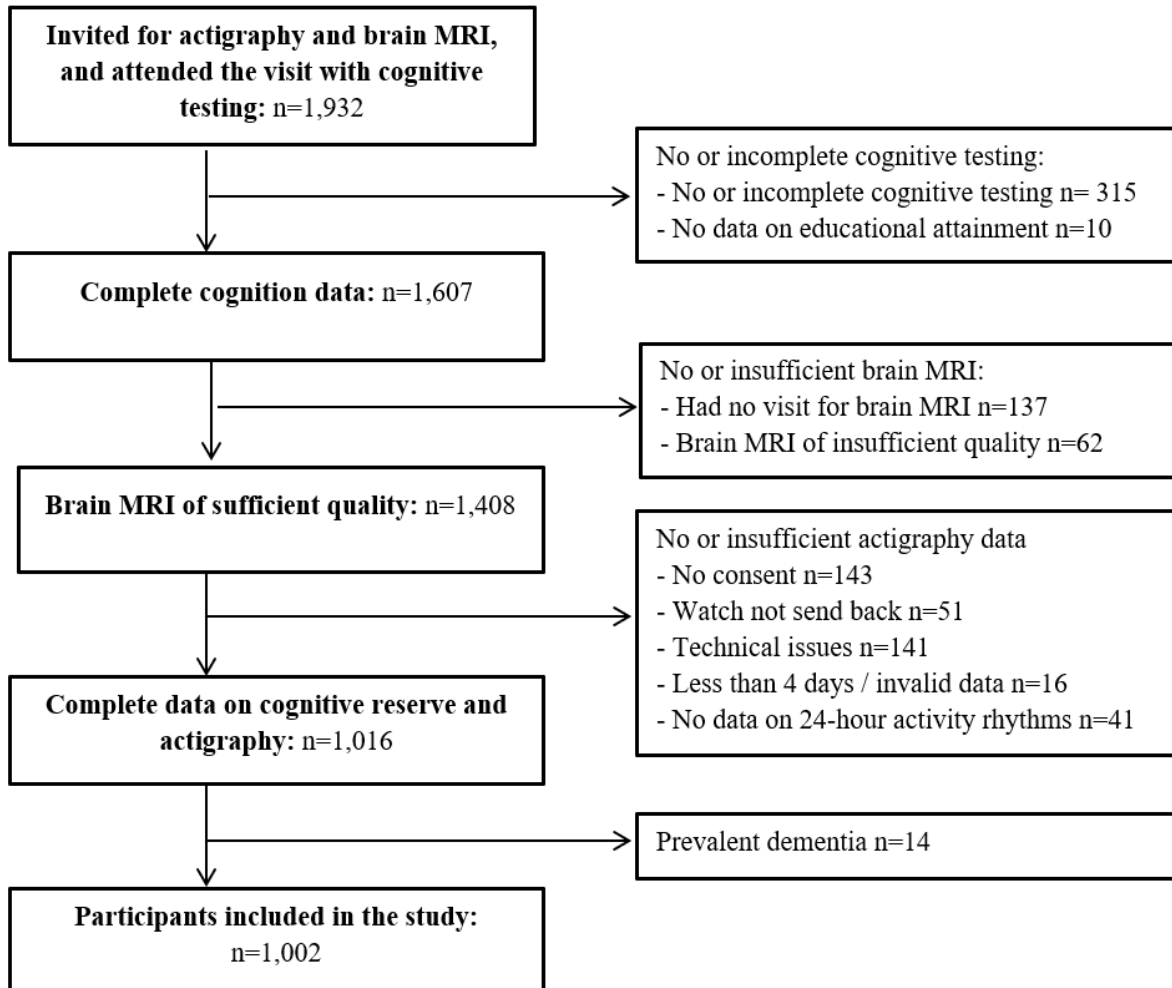


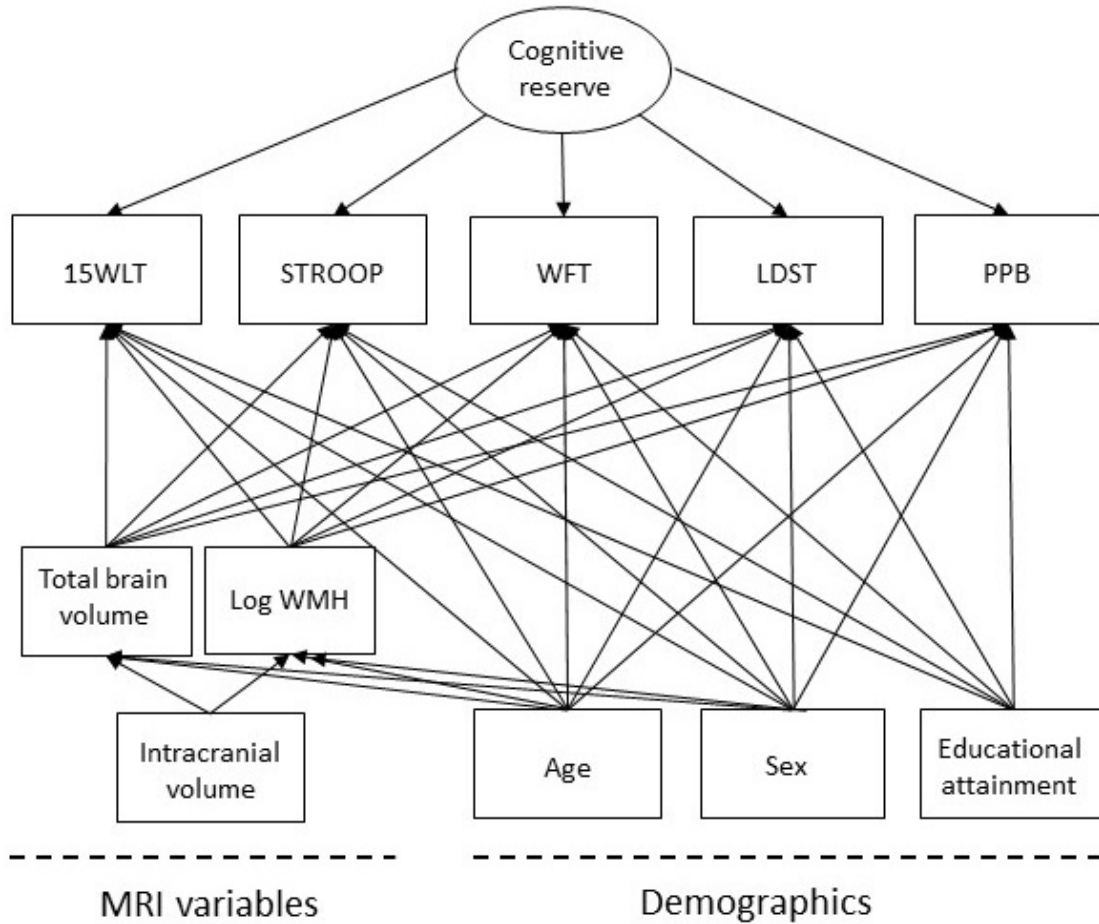
Supplementary Material

Sleep, 24-Hour Activity Rhythms, and Cognitive Reserve: A Population-Based Study

Supplementary Figure 1. Flow diagram of the inclusion process



Supplementary Figure 2. Diagram of the multivariate structural equations model that was fit to quantify cognitive reserve. Rectangles are observed variables and ovals are latent variables. The diagram shows that cognitive reserve was defined as the residual variance of the regressions of five cognitive tests on MRI-scan inferred brain pathology and demographics. For simplicity, the model does not show the correlations among the observed variables.



15WLT, the 15-word learning test; STROOP, Stroop task; WFT, Word fluency test; LDST, Letter-digit substitution task; PPB, Purdue pegboard test; WMH, white matter hyperintensities volume

Supplementary Table 1. Associations of actigraphy-estimated sleep and 24-hour activity rhythms with cognitive reserve when including *APOE* $\epsilon 4$ status as confounder in the analyses (n=1,002).

	Model 2 as in manuscript Mean difference (95%CI)	Model 2 + <i>APOE</i> $\epsilon 4$ Mean difference (95%CI)
<i>Sleep</i>		
Total sleep time, per SD	0.08 (-0.01; 0.16)	0.08 (-0.01; 0.16)
Sleep efficiency, per SD	0.14 (0.05; 0.22)	0.14 (0.05; 0.22)
Sleep onset latency, per SD	-0.16 (-0.24; -0.09)	-0.17 (-0.24; -0.09)
Wake after sleep onset, per SD	-0.06 (-0.14; 0.02)	-0.06 (-0.14; 0.02)
<i>24-hour activity rhythms</i>		
Interdaily stability, per SD	0.05 (-0.03; 0.14)	0.05 (-0.03; 0.14)
Intradaily variability, per SD	-0.03 (-0.11; 0.06)	-0.03 (-0.11; 0.06)
L5-onset, per SD	0.06 (-0.04; 0.17)	0.06 (-0.04; 0.17)
Adjusted per model 2: employment status, body mass index, smoking habits, alcohol intake, coffee consumption, sleep medication, diabetes, hypertension, sleep apnea, depression and time between the cognition, MRI and actigraphy measurements. All variables within the models have been standardized. Statistically significant results are in bold. CI, confidence interval		

Supplementary Table 2. Associations of actigraphy-estimated sleep and 24-hour activity rhythms with cognitive reserve stratified on sex (n=1,002).

	Men	Women
	Mean difference (95%CI)	Mean difference (95%CI)
<i>Sleep</i>		
Total sleep time, per SD	0.10 (-0.02; 0.22)	0.08 (-0.04; 0.21)
Sleep efficiency, per SD	0.10 (-0.14; 0.21)	0.18 (0.05; 0.31)
Sleep onset latency, per SD	-0.14 (-0.25; -0.03)	-0.18 (-0.30; -0.07)
Wake after sleep onset, per SD	-0.07 (-0.19; 0.04)	-0.03 (-0.15; 0.09)
<i>24-hour activity rhythms</i>		
Interdaily stability, per SD	0.10 (-0.02; 0.22)	0.02 (-0.11; 0.16)
Intradaily variability, per SD	-0.08 (-0.19; 0.02)	0.01 (-0.13; 0.16)
L5-onset, per SD	-0.07 (-0.21; 0.06)	0.14 (-0.00; 0.28)

Adjusted per model 2: employment status, body mass index, smoking habits, alcohol intake, coffee consumption, sleep medication, diabetes, hypertension, sleep apnea, depression and time between the cognition, MRI and actigraphy measurements. All variables within the models have been standardized. Statistically significant results are in bold. CI, confidence interval

Supplementary Table 3. Associations of actigraphy-estimated sleep and 24-hour activity rhythms with cognitive reserve stratified on age (n=1,002).

	Age <65 years old	Age ≥65 years old
	Mean difference (95%CI)	Mean difference (95%CI)
<i>Sleep</i>		
Total sleep time, per SD	0.10 (-0.04; 0.24)	0.05 (-0.08; 0.17)
Sleep efficiency, per SD	0.16 (0.02; 0.30)	0.12 (0.00; 0.23)
Sleep onset latency, per SD	-0.18 (-0.30; -0.05)	-0.17 (-0.28; -0.07)
Wake after sleep onset, per SD	-0.07 (-0.20; 0.05)	-0.04 (-0.15; 0.07)
<i>24-hour activity rhythms</i>		
Interdaily stability, per SD	0.14 (-0.00; 0.27)	-0.02 (-0.13; 0.10)
Intradaily variability, per SD	-0.04 (-0.17; 0.09)	-0.01 (-0.13; 0.10)
L5-onset, per SD	0.07 (-0.11; 0.25)	0.03 (-0.08; 0.14)
Adjusted per model 2: employment status, body mass index, smoking habits, alcohol intake, coffee consumption, sleep medication, diabetes, hypertension, sleep apnea, depression and time between the cognition, MRI and actigraphy measurements. All variables within the models have been standardized. Statistically significant results are in bold. CI, confidence interval		

Supplementary Table 4. Associations of actigraphy-estimated sleep and 24-hour activity rhythms with cognitive reserve for all participants with measurements within six months (n=837).

	Model 2
	Mean difference (95%CI)
<i>Sleep</i>	
Total sleep time, per SD	0.09 (-0.01; 0.19)
Sleep efficiency, per SD	0.15 (0.06; 0.25)
Sleep onset latency, per SD	-0.15 (-0.24; -0.07)
Wake after sleep onset, per SD	-0.07 (-0.16; 0.01)
<i>24-hour activity rhythms</i>	
Interdaily stability, per SD	0.01 (-0.11; 0.13)
Intradaily variability, per SD	0.03 (-0.11; 0.17)
L5-onset, per SD	0.03 (-0.12; 0.17)
Adjusted per model 2: Adjusted for employment status, body mass index, smoking habits, alcohol intake, coffee consumption, sleep medication, diabetes, hypertension, sleep apnea, depression and time between the cognition, MRI and actigraphy measurements; All variables within the models have been standardized. Statistically significant results are in bold. CI, confidence interval	

Supplementary Table 5. Associations of actigraphy-estimated sleep and 24-hour activity rhythms with cognitive reserve stratified based on actigraphy device.

	Geneactiv (n=618) Mean difference (95% CI)	Actiwatch (n=384) Mean difference (95% CI)
<i>Sleep</i>		
Total sleep time, per SD	0.05 (-0.06; 0.17)	0.09 (-0.04; 0.23)
Sleep efficiency, per SD	0.10 (-0.01; 0.21)	0.20 (0.04; 0.35)
Sleep onset latency, per SD	-0.15 (-0.25; -0.04)	-0.19 (-0.32; -0.07)
Wake after sleep onset, per SD	-0.00 (-0.11; 0.11)	-0.12 (-0.26; 0.01)
<i>24-hour activity rhythms</i>		
Interdaily stability, per SD	0.07 (-0.05; 0.18)	0.01 (-0.11; 0.13)
Intradaily variability, per SD	-0.04 (-0.16; 0.07)	0.03 (-0.11; 0.17)
L5-onset, per SD	0.11 (-0.04; 0.24)	0.03 (-0.12; 0.17)
Adjusted per model 2: employment status, body mass index, smoking habits, alcohol intake, coffee consumption, sleep medication, diabetes, hypertension, sleep apnea, depression and time between the cognition, MRI and actigraphy measurements; All variables within the models have been standardized. Statistically significant results are in bold. CI, confidence interval		