Supplemental Methods

Assessment of circadian motor activity rhythms

We performed both parametric cosinor analysis and nonparametric analysis to assess circadian rhythmicity based on actigraphy. The cosinor analysis (1) fitted a cosine function of 24-hour period with a 12-hour harmonic to each actigraphy recording. Specifically, the target best-of-fit function can be denoted as

$$\tilde{y} = A\cos\left(2\pi\frac{1}{24}t + \theta\right) + A'\cos\left(2\pi\frac{1}{12} + \theta'\right), \quad \text{(S1)}$$

where ***A is defined circadian amplitude and θ acrophase***. To alleviate the impact of inter-individual difference in activity level on circadian amplitude, *A* was further normalized by the standard deviation (SD) of the activity for each individual. The acrophase θ was further converted into clock hour with 0 degree being defined as mid-night (i.e., 00:00) and a full 360-degree cycle being equally distributed across 24 hours (i.e., 15 degree per hour). Since the kernel here was a cosine function, the ***acrophase basically corresponds to the time of peak activity***. The nonparametric analysis did not fit a mathematical function to the data (2). Two metrics, interdaily stability and intradaily variability, were derived from the nonparametric analysis. ***Interdaily stability (IS) measured how similar one 24-hour period is to another, thus being a measure of robustness of daily activity rhythm***. It was calculated based on

$$IS = \frac{n\sum_{h=1}^{24}(\overline{x}_h - \overline{x})^2}{24\sum_{i=1}^{n}(x_i - \overline{x})^2}, \quad \text{(S2)}$$

where x_i is the hourly-resampled actigraphy signal; $\overline{x}_h$ is the average at a specific hour *h* across all days measured, and $\overline{x}$ is the mean of x_i. Higher IS value indicated more day-to-day robustness. ***Intradaily variability (IV) represented how fragmented, or in other words consolidated, the rest-activity rhythm was***. It was calculated using

$$IV = \frac{n\sum_{i=2}^{n}(x_i - x_{i-1})^2}{(n-1)\sum_{i=1}^{n}(x_i - \overline{x})^2}. \quad \text{(S3)}$$

Higher IV value indicated more fragmented rhythm.

Supplemental Results

Circadian/daily activity rhythms at baseline

All four circadian measures at baseline followed approximately a normal distribution (Fig. S1A). Pearson correlation analysis (Fig. S1B) showed that age was negatively correlated with amplitude [*r* = -0·20, 95% CI: (-0·15, -0·26)] and acrophase [*r* = -0·13, 95% CI: (-0·08, -0.19)], and was positively correlated with intradaily variability [*r* = 0·28, 95% CI (0·22, 0·33)], and surprisingly, was positively corrected with interdaily stability [*r* = 0·10, 95% CI: (0·04, 0·16)] as well. Females had higher amplitude [*t* = 4·20; degrees of freedom (DF) = 1182; *p* < 0·0001], higher interdaily stability (*t* = 2·87; DF = 1140; *p* = 0·0044), and lower intradaily variability (*t* = 4·46; DF = 1140; *p* < 0·0001) (Fig. S1C), whereas no significant sex difference in acrophase was found (*t* = 1·64; DF = 1182; *p* = 0·10). Education was not correlated with these baseline circadian measures except for a weak negative correlation with interdaily stability [*r* = -0·07, 95% CI: (-0·01, -0·12)]. All circadian measures were correlated except that amplitude and acrophase were independent (Fig. S1D). There were no statistically significant differences in these circadian measures between *APOE* ε4 carrier and noncarriers (all *p* > 0.10), implying different pathway(s) than circadian degradation through which this specific genetic factor impacts the risk of AD.

Supplemental Discussions

Circadian function, sleep homeostasis, and AD

A previous in laboratory human study have showed that sleep loss may lead to more amyloid accumulation (3). Two recent longitudinal human studies showed that self-reported sleep duration longer than nine hours predicted faster cognitive decline (4)·(5). Together, it is plausible that sleep time and risk of dementia may possess a V-shaped relationship with increased risk in both short and long sleepers, which has been supported by a recent study of women (6). While a standard sleep assessment in this community-based cohort is lacking, we did try to apply validated algorithms to extract certain sleep constructs from actigraphy, including sleep duration and fragmentation index. We did not replicate the effect of sleep duration on incident Alzheimer's dementia. This is probably because our participants were almost at their very late life; most of them did not have regular night sleep, and very few had >9 hours of sleep per night. On the other hand, self-reported sleep duration, as employed in prior studies, and the objectively estimated sleep based on actigraphy might provide different results, i.e., 10-day actigraphy data might only capture habitual sleep in a short period while self-report might be masked/biased by the cognitive status of elderly people. This calls for future studies to examine the differences between self-reported measurements and objective sleep traits.

On the other hand, a previous study of the same cohort (but less participants due to earlier censored dates) reported an association of more fragmented sleep with increased risk of incident Alzheimer's dementia (7). In our adjusted model B (see Supplemental Tables 1 and 2), sleep fragmentation index had no significant influence whereas the significant associations of incident Alzheimer's dementia with circadian amplitude and intradaily variables still help up. It is known that the circadian system orchestrates many diurnal oscillations including the sleep-wake cycle (8); and circadian disturbances can lead to sleep

loss and neurodegenerative diseases including AD (9). Thus, our results suggest that circadian dysfunction may underlie/mediate the effect of fragmented sleep on Alzheimer's risk. We also checked and found no significant interaction effect between sleep fragmentation and circadian measures on incident Alzheimer's dementia. Circadian dysfunction may also play a similar mediator role in the association between physical activity level and Alzheimer's risk (10). This is supported by our finding that the effect of total daily activity level on risk of Alzheimer's dementia was not significant in our adjusted models. Nevertheless, how to fully dissect the complex relationships between sleep, circadian function, cognition, and neurodegeneration in human populations is still a temporary challenge in the field. Other factors such as environmental influence, social activities, and motor pathways (11), further complicates the pathological mechanism underlying the risk for AD.

Supplemental References

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Supplemental Figures

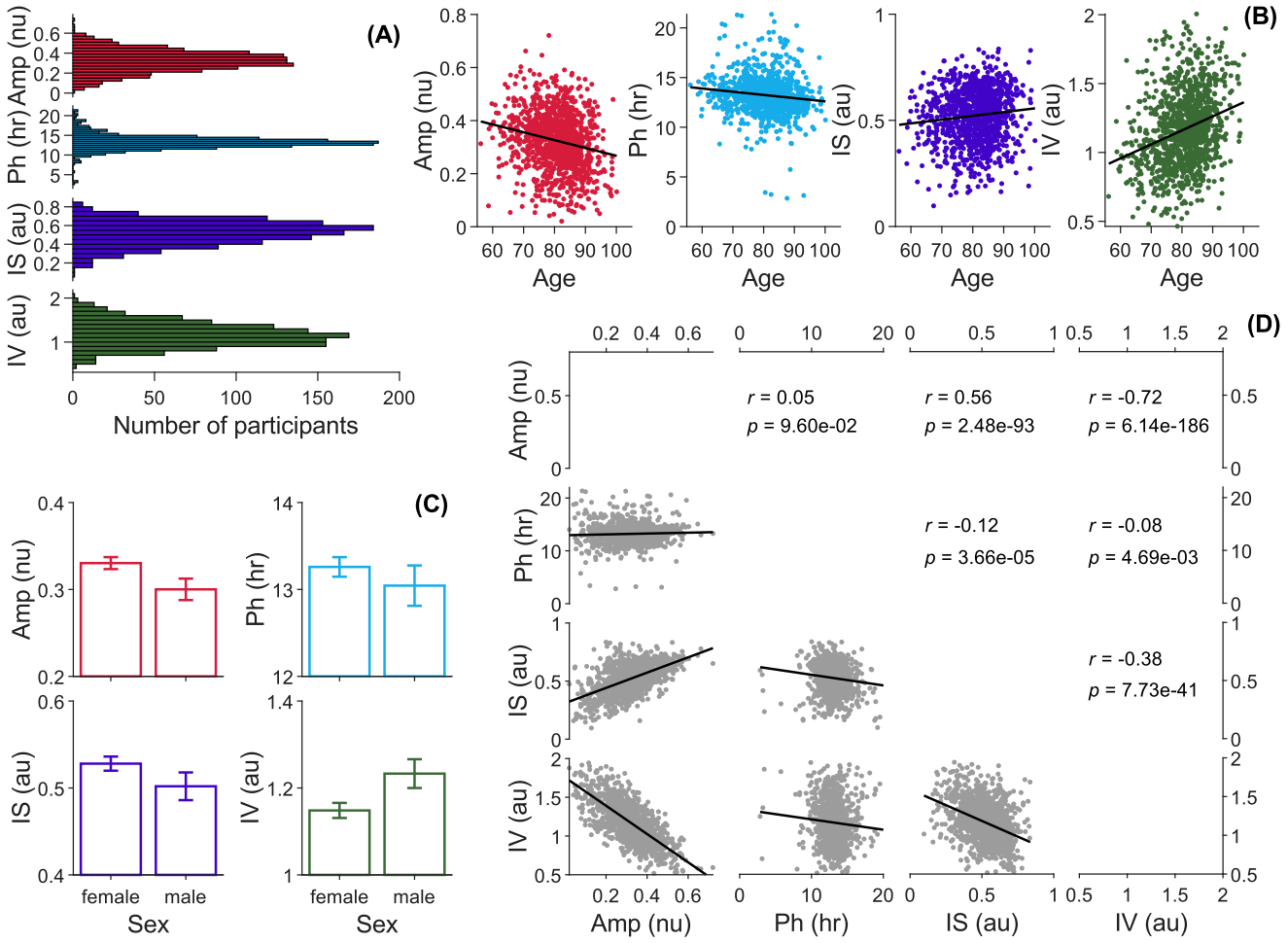

Figure S1. Circadian measures derived from motor activity recordings. **(A)** Baseline distributions of four circadian measures: amplitude of the 24-hour component, acrophase of the 24-hour component, interdaily stability, and intradaily variability. **(B)** Cross-sectional correlations of the four circadian measures with age at baseline. **(C)** Sex difference in the four circadian measures at baseline. **(D)** Pair wise Pearson correlation analysis between circadian measures at baseline (scatter plots and *r*/*p* values are shown separately on the corresponding symmetrical panels along the main diagonal). Abbreviations: Amp = amplitude; Ph = acrophase; IS = interdaily stability; IV = intradaily variability; au = arbitrary unit; nu = normalized unit.

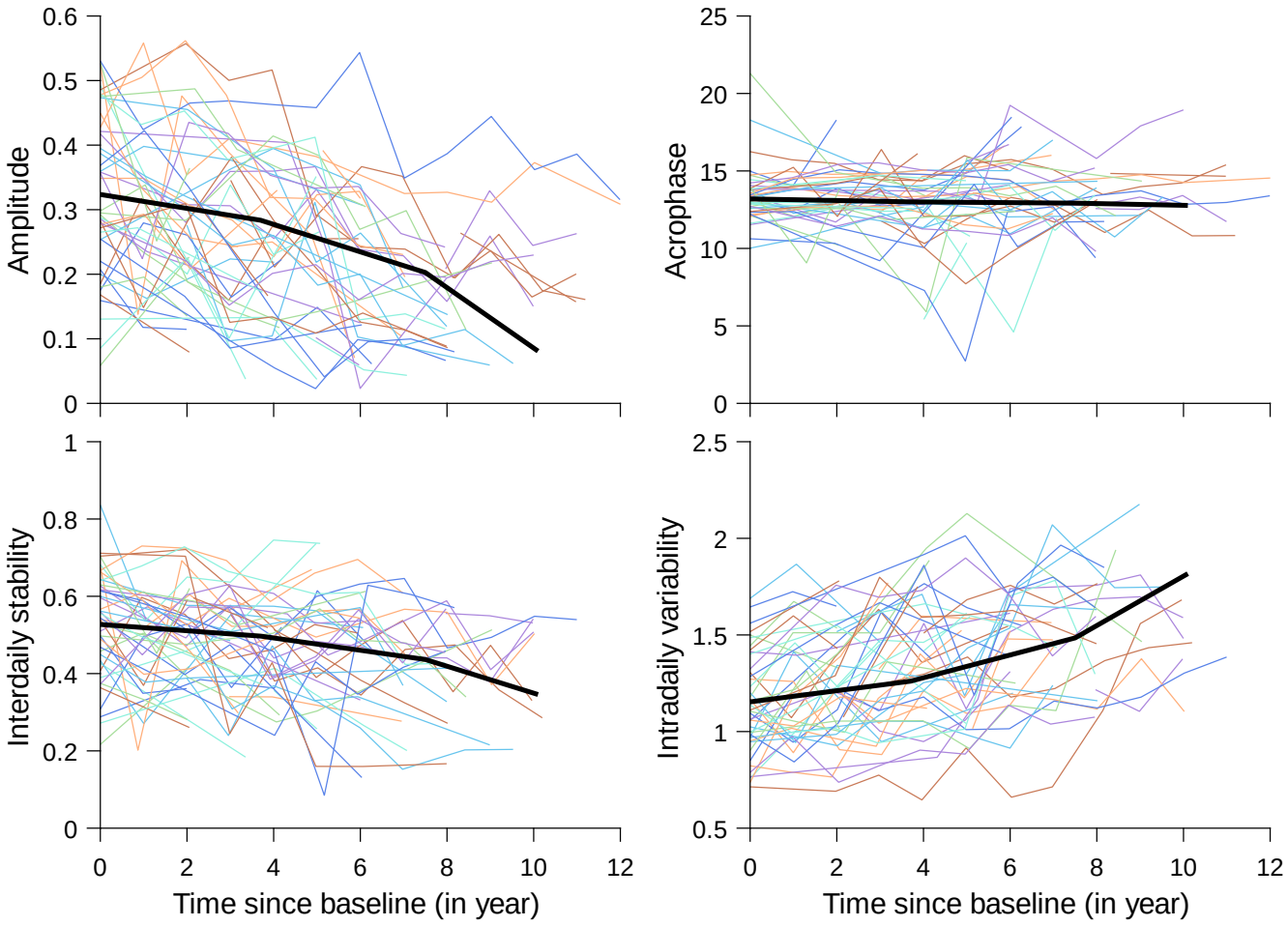

Figure S2. The level of different circadian measures at different follow-up years. Shown are the raw data from 50 participants randomly selected from the complete data set overlaid with the model predicted mean level at different times. Change points represent the mean time intervals between baseline and diagnoses.

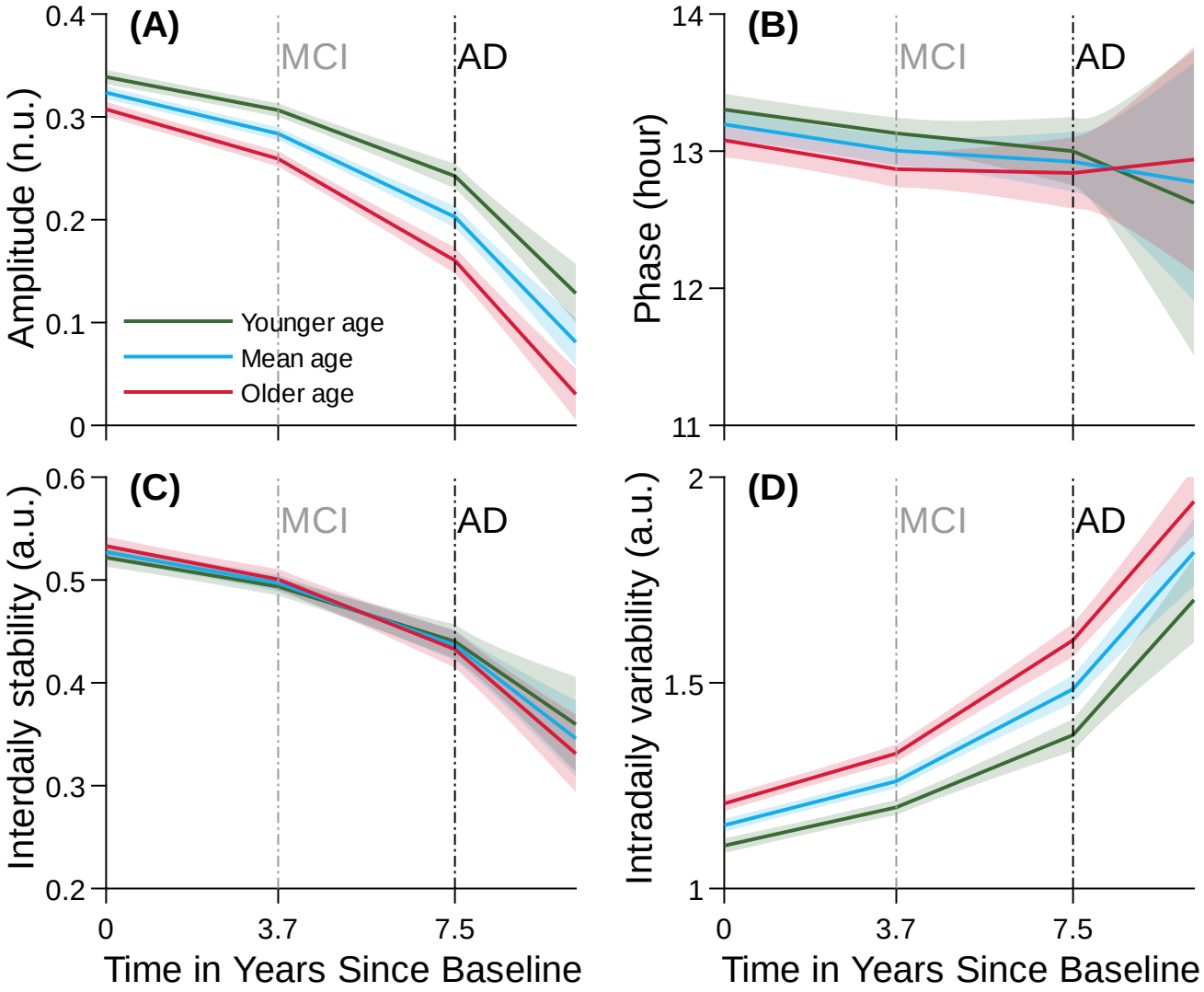

Figure S3. Circadian disturbance interacts with Alzheimer's disease progression in females. Shown are the predicted levels of **(A)** amplitude, **(B)** acrophase, **(C)** interdaily stability (IS), and **(D)** intradaily variability based on mixed models for hypothetical female individuals with younger age (i.e., the 25th percentile of the cohort, 76 years old; green), mean age (81 years old; blue), and older age (i.e., the 75th percentile of the cohort, 86 years old; red) who developed mild cognitive impairment (MCI) and Alzheimer's dementia (AD) 3·7 and 7·5 years, respectively, after baseline. Predicted confidence intervals are shown by filled polygons overlaid on the corresponding predicted means. Age had significant effects on the slopes of amplitude and intradaily variability (see Table S6), as shown by the progressively steeper slopes from younger age to mean age, and to older age in (A) and (D).

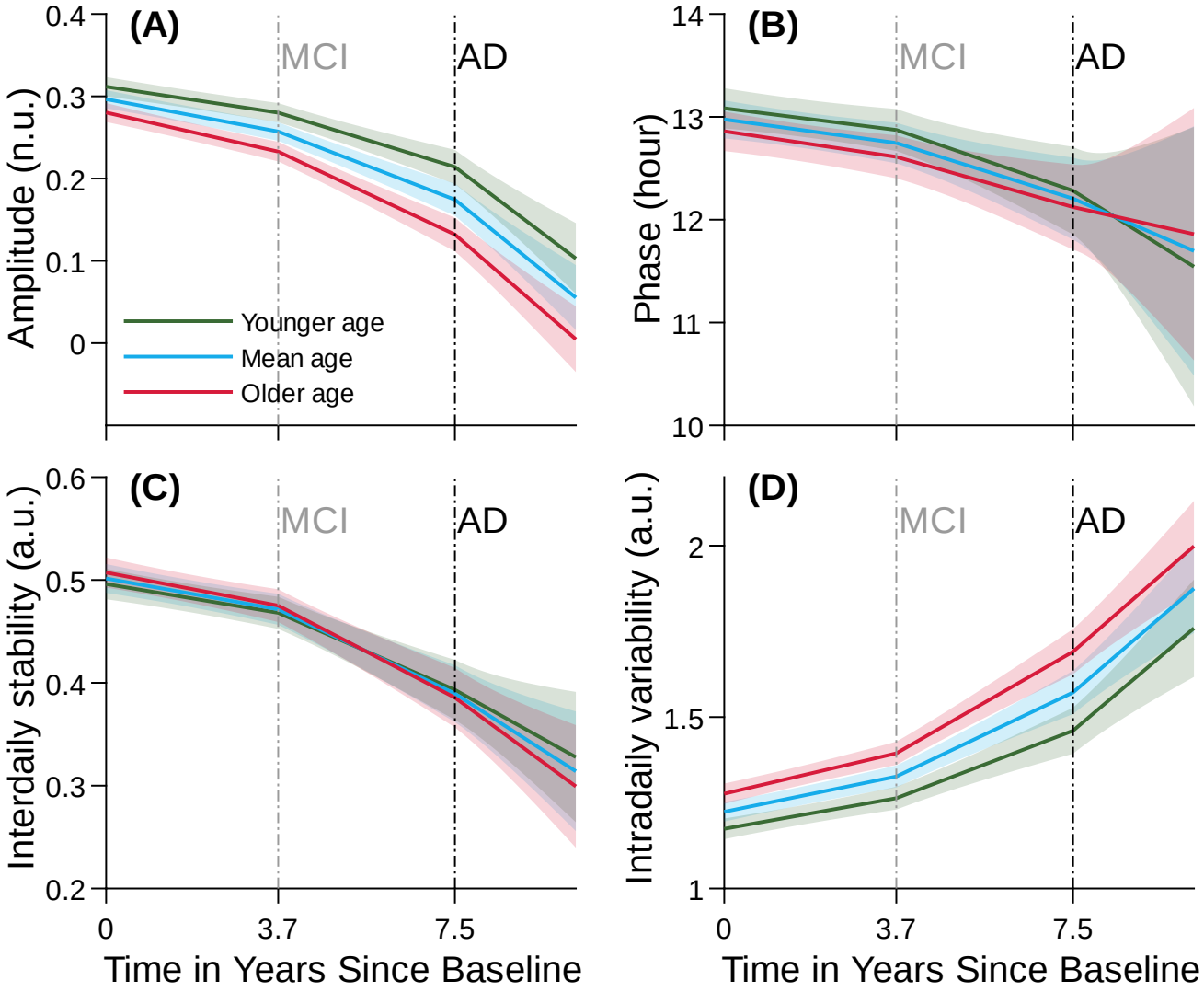

Figure S4. Circadian disturbance interacts with Alzheimer's disease progression in males. Shown are the predicted levels of **(A)** amplitude, **(B)** acrophase, **(C)** interdaily stability (IS), and **(D)** intradaily variability based on mixed models for hypothetical male individuals with younger age (i.e., the 25th percentile of the cohort; green), mean age (blue), and older age (i.e., the 75th percentile of the cohort; red) who developed mild cognitive impairment (MCI) and Alzheimer's dementia (AD) 3·7 and 7·5 years, respectively, after baseline. Predicted confidence intervals are shown by filled polygons overlaid on the corresponding predicted means. Age had significant effects on the slopes of amplitude and intradaily variability (see Table S6), as shown by the progressively steeper slopes from younger age to mean age, and to older age in (A) and (D).

Supplemental Tables

Table S1. Associations of circadian amplitude and incident Alzheimer's dementia with adjustment for covariates. Model A is the core model adjusted for demographics. Models B through G all build on model A by additionally including sleep related covariates (B), total daily activity (C), depressive symptoms (D), comorbidities (E), global cognition (F), and APOE ε4 genotype (G). [a]Results for 1-unit increase. [b]Results for 1-unit decrease. [c]Results for 1-SD decrease. [d]Results for 1-SD increase. Abbreviations: CI = confidential interval; HR = hazard ratio; SD = standard deviation

	Models						
	A	**B**	**C**	**D**	**E**	**F**	**G**
Variables	**HR (95% CI)** ***p* value**	**HR (95% CI)** ***p* value**	**HR (95% CI)** ***p* value**	**HR (95% CI)** ***p* value**	**HR (95% CI)** ***p* value**	**HR (95% CI)** ***p* value**	**HR (95% CI)** ***p* value**
Age[a]	1.11 (1.09-1.14) < 0.0001	1.12 (1.09-1.14) < 0.0001	1.11 (1.09-1.13) < 0.0001	1.11 (1.09-1.13) < 0.0001	1.12 (1.09-1.14) < 0.0001	1.08 (1.06-1.11) < 0.0001	1.12 (1.01-1.10) < 0.0001
Sex (female)	1.12 (0.81-1.56) 0.51	1.15 (0.83-1.63) 0.42	1.13 (0.82-1.58) 0.46	1.07 (0.78-1.51) 0.68	1.10 (0.79-1.54) 0.57	1.59 (1.16-2.24) 0.0034	1.10 (0.80-1.55) 0.57
Education[b]	1.05 (1.00-1.09) 0.030	1.05 (1.00-1.09) 0.030	1.05 (1.01-1.09) 0.028	1.04 (1.00-1.08) 0.073	1.05 (1.01-1.10) 0.025	0.93 (0.89–0.97) 0.0006	1.06 (1.02-1.11) 0.0056
Amplitude[c]	1.39 (1.19-1.62) <0.0001	1.39 (1.18-1.63) <0.0001	1.31 (1.09-1.56) 0.0034	1.34 (1.14-1.56) 0.0003	1.37 (1.17-1.62) 0.0002	1.30 (1.12-1.51) 0.0007	1.36 (1.16-1.60) 0.0002
Amplitude[c] * Age[a]	1.00 (0.99, 1.02) 0.64	1.00 (0.99, 1.02) 0.70	1.00 (0.99, 1.02) 0.59	1.01 (0.99, 1.02) 0.50	1.01 (0.99, 1.03) 0.40	0.99 (0.97, 1.01) 0.33	1.00 (0.99-1.02) 0.76
Amplitude[c] * Sex (female)	0.67 (0.50, 0.90) 0.0087	0.64 (0.47, 0.87) 0.0052	0.66 (0.49, 0.89) 0.0065	0.68 (0.51, 0.91) 0.0091	0.65 (0.48, 0.89) 0.0073	0.68 (0.52, 0.90) 0.0066	0.70 (0.51-0.94) 0.020
Amplitude[c] * Education[b]	1.01 (0.97, 1.05) 0.56	1.02 (0.98, 1.06) 0.37	1.01 (0.97, 1.05) 0.58	1.01 (0.97, 1.05) 0.57	1.01 (0.97, 1.05) 0.66	1.03 (0.99, 1.07) 0.12	1.02 (0.98-1.06) 0.35
Total nighttime sleep duration[a]	-	0.96 (0.86-1.08) 0.53	-	-	-	-	-
Sleep fragmentation index[d]	-	0.99 (0.85-1.13) 0.87	-	-	-	-	-
Total daily activity[c]	-	-	1.13 (0.96-1.35) 0.15	-	-	-	-
Depression (square root transformed)[a]	-	-	-	1.39 (1.20-1.61) < 0.0001	-	-	-
Body mass index[a]	-	-	-	-	0.98 (0.96, 1.01) 0.17	-	-
Vascular diseases[a]	-	-	-	-	1.04 (0.87-1.24) 0.68	-	-
Vascular risk factors[a]	-	-	-	-	1.02 (0.87-1.20) 0.83	-	-
Global cognition[c]	-	-	-	-	-	2.91 (2.54-3.32) < 0.0001	-
APOE ε4 genotype (carriers)	-	-	-	-	-	-	1.46 (1.28-1.66) <0.0001

Table S2. Associations of intradaily variabilityand incident Alzheimer's dementia with adjustment for covariates. Model A is the core model adjusted for demographics. Models B through G all build on model A by additionally including sleep related covariates (B), total daily activity (C), depressive symptoms (D), comorbidities (E), global cognition (F), and APOE ε4 genotype (G). [a]Results for 1-unit increase. [b]Results for 1-unit decrease. [c]Results for 1-SD decrease. [d]Results for 1-SD increase. Abbreviations: CI = confidential interval; HR = hazard ratio; SD = standard deviation

	Models						
Variables	**A** **HR (95% CI)** ***p* value**	**B** **HR (95% CI)** ***p* value**	**C** **HR (95% CI)** ***p* value**	**D** **HR (95% CI)** ***p* value**	**E** **HR (95% CI)** ***p* value**	**F** **HR (95% CI)** ***p* value**	**G** **HR (95% CI)** ***p* value**
Age[a]	1.11 (1.09-1.14) < 0.0001	1.12 (1.09-1.14) < 0.0001	1.11 (1.09-1.14) < 0.0001	1.11 (1.09-1.14) < 0.0001	1.12 (1.09-1.14) < 0.0001	1.08 (1.06-1.11) < 0.0001	1.12 (1.10-1.15) < 0.0001
Sex (female)	1.06 (0.78 -1.47) 0.72	1.09 (0.79-1.54) 0.60	1.08 (0.79-1.50) 0.64	1.03 (0.75-1.45) 0.85	1.04 (0.75-1.45) 0.80	1.54 (1.13-2.16) 0.0062	1.01 (0.74-1.41) 0.94
Education[b]	1.04 (1.00-1.09) 0.053	1.04 (1.00-1.09) 0.053	1.04 (1.00-1.09) 0.042	1.03 (0.99-1.08) 0.14	1.04 (1.00-1.09) 0.062	0.93 (0.89-0.97) 0.0006	1.06 (1.01-1.10) 0.015
Intradaily variability[d]	1.22 (1.04-1.42) 0.017	1.21 (1.02-1.42) 0.028	1.13 (0.95-1.34) 0.17	1.21 (1.03-1.42) 0.020	1.19 (1.01-1.40) 0.043	1.23 (1.06-1.43) 0.0078	1.15 (0.98-1.34) 0.097
Intradaily variability[d] * Age[a]	1.00 (0.98, 1.02) 0.70	1.00 (0.99, 1.02) 0.63	1.00 (0.99, 1.02) 0.62	1.00 (0.99, 1.02) 0.66	1.01 (0.99, 1.03) 0.39	1.00 (0.98, 1.02) 0.97	1.00 (0.99-1.02) 0.62
Intradaily variability[d] * Sex (female)	0.80 (0.59, 1.08) 0.14	0.81 (0.60, 1.11) 0.18	0.77 (0.57, 1.05) 0.096	0.74 (0.54, 1.00) 0.052	0.75 (0.55, 1.02) 0.068	0.67 (0.50, 0.90) 0.0078	0.85 (0.63-1.14) 0.28
Intradaily variability[d] * Education[b]	1.02 (0.97, 1.06) 0.46	1.03 (0.98, 1.08) 0.24	1.01 (0.97, 1.06) 0.54	1.02 (0.97, 1.07) 0.40	1.02 (0.97, 1.06) 0.49	1.03 (0.99, 1.07) 0.096	1.04 (0.99-1.08) 0.13
Total nighttime sleep duration[a]	-	1.05 (0.93-1.18) 0.43	-	-	-	-	-
Sleep fragmentation index[d]	-	1.00 (0.87-1.15) 0.96	-	-	-	-	-
Total daily activity[c]	-	-	1.20 (1.03-1.42) 0.022	-	-	-	-
Depression (square root transformed)[a]	-	-	-	1.44 (1.24-1.67) < 0.0001	-	-	-
Body mass index[a]	-	-	-	-	0.98 (0.96-1.01) 0.21	-	-
Vascular diseases[a]	-	-	-	-	0.99 (0.82-1.18) 0.89	-	-
Vascular risk factors[a]	-	-	-	-	1.01 (0.86-1.19) 0.87	-	-
Global cognition[c]	-	-	-	-	-	2.90 (2.54-3.31) < 0.0001	-
APOE ε4 genotype (carriers)	-	-	-	-	-	-	1.47 (1.28-1.67) < 0.0001

Table S3. Association of circadian regulation and incident Alzheimer's dementia in females. No interactions between circadian measures and demographics are included in these models. [a]Results for 1-unit increase. [b]Results for 1-unit decrease. [c]Results for 1-SD decrease. [d]Results for 1-SD increase. Abbreviations: CI = confidential interval; HR = hazard ratio; SD = standard deviation

Variables	HR (95% CI), *p* value	HR (95% CI), *p* value	HR (95% CI), *p* value	HR (95% CI), *p* value
Age[a]	1.12 (1.09-1.14), <0.0001	1.12 (1.10-1.15), <0.0001	1.12 (1.10-1.15), <0.0001	1.12 (1.09-1.14), <0.0001
Education[b]	1.05 (1.00-1.10), 0.071	1.04 (0.99-1.10), 0.11	1.04 (0.99-1.09), 0.13	1.04 (0.99-1.10), 0.10
Amplitude[c]	1.17 (1.02-1.33), 0.024	-	-	-
Acrophase[a]	-	1.03 (0.95-1.12), 0.43	-	-
Interdaily stability[c]	-	-	1.02 (0.88-1.17), 0.81	-
Intradaily variability[d]	-	-	-	1.12 (0.96-1.30), 0.15

Table S4. Association of circadian regulation and incident Alzheimer's dementia in males. No interactions between circadian measures and demographics are included in these models. [a]Results for 1-unit increase. [b]Results for 1-unit decrease. [c]Results for 1-SD decrease. [d]Results for 1-SD increase. Abbreviations: CI = confidential interval; HR = hazard ratio; SD = standard deviation

Variables	HR (95% CI), *p* value	HR (95% CI), *p* value	HR (95% CI), *p* value	HR (95% CI), *p* value
Age[a]	1.11 (1.06-1.16), <0.0001	1.12 (1.08-1.18), <0.0001	1.13 (1.08-1.18), <0.0001	1.11 (1.06-1.17), <0.0001
Education[b]	1.05 (0.98-1.13), 0.15	1.05 (0.97-1.13), 0.23	1.05 (0.97-1.14), 0.19	1.05 (0.97-1.14), 0.19
Amplitude[c]	1.70 (1.30-2.20), <0.0001	-	-	-
Acrophase[a]	-	1.06 (0.92-1.20), 0.42	-	-
Interdaily stability[c]	-	-	1.19 (0.94-1.50), 0.15	-
Intradaily variability[d]	-	-	-	1.37 (1.05-1.78), 0.023

Table S5. Association of circadian regulation and incident Alzheimer's dementia. No interactions between circadian measures and demographics are included in these models. [a]Results for 1-unit increase. [b]Results for 1-unit decrease. [c]Results for 1-SD decrease. [d]Results for 1-SD increase. Abbreviations: CI = confidential interval; HR = hazard ratio; SD = standard deviation

Variables	**HR (95% CI), *p* value**	**HR (95% CI), *p* value**	**HR (95% CI), *p* value**	**HR (95% CI), *p* value**
Age[a]	1.11 (1.09-1.14), <0.0001	1.12 (1.10-1.14), <0.0001	1.12 (1.10-1.14), <0.0001	1.11 (1.09-1.14), <0.0001
Sex (female)	0.96 (0.73-1.29), 0.80	0.91 (0.68-1.21), 0.50	0.95 (0.72-1.29), 0.74	0.98 (0.73-1.33), 0.92
Education[b]	1.05 (1.01-1.10), 0.021	1.04 (1.00-1.09), 0.045	1.04 (1.00-1.09), 0.044	1.05 (1.00-1.09), 0.032
Amplitude[c]	1.26 (1.12-1.42), 0.0002	-	-	-
Acrophase[a]	-	1.04 (0.97-1.12), 0.27	-	-
Interdaily stability[c]	-	-	1.06 (0.94-1.20), 0.34	-
Intradaily variability[d]	-	-	-	1.17 (1.03-1.34), 0.019

Table S6. Longitudinal changes of circadian metrics with respects to the progression of Alzheimer's disease. Abbreviation: dementia = Alzheimer's dementia; MCI = mild cognitive impairment.

	Amplitude		Acrophase		Interdaily stability		Intradaily variability	
	Estimate (SE)	***p***	**Estimate (SE)**	***p***	**Estimate (SE)**	***p***	**Estimate (SE)**	***p***
Intercept	0.3221 (0.0031)	< 0.0001	13.1730 (0.0530)	< 0.0001	0.5272 (0.0040)	< 0.0001	1.1536 (0.0082)	< 0.0001
Time since baseline	-0.0100 (0.0007)	< 0.0001	-0.0379 (0.0124)	0.0024	-0.0082 (0.0009)	< 0.0001	0.0289 (0.0021)	< 0.0001
Age	-0.0033 (0.0004)	< 0.0001	-0.0225 (0.0064)	0.0004	0.0012 (0.0005)	0.015	0.0108 (0.0010)	< 0.0001
Age * Time since baseline	-0.0004 (0.0001)	< 0.0001	-0.0008 (0.0015)	0.57	-0.0001 (0.0001)	0.28	0.0008 (0.0002)	0.0008
Sex (male)	-0.0272 (0.0064)	< 0.0001	-0.1763 (0.1083)	0.10	-0.0257 (0.0082)	0.0018	0.0700 (0.0168)	< 0.0001
Sex (male) * Time since baseline	-0.0002 (0.0014)	0.90	-0.0179 (0.0262)	0.49	0.0001 (0.0020)	0.98	-0.0011 (0.0044)	0.81
Education	-0.0024 (0.0009)	0.010	-0.0155 (0.0156)	0.32	-0.0026 (0.0012)	0.027	0.0073 (0.0024)	0.0026
Education * Time since baseline	0.0004 (0.0002)	0.037	0.0007 (0.0038)	0.86	0.0004 (0.0003)	0.14	-0.0011 (0.0006)	0.090
Time since MCI	-0.0110 (0.0009)	< 0.0001	0.0156 (0.0180)	0.39	-0.0077 (0.0016)	< 0.0001	0.0300 (0.0038)	< 0.0001
Age * Time since MCI	-0.0005 (0.0001)	< 0.0001	0.0008 (0.0022)	0.73	-0.0003 (0.0002)	0.15	0.0020 (0.0005)	0.0001
Sex * Time since MCI	0.0013 (0.0019)	0.51	-0.0179 (0.0262)	0.49	-0.0057 (0.0032)	0.076	0.0066 (0.0078)	0.40
Education * Time since MCI	0.0002 (0.0003)	0.51	0.0081 (0.0054)	0.14	0.0006 (0.0005)	0.20	-0.0008 (0.0011)	0.46
Time since dementia	-0.0238 (0.0027)	< 0.0001	-0.1300 (0.0549)	0.018	-0.0189 (0.0065)	0.0034	0.0690 (0.0146)	< 0.0001
Age * Time since dementia	-0.0002 (0.0003)	0.42	0.0124 (0.0061)	0.041	-0.0004 (0.0007)	0.52	-0.0024 (0.0016)	0.13
Sex * Time since dementia	0.0014 (0.0050)	0.79	-0.0624 (0.0995)	0.53	0.0115 (0.0107)	0.28	-0.0168 (0.0241)	0.48
Education * Time since dementia	0.0004 (0.0007)	0.58	-0.0188 (0.0144)	0.19	0.0022 (0.0015)	0.14	0.0022 (0.0034)	0.51

Table S7. Correlation of baseline and longitudinal changes in circadian metrics and cognition. Results are shown by correlation (95% confidence interval). In each part of the four parts A through D, the two variables were jointly modeled through a bivariable linear mixed-effects model, and the results shown were the cross-correlation across the four subject-specific random effects. The confidence intervals were estimated by a nonparametric bootstrap approach with 1000 bootstrapped samples. The focus of interest is in the last cell in each part that demonstrates the correlation between subject-specific changes in a circadian metric and in global cognition.

A Circadian amplitude and cognition			
Variable	Baseline amplitude	Change in cognition	Change in amplitude
Baseline cognition	0.17 (0.09, 0.25)	0.38 (0.29, 0.48)	0.28 (0.14, 0.41)
Baseline amplitude	-	0.05 (-0.04, 0.16)	-0.35 (-0.45, -0.22)
Change in cognition	-	-	0.57 (0.46, 0.69)
B Acrophase and cognition			
Variable	Baseline acrophase	Change in cognition	Change in acrophase
Baseline cognition	-0.07 (-0.16, 0.02)	0.38 (0.27, 0.48)	0.06 (-0.14, 0.21)
Baseline acrophase	-	-0.01 (-0.13, 0.11)	-0.27 (-0.48, 0.00)
Change in cognition	-	-	0.02 (-0.21, 0.20)
C Interdaily stability and cognition			
Variable	Baseline interdaily stability	Change in cognition	Change in interdaily stability
Baseline cognition	0.09 (0.01, 0.18)	0.38 (0.27, 0.48)	0.20 (0.06, 0.34)
Baseline interdaily stability	-	0.03 (-0.09, 0.13)	-0.34 (-0.45, -0.19)
Change in cognition	-	-	0.31 (0.14, 0.48)
D Intradaily variability and cognition			
Variable	Baseline intradaily variability	Change in cognition	Change in intradaily variability
Baseline cognition	-0.12 (-0.22, -0.04)	0.37 (0.27, 0.48)	-0.18 (-0.33, -0.03)
Baseline intradaily variability	-	-0.06 (-0.17, 0.04)	-0.23 (-0.37, -0.08)
Change in cognition	-	-	-0.52 (-0.67, -0.38)