 20.36	0.036	-3.45 [-10.81, 3.90]	0.353 (0.353)	-6.95 [-13.99, 0.09]	0.053 (0.080)	-10.40 [-18.58, -2.23]	0.013 (0.039)	-0.035 (0.326) ^d
SL (min)	15.44 $\pm$ 31.54	8.02 $\pm$ 7.38	12.98 $\pm$ 27.06	24.92 $\pm$ 45.23	0.346	2.26 [-13.41, 17.93]	0.776 (0.776)	9.37 [-5.63, 24.37]	0.218 (0.327)	11.63 [-5.78, 29.04]	0.188 (0.327)	0.120 (0.064) ^c
REM latency (min)	120.11 $\pm$ 83.15	104.17 $\pm$ 67.71	96.01 $\pm$ 47.67	165.35 $\pm$ 111.24	<.001	-2.58 [-41.39, 36.23]	0.895 (0.895)	78.92 [41.77, 116.07]	<.001 (<.001)	76.34 [33.23, 119.46]	<.001 (0.001)	0.241 (0.001) ^c
REM (min)	59.51 $\pm$ 25.04	67.19 $\pm$ 22.37	56.67 $\pm$ 21.07	56.82 $\pm$ 30.81	0.277	-9.85 [-22.57, 2.86]	0.127 (0.294)	0.59 [-11.59, 12.76]	0.924 (0.924)	-9.27 [-23.40, 4.86]	0.196 (0.294)	0.025 (0.622) ^d
N1 (min)	57.04 $\pm$ 31.08	59.23 $\pm$ 24.09	51.50 $\pm$ 24.99	62.53 $\pm$ 41.59	0.272	-4.71 [-19.93, 10.52]	0.541 (0.541)	11.93 [-2.64, 26.50]	0.107 (0.322)	7.22 [-9.69, 24.13]	0.399 (0.541)	0.094 (0.117) ^c
N2 (min)	175.38 $\pm$ 51.40	184.96 $\pm$ 35.18	170.29 $\pm$ 45.49	174.10 $\pm$ 68.09	0.653	-11.01 [-37.07, 15.05]	0.404 (0.762)	8.35 [-16.60, 33.30]	0.508 (0.762)	-2.66 [-31.62, 26.29]	0.856 (0.856)	0.074 (0.825) ^d
N3 (min)	55.09 $\pm$ 35.37	55.85 $\pm$ 27.95	59.32 $\pm$ 35.12	48.87 $\pm$ 41.03	0.694	2.49 [-14.08, 19.06]	0.766 (0.766)	-6.84 [-22.71, 9.02]	0.394 (0.766)	-4.36 [-22.77, 14.05]	0.639 (0.766)	-0.075 (0.170) ^d
N2+N3 (min)	230.48 $\pm$ 60.87	240.81 $\pm$ 38.88	229.60 $\pm$ 56.81	222.97 $\pm$ 79.15	0.847	-8.52 [-38.32, 21.28]	0.571 (0.917)	1.50 [-27.02, 30.03]	0.917 (0.917)	-7.02 [-40.12, 26.09]	0.675 (0.917)	0.026 (0.627) ^d
Micro-architecture												
SO power (log10, μV^2)	3.37 $\pm$ 0.14	3.41 $\pm$ 0.14	3.36 $\pm$ 0.14	3.34 $\pm$ 0.14	0.063	-0.06 [-0.12, 0.01]	0.073 (0.110)	-0.02 [-0.08, 0.04]	0.422 (0.422)	-0.08 [-0.15, -0.01]	0.022 (0.067)	0.020 (0.600) ^d
Delta power (log10, μV^2)	3.27 $\pm$ 0.15	3.32 $\pm$ 0.15	3.27 $\pm$ 0.14	3.21 $\pm$ 0.15	0.037	-0.05 [-0.12, 0.01]	0.114 (0.171)	-0.04 [-0.11, 0.02]	0.176 (0.176)	-0.10 [-0.17, -0.02]	0.011 (0.032)	-0.049 (0.267) ^d
SWA power (log10, μV^2)	3.60 $\pm$ 0.14	3.65 $\pm$ 0.14	3.60 $\pm$ 0.14	3.56 $\pm$ 0.14	0.025	-0.06 [-0.12, 0.00]	0.055 (0.082)	-0.03 [-0.09, 0.03]	0.254 (0.254)	-0.10 [-0.17, -0.03]	0.007 (0.022)	-0.009 (0.457) ^d
Slow-wave parameters												
Number (SW)	615.42 $\pm$ 507.39	768.77 $\pm$ 490.83	621.93 $\pm$ 536.90	478.19 $\pm$ 455.40	0.137	-164.49 [-390.45, 61.48]	0.152 (0.228)	-86.81 [-303.11, 129.50]	0.428 (0.428)	-251.29 [-502.33, -0.25]	0.050 (0.149)	-0.028 (0.360) ^d
Density (SW/min)	2.64 $\pm$ 1.99	3.07 $\pm$ 1.74	2.72 $\pm$ 2.22	2.17 $\pm$ 1.83	0.206	-0.49 [-1.40, 0.41]	0.281 (0.346)	-0.41 [-1.28, 0.45]	0.346 (0.346)	-0.91 [-1.92, 0.10]	0.076 (0.229)	-0.015 (0.426) ^d
Slope ($\mu V/s$)	334.83 $\pm$ 57.26	366.64 $\pm$ 57.17	341.09 $\pm$ 46.85	299.87 $\pm$ 52.53	<.001	-25.72 [-49.29, -2.15]	0.033 (0.033)	-34.06 [-56.62, -11.50]	0.003 (0.005)	-59.78 [-85.97, -33.60]	<.001 (<.001)	-0.133 (0.046) ^d
PTP amplitude (μV)	94.58 $\pm$ 11.09	99.86 $\pm$ 11.88	95.20 $\pm$ 9.45	89.33 $\pm$ 10.36	0.002	-5.07 [-9.75, -0.39]	0.034 (0.040)	-4.69 [-9.17, -0.21]	0.040 (0.040)	-9.76 [-14.96, -4.56]	<.001 (<.001)	-0.083 (0.146) ^d
Duration (s)	1.26 $\pm$ 0.10	1.22 $\pm$ 0.10	1.25 $\pm$ 0.09	1.32 $\pm$ 0.11	0.011	0.03 [-0.02, 0.07]	0.307 (0.307)	0.05 [0.01, 0.10]	0.021 (0.032)	0.08 [0.03, 0.13]	0.004 (0.012)	0.140 (0.038) ^c

Prev. TST: Previous Total Sleep Time (actigraphy). Measures expressed as mean ± standard deviation. ANCOVA adjusted for age and sex. Beta: mean difference. CI: confidence interval. p-FDR: FDR-corrected p-value (Benjamini-Hochberg). c: Increasing trend. d: Decreasing trend. TST: Total Sleep Time, WASO: Wake After Sleep Onset, SE: Sleep Efficiency, SL: Sleep Latency, REM: Rapid Eye Movement sleep, N1, N2 and N3: non-REM sleep stages, SO: Slow Oscillation, SWA: Slow Wave Activity, SW: slow-wave, PTP: peak to peak amplitude, min: minute, s: second, μV : micro Volts. Bold: $p < 0.05$.

Supplementary Table 4: Demographics across AD continuum groups, excluding participants taking sleep-related medication

	Descriptive statistics				ANOVA	
	Total (n=107)	CU A- (n=30, 28.0%)	CU A+ (n=45, 42.1%)	Early AD (n=32, 29.9%)	P	
Age (years)	66.20 ± 5.90	63.73 ± 4.73	66.06 ± 4.33	68.72 ± 7.67	0.003	
Sex (female)	60 (56.1)	16 (53.3)	28 (62.2)	16 (50.0)	0.532	
APOE (ε4 carrier)	64 (59.8)	12 (40.0)	37 (82.2)	15 (46.9)	<.001	
Amyloid (positive)	77 (72.0)	0 (0.0)	45 (100.0)	32 (100.0)	<.001	
Education (years)	13.18 ± 3.74	14.40 ± 3.39	13.27 ± 3.76	11.91 ± 3.74	0.030	
MMSE (score)	27.61 ± 3.14	28.87 ± 1.28	29.27 ± 1.05	24.00 ± 3.48	<.001	
Sleep medication (yes)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1.000	
Prev. TST (minutes)	422.49 ± 53.47	423.68 ± 53.30	424.26 ± 47.78	418.83 ± 62.35	0.906	
Arousal index	17.41 ± 6.65	18.97 ± 6.89	17.44 ± 6.79	15.91 ± 6.07	0.195	
Arousal index NREM	18.34 ± 7.43	19.66 ± 7.77	18.05 ± 7.81	17.50 ± 6.56	0.495	
AHI (events/h)	11.50 ± 8.12	10.64 ± 8.12	11.62 ± 8.27	12.13 ± 8.09	0.767	
- normal (AHI<=5)	30 (28.0)	9 (30.0)	12 (26.7)	9 (28.1)	0.952	
- mild OSA (5<AHI<=15)	42 (39.3)	13 (43.3)	16 (35.6)	13 (40.6)	0.782	
- moderate OSA (15<AHI<=30)	35 (32.7)	8 (26.7)	17 (37.8)	10 (31.2)	0.590	
PLMS index	17.77 ± 27.37	11.54 ± 20.52	18.42 ± 26.79	22.69 ± 32.96	0.273	
RBD (cases)	9 (8.4)	3 (10.0)	2 (4.4)	4 (12.5)	0.382	

Continuous measures expressed as mean ± standard deviation. Categorical measures expressed as count (percentage). APOE: Apolipoprotein E, Prev. TST: Previous Total Sleep Time (actigraphy), AHI: Apnea-Hypopnea Index, OSA: Obstructive Sleep Apnea, PLMS: Periodic Limb Movements in Sleep, MMSE: Mini-Mental State Examination, RBD: REM sleep Behaviour Disorder. Bold: p < 0.05.

Supplementary Table 5: Sleep parameters across AD continuum groups, excluding participants taking sleep-related medication.

	Descriptive statistics			ANCOVA		Post-hoc comparisons - β [95% CI] p (p-FDR)			Kendall's tau-b	
	Total (n=107)	CU A- (n=30)	CU A+ (n=45)	Early AD (n=32)	P	CU A+ vs CU A-	Early AD vs CU A+	Early AD vs CU A-	τ (p value)	
Macro-architecture										
TST (min)	350.21 ± 72.57	372.03 ± 41.72	342.20 ± 62.96	341.03 ± 100.57	0.405	-22.80 [-56.43, 10.82]	0.182 (0.545)	6.39 [-26.86, 39.64]	0.704 (0.704)	-16.41 [-54.09, 21.27] 0.390 (0.584) 0.115 (0.937) ^d
WASO (min)	76.59 ± 55.01	60.75 ± 29.72	63.91 ± 38.56	109.28 ± 76.37	0.002	1.10 [-22.93, 25.13]	0.928 (0.928)	39.93 [16.16, 63.70]	0.001 (0.004)	41.03 [14.10, 67.96] 0.003 (0.005) 0.146 (0.026) ^c
SE (%)	77.38 ± 15.12	83.31 ± 8.12	79.28 ± 12.64	69.13 ± 19.58	0.007	-2.83 [-9.47, 3.81]	0.400 (0.400)	-8.63 [-15.19, -2.07]	0.010 (0.016)	-11.46 [-18.90, -4.02] 0.003 (0.009) -0.083 (0.136) ^d
SL (min)	15.52 ± 30.94	8.04 ± 7.28	12.16 ± 25.94	27.24 ± 45.34	0.103	1.51 [-12.71, 15.73]	0.833 (0.833)	13.62 [-0.44, 27.68]	0.057 (0.094)	15.13 [-0.80, 31.07] 0.062 (0.094) 0.171 (0.011) ^c
REM latency (min)	117.96 ± 82.09	105.03 ± 65.92	94.59 ± 46.62	162.94 ± 113.37	<.001	-7.83 [-44.36, 28.70]	0.671 (0.671)	75.24 [39.11, 111.36]	<.001 (<.001)	67.40 [26.47, 108.34] 0.001 (0.002) 0.216 (0.002) ^c
REM (min)	59.33 ± 25.40	68.53 ± 22.10	59.42 ± 22.63	50.58 ± 29.35	0.058	-8.01 [-19.81, 3.79]	0.181 (0.181)	-8.10 [-19.77, 3.57]	0.171 (0.181)	-16.11 [-29.33, -2.89] 0.017 (0.052) -0.079 (0.149) ^d
N1 (min)	58.06 ± 31.63	61.43 ± 26.10	51.58 ± 24.04	64.00 ± 43.06	0.245	-6.57 [-20.77, 7.62]	0.360 (0.523)	11.71 [-2.33, 25.75]	0.101 (0.303)	5.14 [-10.77, 21.04] 0.523 (0.523) 0.093 (0.108) ^c
N2 (min)	179.67 ± 54.28	186.15 ± 34.80	174.86 ± 46.83	180.34 ± 75.86	0.760	-8.69 [-34.76, 17.38]	0.510 (0.870)	7.22 [-18.56, 33.00]	0.580 (0.870)	-1.46 [-30.68, 27.75] 0.921 (0.921) 0.057 (0.776) ^d
N3 (min)	53.36 ± 34.68	56.17 ± 28.17	56.49 ± 35.28	46.31 ± 39.12	0.835	0.37 [-14.88, 15.62]	0.962 (0.962)	-4.37 [-19.46, 10.71]	0.566 (0.962)	-4.00 [-21.10, 13.09] 0.643 (0.962) -0.040 (0.298) ^d
N2+N3 (min)	233.02 ± 58.69	242.32 ± 41.38	231.35 ± 54.82	226.66 ± 76.02	0.835	-8.31 [-35.72, 19.09]	0.549 (0.835)	2.85 [-24.25, 29.95]	0.835 (0.835)	-5.47 [-36.18, 25.24] 0.725 (0.835) 0.036 (0.684) ^d
Micro-architecture										
SO power (log10, μV^2)	3.36 ± 0.15	3.41 ± 0.14	3.36 ± 0.14	3.34 ± 0.16	0.071	-0.07 [-0.13, -0.00]	0.035 (0.077)	-0.00 [-0.06, 0.06]	0.943 (0.943)	-0.07 [-0.14, 0.00] 0.051 (0.077) 0.066 (0.811) ^d
Delta power (log10, μV^2)	3.26 ± 0.15	3.32 ± 0.15	3.27 ± 0.14	3.21 ± 0.15	0.032	-0.06 [-0.12, 0.00]	0.057 (0.085)	-0.03 [-0.09, 0.03]	0.311 (0.311)	-0.09 [-0.16, -0.02] 0.010 (0.031) -0.019 (0.402) ^d
SWA power (log10, μV^2)	3.60 ± 0.15	3.65 ± 0.13	3.59 ± 0.14	3.56 ± 0.16	0.030	-0.07 [-0.13, -0.01]	0.023 (0.035)	-0.01 [-0.07, 0.04]	0.641 (0.641)	-0.08 [-0.15, -0.02] 0.015 (0.035) 0.051 (0.750) ^d
Slow-wave parameters										
Number (SW)	618.07 ± 508.34	789.80 ± 508.44	601.09 ± 519.86	480.94 ± 458.06	0.098	-201.40 [-411.53, 8.73]	0.060 (0.090)	-31.54 [-239.33, 176.25]	0.764 (0.764)	-232.94 [-468.41, 2.54] 0.052 (0.090) 0.019 (0.598) ^d
Density (SW/min)	2.62 ± 1.99	3.14 ± 1.76	2.61 ± 2.16	2.13 ± 1.88	0.163	-0.65 [-1.48, 0.19]	0.126 (0.190)	-0.21 [-1.04, 0.62]	0.614 (0.614)	-0.86 [-1.80, 0.08] 0.071 (0.190) 0.024 (0.624) ^d
Slope ($\mu V/s$)	337.33 ± 57.51	369.70 ± 56.17	341.99 ± 46.79	300.43 ± 52.91	<.001	-27.36 [-49.32, -5.40]	0.015 (0.015)	-31.64 [-53.36, -9.92]	0.005 (0.007)	-59.00 [-83.61, -34.39] <.001 (<.001) -0.118 (0.059) ^d
PTP amplitude (μV)	94.77 ± 11.03	100.29 ± 11.43	95.20 ± 9.54	88.98 ± 10.01	<.001	-5.40 [-9.66, -1.15]	0.013 (0.020)	-4.36 [-8.57, -0.15]	0.042 (0.042)	-9.77 [-14.54, -5.00] <.001 (<.001) -0.069 (0.180) ^d
Duration (s)	1.25 ± 0.10	1.22 ± 0.10	1.25 ± 0.09	1.30 ± 0.11	0.022	0.02 [-0.02, 0.07]	0.305 (0.305)	0.05 [0.00, 0.09]	0.041 (0.062)	0.07 [0.02, 0.12] 0.007 (0.021) 0.123 (0.051) ^c

Measures expressed as mean ± standard deviation. ANCOVA adjusted for age and sex. Beta: mean difference, CI: confidence interval, p-FDR: FDR-corrected p-value (Benjamini-Hochberg). c: Increasing trend, d: Decreasing trend. TST: Total Sleep Time, WASO: Wake After Sleep Onset, SE: Sleep Efficiency, SL: Sleep Latency, REM: Rapid Eye Movement sleep, N1, N2 and N3: non-REM sleep stages, SW: Slow Wave Activity, SWA: Slow Wave Activity, SW: slow-wave, PTP: peak to peak amplitude, min: minute, s: second, μV : micro Volts. Bold: p < 0.05.

Supplementary Table 6: Demographics across sex

	Descriptive statistics			ANOVA
	Total (n=116)	Men (n=50, 43.1%)	Women (n=66, 56.9%)	p
Age (years)	66.42 ± 5.82	66.40 ± 5.97	66.44 ± 5.75	0.974
APOE (ε4 carrier)	69 (59.5)	30 (60.0)	39 (59.1)	0.994
Amyloid (positive)	86 (74.1)	36 (72.0)	50 (75.8)	0.808
Education (years)	13.03 ± 3.70	13.76 ± 3.44	12.47 ± 3.81	0.062
MMSE (score)	27.41 ± 3.19	27.34 ± 3.42	27.46 ± 3.02	0.840
Sleep medication (yes)	9 (7.8)	3 (6.0)	6 (9.1)	0.790
Prev. TST (minutes)	420.57 ± 55.34	403.70 ± 55.39	433.64 ± 52.06	0.004
Arousal index	16.98 ± 6.88	17.87 ± 7.07	16.30 ± 6.71	0.225
Arousal index NREM	18.00 ± 7.71	19.34 ± 7.46	16.99 ± 7.79	0.105
AHI (events/h)	11.41 ± 8.13	13.68 ± 8.69	9.68 ± 7.29	0.008
- normal (AHI≤5)	33 (28.4)	13 (26.0)	20 (30.3)	0.763
- mild OSA (5<AHI≤15)	46 (39.7)	15 (30.0)	31 (47.0)	0.097
- moderate OSA (15<AHI≤30)	37 (31.9)	22 (44.0)	15 (22.7)	0.026
PLMS index	19.07 ± 28.90	23.39 ± 28.24	15.80 ± 29.17	0.162
RBD (cases)	9 (7.8)	7 (14.0)	2 (3.0)	0.065
CU A-	30 (25.9)	14 (28.0)	16 (24.2)	0.808
CU A+	45 (38.8)	17 (34.0)	28 (42.4)	0.466
Early AD	41 (35.3)	19 (38.0)	22 (33.3)	0.745

Continuous measures expressed as mean ± standard deviation. Categorical measures expressed as count (percentage). APOE: Apolipoprotein E, Prev. TST: Previous Total Sleep Time (actigraphy), AHI: Apnea-Hypopnea Index, OSA: Obstructive Sleep Apnea, PLMS: Periodic Limb Movements in Sleep, MMSE: Mini-Mental State Examination, RBD: REM sleep Behaviour Disorder. Bold: $p < 0.05$.

Supplementary Table 7: Sleep parameters across sexes

	Descriptive statistics			ANCOVA
	Total (n=116)	Men (n=50, 43.1%)	Women (n=66, 56.9%)	P
Macro-architecture				
TST (min)	348.07 ± 75.12	346.48 ± 78.30	349.27 ± 73.21	0.834
WASO (min)	78.51 ± 57.87	90.42 ± 67.03	69.48 ± 48.43	0.048
SE (%)	76.66 ± 15.79	75.40 ± 16.77	77.61 ± 15.06	0.435
SL (min)	15.53 ± 29.85	12.65 ± 25.50	17.71 ± 32.78	0.362
REM latency (min)	119.17 ± 82.61	114.04 ± 95.09	123.06 ± 72.26	0.563
REM (min)	60.43 ± 25.11	61.11 ± 27.21	59.91 ± 23.59	0.803
N1 (min)	57.16 ± 31.23	67.70 ± 36.16	49.17 ± 24.28	0.001
N2 (min)	177.81 ± 54.72	179.97 ± 56.15	176.17 ± 54.00	0.715
N3 (min)	52.87 ± 35.10	37.88 ± 28.52	64.23 ± 35.54	<.001
N2+N3 (min)	230.68 ± 61.18	217.85 ± 62.38	240.40 ± 58.87	0.045
Micro-architecture				
SO power (log10, μV^2)	3.36 ± 0.14	3.29 ± 0.10	3.42 ± 0.14	<.001
Delta power (log10, μV^2)	3.26 ± 0.15	3.18 ± 0.10	3.31 ± 0.15	<.001
SWA power (log10, μV^2)	3.60 ± 0.14	3.51 ± 0.10	3.66 ± 0.14	<.001
Slow-wave parameters				
Number (SW)	596.72 ± 499.60	346.32 ± 274.33	786.41 ± 547.81	<.001
Density (SW/min)	2.55 ± 1.95	1.56 ± 1.12	3.30 ± 2.11	<.001
Slope ($\mu V/s$)	334.24 ± 57.88	309.72 ± 47.39	352.81 ± 58.50	<.001
PTP amplitude (μV)	94.50 ± 11.08	88.73 ± 7.55	98.87 ± 11.37	<.001
Duration (s)	1.26 ± 0.11	1.27 ± 0.10	1.26 ± 0.11	0.355

Measures expressed as mean ± standard deviation. ANCOVA adjusted for age. TST: Total Sleep Time, WASO: Wake After Sleep Onset, SE: Sleep Efficiency, SL: Sleep Latency, REM: Rapid Eye Movement sleep, N1, N2 and N3: non-REM sleep stages, SO: Slow Oscillation, SWA: Slow Wave Activity, SW: slow-wave, PTP: peak to peak amplitude, min: minute, s: second, μV : micro Volts. Bold: $p < 0.05$.

Supplementary Table 8: Sex interactions in the associations between AD group and sleep parameters

	AD group - Sex interaction		
	beta	CI	p value
Macro-architecture			
TST (min)	11.205	(-24.089, 46.498)	0.531
WASO (min)	-21.26	(-46.892, 4.359)	0.103
SE (%)	1.694	(-5.327, 8.715)	0.634
SL (min)	4.394	(-9.511, 18.299)	0.533
REM latency (min)	-10.83	(-49.157, 27.497)	0.577
REM (min)	6.899	(-4.984, 18.783)	0.252
N1 (min)	0.561	(-13.907, 15.028)	0.939
N2 (min)	-6.661	(-33.126, 19.804)	0.619
N3 (min)	10.439	(-4.949, 25.826)	0.182
N2+N3 (min)	3.778	(-24.873, 32.428)	0.794
Micro-architecture			
SO power (log10, μV^2)	-0.026	(-0.086, 0.034)	0.393
Delta power (log10, μV^2)	-0.029	(-0.089, 0.031)	0.333
SWA power (log10, μV^2)	-0.028	(-0.087, 0.03)	0.337
Slow-wave parameters			
Number (SW)	-92.08	(-298.558, 114.396)	0.379
Density (SW/min)	-0.127	(-0.95, 0.697)	0.761
Slope ($\mu V/s$)	-0.61	(-22.553, 21.334)	0.956
PTP amplitude (μV)	-0.719	(-5.015, 3.577)	0.741
Duration (s)	-0.01	(-0.056, 0.036)	0.668

TST: Total Sleep Time, WASO: Wake After Sleep Onset, SE: Sleep Efficiency, SL: Sleep Latency, REM: Rapid Eye Movement sleep, N1, N2 and N3: non-REM sleep stages, SO: Slow Oscillation, SWA: Slow Wave Activity, SW: slow-wave, PTP: peak to peak amplitude, min: minute, s: second, β : beta coefficient, CI: confidence interval. P value adjusted for age. Bold: $p < 0.05$.

Supplementary Table 9: Sleep parameters across AD continuum groups in men

	Descriptive statistics				ANCOVA		Post-hoc comparisons - β [95% CI] p (p-FDR)			Kendall's tau-b	
	Total (n=50)	CU A- (n=14)	CU A+ (n=17)	Early AD (n=19)	p		CU A+ vs CU A-	Early AD vs CU A+	Early AD vs CU A-	τ (p value)	
Macro-architecture											
TST (min)	346.48 ± 78.30	375.21 ± 30.93	338.00 ± 58.46	332.89 ± 109.80	0.404		-33.23 [-89.47, 23.01] 0.240 (0.361)	-0.60 [-52.75, 51.56] 0.982 (0.982)	-33.83 [-89.80, 22.14] 0.230 (0.361)	0.124 (0.868) ^d	
WASO (min)	90.42 ± 67.03	64.54 ± 27.09	66.65 ± 32.03	130.76 ± 89.54	0.005		0.18 [-43.90, 44.27] 0.993 (0.993)	61.94 [21.05, 102.82] 0.004 (0.010)	62.12 [18.24, 106.00] 0.007 (0.010)	0.241 (0.015)^c	
SE (%)	75.40 ± 16.77	83.11 ± 6.96	77.71 ± 12.08	67.64 ± 22.04	0.045		-4.78 [-16.29, 6.73] 0.408 (0.408)	-9.35 [-20.03, 1.32] 0.084 (0.127)	-14.13 [-25.59, -2.68] 0.017 (0.050)	-0.069 (0.269) ^d	
SL (min)	12.65 ± 25.50	4.63 ± 1.94	15.32 ± 40.38	16.17 ± 15.74	0.482		9.99 [-8.74, 28.72] 0.288 (0.433)	0.05 [-17.32, 17.42] 0.996 (0.996)	10.04 [-8.60, 28.68] 0.284 (0.433)	0.190 (0.044)^c	
REW latency (min)	114.04 ± 95.09	94.04 ± 73.45	79.12 ± 22.87	160.03 ± 128.68	0.016		-11.59 [-76.97, 53.79] 0.723 (0.723)	84.67 [24.04, 145.31] 0.007 (0.022)	73.08 [8.01, 138.15] 0.029 (0.043)	0.188 (0.046)^c	
REM (min)	61.11 ± 27.21	71.25 ± 24.99	62.82 ± 23.19	52.10 ± 30.31	0.201		-7.58 [-27.07, 11.91] 0.438 (0.438)	-9.77 [-27.84, 8.31] 0.282 (0.424)	-17.35 [-36.74, 2.05] 0.078 (0.235)	-0.136 (0.111) ^d	
N1 (min)	67.70 ± 36.16	72.54 ± 26.30	59.68 ± 29.82	71.32 ± 46.65	0.483		-10.62 [-36.73, 15.49] 0.417 (0.626)	14.18 [-10.04, 38.39] 0.245 (0.626)	3.56 [-22.43, 29.54] 0.784 (0.784)	0.156 (0.081) ^c	
N2 (min)	179.97 ± 56.15	185.29 ± 33.35	173.33 ± 39.99	182.00 ± 79.30	0.833		-11.98 [-54.14, 30.17] 0.570 (0.873)	8.64 [-30.46, 47.74] 0.659 (0.873)	-3.35 [-45.30, 38.61] 0.873 (0.873)	0.077 (0.754) ^d	
N3 (min)	37.88 ± 28.52	46.39 ± 23.98	42.29 ± 28.01	27.66 ± 30.28	0.199		-3.17 [-23.57, 17.24] 0.756 (0.756)	-13.58 [-32.51, 5.34] 0.155 (0.233)	-16.75 [-37.06, 3.56] 0.104 (0.233)	-0.150 (0.089) ^d	
N2+N3 (min)	217.85 ± 62.38	231.68 ± 34.20	215.62 ± 51.98	209.66 ± 84.40	0.672		-15.15 [-61.60, 31.30] 0.515 (0.772)	-4.94 [-48.02, 38.14] 0.818 (0.818)	-20.10 [-66.33, 26.13] 0.386 (0.772)	0.053 (0.682) ^d	
Micro-architecture											
SO power (log10, μV^2)	3.29 ± 0.10	3.32 ± 0.09	3.26 ± 0.10	3.28 ± 0.10	0.248		-0.06 [-0.13, 0.01] 0.110 (0.292)	0.01 [-0.06, 0.08] 0.732 (0.732)	-0.05 [-0.12, 0.02] 0.195 (0.292)	0.077 (0.754) ^d	
Delta power (log10, μV^2)	3.18 ± 0.10	3.23 ± 0.13	3.18 ± 0.08	3.15 ± 0.10	0.134		-0.05 [-0.13, 0.02] 0.166 (0.248)	-0.02 [-0.09, 0.05] 0.517 (0.517)	-0.07 [-0.15, -0.00] 0.049 (0.146)	-0.106 (0.170) ^d	
SWA power (log10, μV^2)	3.51 ± 0.10	3.56 ± 0.10	3.50 ± 0.09	3.50 ± 0.10	0.155		-0.06 [-0.13, 0.01] 0.099 (0.148)	-0.00 [-0.07, 0.06] 0.910 (0.910)	-0.06 [-0.13, 0.01] 0.079 (0.148)	-0.003 (0.489) ^d	
Slow-wave parameters											
Number (SW)	346.32 ± 274.33	495.86 ± 287.40	306.41 ± 193.30	271.84 ± 295.38	0.061		-188.10 [-381.95, 5.76] 0.057 (0.085)	-33.04 [-212.84, 146.75] 0.713 (0.713)	-221.14 [-414.08, -28.21] 0.026 (0.077)	-0.130 (0.121) ^d	
Density (SW/min)	1.56 ± 1.12	2.18 ± 1.29	1.41 ± 0.80	1.23 ± 1.10	0.054		-0.76 [-1.55, 0.02] 0.057 (0.086)	-0.17 [-0.90, 0.56] 0.649 (0.649)	-0.93 [-1.71, -0.14] 0.021 (0.064)	-0.112 (0.157) ^d	
Slope ($\mu V/s$)	309.72 ± 47.39	344.53 ± 45.94	315.88 ± 33.20	278.57 ± 40.08	<.001		-26.05 [-54.36, 2.27] 0.070 (0.070)	-34.37 [-60.63, -8.11] 0.011 (0.017)	-60.42 [-88.59, -32.24] <.001 (<.001)	-0.241 (0.015)^d	
PTP amplitude (μV)	88.73 ± 7.55	94.25 ± 7.98	88.76 ± 5.74	84.63 ± 6.18	0.002		-5.11 [-9.86, -0.36] 0.036 (0.053)	-3.71 [-8.12, 0.69] 0.096 (0.096)	-8.82 [-13.55, -4.10] <.001 (0.001)	-0.186 (0.048)^d	
Duration (s)	1.27 ± 0.10	1.22 ± 0.09	1.25 ± 0.09	1.33 ± 0.10	0.020		0.03 [-0.04, 0.09] 0.467 (0.467)	0.07 [0.00, 0.13] 0.036 (0.054)	0.09 [0.02, 0.16] 0.009 (0.026)	0.269 (0.008)^c	

Measures expressed as mean ± standard deviation. ANCOVA adjusted for age. Beta: mean difference. CI: confidence interval. p-FDR: FDR-corrected p-value (Benjamini-Hochberg). c: increasing trend. d: Decreasing trend. TST: Total Sleep Time. WASO: Wake After Sleep Onset. SE: Sleep Efficiency. SL: Sleep Latency. REM: Rapid Eye Movement sleep. N1, N2 and N3: non-REM sleep stages. SO: Slow Oscillation. SWA: Slow Wave Activity. SW: Slow-wave. PTP: peak to peak amplitude. min: minute, μV : micro Volts. Bold: p < 0.05.

Supplementary Table 10: Sleep parameters across AD continuum groups in women													
	Descriptive statistics			ANCOVA		Post-hoc comparisons - β [95% CI] p (p-FDR)			Kendall's tau-b				
	Total (n=66)	CU A- (n=16)	CU A+ (n=28)	Early AD (n=22)	p		CU A+ vs CU A-	Early AD vs CU A+	Early AD vs CU A-	τ (p value)			
Macro-architecture													
TST (min)	349.27 $\pm$ 73.21	369.25 $\pm$ 50.18	344.75 $\pm$ 66.46	340.50 $\pm$ 93.28	0.792		-15.91 [-62.59, 30.78]	0.498 (0.794)	5.66 [-37.46, 48.77]	0.794 (0.794)	-10.25 [-63.18, 42.68]	0.700 (0.794)	0.059 (0.728) ^d
WASO (min)	69.48 $\pm$ 48.43	57.44 $\pm$ 32.35	62.25 $\pm$ 42.52	87.45 $\pm$ 60.57	0.307		0.76 [-29.67, 31.18]	0.961 (0.961)	20.53 [-7.57, 48.63]	0.149 (0.333)	21.29 [-13.21, 55.78]	0.222 (0.333)	0.056 (0.280) ^c
SE (%)	77.61 $\pm$ 15.06	83.49 $\pm$ 9.25	80.24 $\pm$ 13.10	69.99 $\pm$ 18.01	0.090		-1.58 [-10.61, 7.45]	0.728 (0.728)	-8.32 [-16.67, 0.02]	0.050 (0.087)	-9.90 [-20.15, 0.34]	0.058 (0.087)	-0.101 (0.148) ^d
SL (min)	17.71 $\pm$ 32.78	11.02 $\pm$ 8.88	10.25 $\pm$ 10.95	32.06 $\pm$ 52.84	0.167		-4.25 [-24.41, 15.92]	0.675 (0.675)	17.82 [-0.80, 36.44]	0.060 (0.181)	13.57 [-9.29, 36.44]	0.240 (0.360)	0.123 (0.102) ^c
REM latency (min)	123.06 $\pm$ 72.26	114.66 $\pm$ 59.27	103.98 $\pm$ 54.69	153.45 $\pm$ 91.11	0.029		-5.38 [-50.34, 39.59]	0.812 (0.812)	55.58 [14.05, 97.11]	0.010 (0.029)	50.20 [-0.78, 101.19]	0.053 (0.080)	0.221 (0.011)^c
REM (min)	59.91 $\pm$ 23.59	66.16 $\pm$ 19.75	57.36 $\pm$ 22.45	58.61 $\pm$ 27.50	0.588		-7.94 [-23.28, 7.40]	0.305 (0.753)	2.24 [-11.93, 16.40]	0.753 (0.753)	-5.70 [-23.09, 11.69]	0.514 (0.753)	0.051 (0.699) ^d
N1 (min)	49.17 $\pm$ 24.28	51.72 $\pm$ 22.39	46.66 $\pm$ 18.68	50.52 $\pm$ 31.67	0.734		-6.20 [-22.09, 9.68]	0.438 (0.730)	2.54 [-12.13, 17.21]	0.730 (0.730)	-3.66 [-21.67, 14.35]	0.686 (0.730)	0.007 (0.472) ^c
N2 (min)	176.17 $\pm$ 54.00	186.91 $\pm$ 37.09	175.79 $\pm$ 51.22	168.84 $\pm$ 67.26	0.889		-7.03 [-42.04, 27.98]	0.690 (0.890)	-2.24 [-34.57, 30.09]	0.890 (0.890)	-9.27 [-48.96, 30.42]	0.642 (0.890)	-0.001 (0.495) ^d
N3 (min)	64.23 $\pm$ 35.54	64.72 $\pm$ 29.47	65.11 $\pm$ 36.87	62.75 $\pm$ 39.21	0.809		5.21 [-17.59, 28.01]	0.649 (0.762)	3.20 [-17.86, 24.25]	0.762 (0.762)	8.41 [-17.44, 34.25]	0.518 (0.762)	0.034 (0.639) ^d
N2+N3 (min)	240.40 $\pm$ 58.87	251.62 $\pm$ 45.81	240.90 $\pm$ 55.19	231.59 $\pm$ 71.65	0.995		-1.82 [-39.01, 35.37]	0.922 (0.967)	0.96 [-33.39, 35.30]	0.956 (0.967)	-0.86 [-43.03, 41.30]	0.967 (0.967)	-0.002 (0.491) ^d
Micro-architecture													
SO power (log10, μV^2)	3.42 $\pm$ 0.14	3.48 $\pm$ 0.13	3.41 $\pm$ 0.13	3.39 $\pm$ 0.17	0.178		-0.07 [-0.16, 0.02]	0.121 (0.182)	-0.02 [-0.11, 0.06]	0.614 (0.614)	-0.09 [-0.20, 0.01]	0.077 (0.182)	0.006 (0.524) ^d
Delta power (log10, μV^2)	3.31 $\pm$ 0.15	3.39 $\pm$ 0.12	3.32 $\pm$ 0.14	3.25 $\pm$ 0.16	0.065		-0.06 [-0.15, 0.03]	0.173 (0.173)	-0.06 [-0.15, 0.02]	0.156 (0.173)	-0.12 [-0.23, -0.02]	0.020 (0.061)	-0.075 (0.220) ^d
SWA power (log10, μV^2)	3.66 $\pm$ 0.14	3.73 $\pm$ 0.11	3.65 $\pm$ 0.13	3.61 $\pm$ 0.16	0.083		-0.08 [-0.16, 0.01]	0.096 (0.144)	-0.04 [-0.12, 0.04]	0.353 (0.353)	-0.11 [-0.22, -0.01]	0.028 (0.084)	0.001 (0.505) ^d
Slow-wave parameters													
Number (SW)	786.41 $\pm$ 547.81	1047.00 $\pm$ 526.31	780.00 $\pm$ 574.80	605.05 $\pm$ 469.02	0.267		-205.98 [-543.16, 131.19]	0.227 (0.340)	-104.63 [-416.01, 206.76]	0.504 (0.504)	-310.61 [-692.88, 71.66]	0.109 (0.328)	-0.013 (0.448) ^d
Density (SW/min)	3.30 $\pm$ 2.11	3.98 $\pm$ 1.72	3.35 $\pm$ 2.39	2.74 $\pm$ 1.90	0.392		-0.55 [-1.90, 0.80]	0.419 (0.421)	-0.51 [-1.75, 0.74]	0.421 (0.421)	-1.06 [-2.59, 0.48]	0.174 (0.421)	-0.011 (0.453) ^d
Slope ($\mu V/s$)	352.81 $\pm$ 58.50	391.72 $\pm$ 56.23	357.84 $\pm$ 47.17	318.10 $\pm$ 54.99	0.008		-27.65 [-60.74, 5.44]	0.100 (0.100)	-32.56 [-63.12, -1.99]	0.037 (0.056)	-60.20 [-97.72, -22.68]	0.002 (0.006)	-0.116 (0.115) ^d
PTP amplitude (μV)	98.87 $\pm$ 11.37	105.58 $\pm$ 11.54	99.11 $\pm$ 9.33	93.70 $\pm$ 11.43	0.036		-5.72 [-12.56, 1.11]	0.099 (0.149)	-4.54 [-10.85, 1.77]	0.155 (0.155)	-10.26 [-18.01, -2.52]	0.010 (0.031)	-0.045 (0.322) ^d
Duration (s)	1.26 $\pm$ 0.11	1.21 $\pm$ 0.10	1.24 $\pm$ 0.09	1.31 $\pm$ 0.11	0.086		0.02 [-0.04, 0.08]	0.556 (0.556)	0.06 [-0.00, 0.11]	0.063 (0.094)	0.07 [0.00, 0.15]	0.043 (0.094)	0.117 (0.113) ^c
Measures expressed as mean $\pm$ standard deviation. ANCOVA adjusted for age. Beta: mean difference, CI: confidence interval, p-FDR: FDR-corrected p-value (Benjamini-Hochberg). c: Increasing trend, d: Decreasing trend, TST: Total Sleep Time, WASO: Wake After Sleep Onset, SE: Sleep Efficiency, SL: Sleep Latency, REM: Rapid Eye Movement sleep, M1, N2 and N3: non-REM sleep stages, SW: Slow Oscillation, SWA: Slow Wave Activity, SWP: peak to peak amplitude, min: minute, s: second, μV : micro Volts. Bold: $p < 0.05$													

Measures expressed as mean ± standard deviation. ANCOVA adjusted for age. Beta: mean difference. CI: confidence interval. p-FDR: FDR-corrected p-value (Benjamini-Hochberg). c: increasing trend. d: Decreasing trend. TST: Total Sleep Time. WASO: Wake After Sleep Onset. SE: Sleep Efficiency. SL: Sleep Latency. REM: Rapid Eye Movement sleep. N1, N2 and N3: non-REM sleep stages. SO: Slow Oscillation. SWA: Slow Wave Activity. SW: Slow-wave. PTP: peak to peak amplitude. min: minute, s: second, μV : micro Volts. Bold: $p < 0.05$.