Supplementary Material

Supplementary Methods

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Insomnia measures

Symptoms related to insomnia were assessed via the questions: “Over the last month, how often did it take you more than 30 minutes to fall asleep?” and “Over the last month, how often did you wake in the middle of the night or too early in the morning and found it difficult to fall asleep again?” Possible responses were: never, less than once per week, once or twice a week, 3–5 times/week, or 6–7 times/week. For each insomnia symptom, participants were also asked: “To what extent do you consider your problem to interfere with your daily functioning (for example, from daytime fatigue, ability to function at work/daily chores, concentration, memory, mood, etc.)?” Possible responses were: not at all, a little, somewhat, much, or very much. They were also asked: “For how long have you had this trouble?” Finally, participants were asked: “How satisfied or dissatisfied are you with your current sleep pattern?” Possible responses were: very satisfied, satisfied, neutral, dissatisfied, very dissatisfied

Neuropsychological data

Executive functions were assessed using the Mental Alternation Test (MAT) [1] and Stroop Test (Victoria version) [2]. The MAT, is a measure of mental flexibility and processing speed, requiring participants to count aloud from 1 to 20 and say the alphabet in alternation between number and letter (i.e., 1-A, 2-B, 3-C, …) as quickly as possible for 30 s, with the number of items attained being the outcome. The Stroop test is a measure of mental speed, inhibition, attention, and mental control and has three parts. In the first part (Stroop 1), the participant was asked to read a list of words printed in different ink colors, and in the second part (Stroop 2), to name the ink color of printed symbols (X’s). In the third part (Stroop 3, interference condition), names of colors were printed in mismatching colored ink, and the participant was asked to quickly name the color of the ink that the words are written in and not to read the words (e.g., say “blue” for the word “green” written in blue ink). For all parts of the Stroop test, the outcome was the

time taken to complete the task. A Stroop interference score was reported and computed as Stroop 3/Stroop 1. Psychomotor speed was assessed with the choice reaction time (CRT) test [3], in which participants were instructed to touch an interactive computer screen as quickly as possible at the location of a box that appears following a 1,000 ms delay. Mean reaction time (in ms) was reported. Individual test scores for the MAT and CRT test were log-transformed prior to analysis to reduce data skewness.

Demographic and lifestyle measures

Language was assessed via the question: "What language do you speak most often at home?". Household income was assessed via the question: "What is your best estimate of the total household income received by all household members, from all sources, before taxes and deductions, in the past 12 months?" Possible responses were: less than $20,000, $20,000 or more, but less than $50,000, $50,000 or more, but less than $100,000, $100,000 or more, but less than $150,000, or $150,000 or more. Tobacco consumption was assessed via the question: "What is your smoking status?" Possible responses were: I currently smoke, I don't smoke and I never have, or I don't smoke now but I have in the past. Weekly alcohol consumption was assessed via the question: "About how often during the past 12 months did you drink alcohol?" Possible responses were: almost every day, 4-5 times a week, 2-3 times a week, once a week, 2-3 times a month, about once a month, less than once a month, or never. Activity level was assessed via the question: "Over the past 7 days how often did you engage in moderate sports or recreational activities such as ballroom, dancing, hunting, skating, golf without a cart, softball, or other similar activities?" Possible responses were: never, seldom, sometimes, or often.

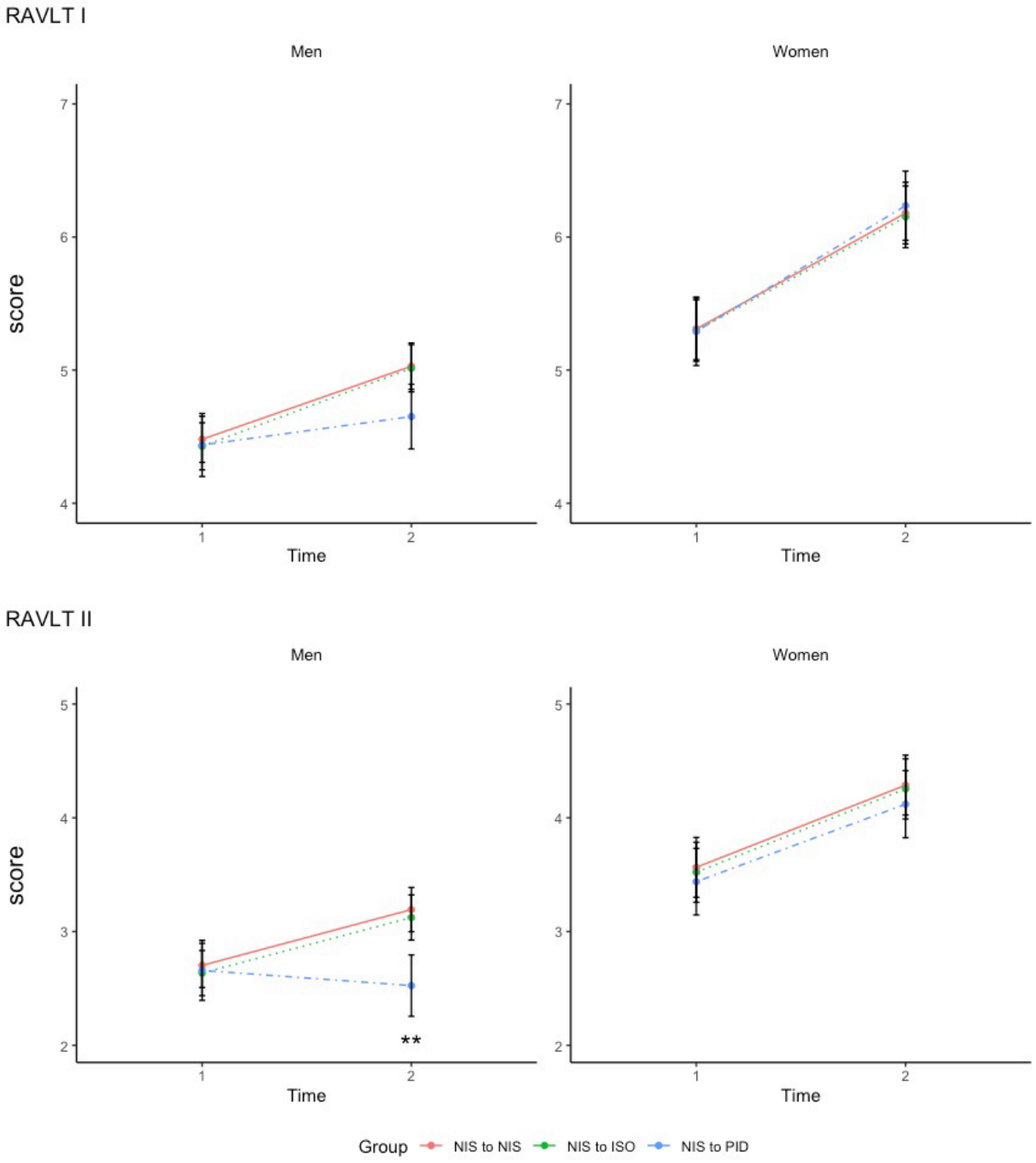
Sleep-related medications

Participants' use of medications was provided and any medications that could be prescribed primarily for sleep issues were selected. These included benzodiazepines: alprazolam (Xanax), chloridiazepoxide (Librium), clonazepmam (Klonopin), clorazepate (Tranzene), diazepam (Valium), estazolam (Prosom),

flurazepam (Dalmane), lorazepam (Ativan), midazolam (Versed), oxazepam (Serax), temazepam (Restoril), triazolam (Halcion), quazepam (Doral); Z-drugs: zolpidem (Ambien), zopiclone (Imovane), alpidem, necopidem, saripidem, divaplon, fasiplon, indiplon, lorediplon, ocinaplon, panadiplon, taniplon, zaleplon, eszopiclone, pagoclone, pazinaclone, suproclone, suriclone, abecarnil, gedocarnil; barbiturates: amobarbital (Amytal), butabarbital (Butisol), pentobarbital (Nembutal), secobarbital (Seconal), phenobarbital (Donnatal); sedating antidepressants: sertraline (Zoloft), fluoxetine (Prozac), citalopram (Celexa), escitalopram (Lexapro), paroxetine (Paxil), fluvoxamine (Luvox), desvenlafaxine (Pristiq), duloxetine (Cymbalta), venlafaxine (Effexor), trazodone (Desyrel), mirtazapine (Remeron), amitriptyline (Elavil), clomipramine (Anafil), desipramine (Norpramin), doxepin (Silenor), imipramine (Tofanil), nortriptyline (Pamelor), amoxapine (Asendin), trimipramine (Surmontil), protiptyline (Vivactil); sedating antipsychotics: aripiprazole (Abilify), clozapine (Clorazil), olanzapine (Zyprexa), paliperidone (Invage), quetiapine (Seroquel), risperidone (Risperdal), ziprasidone (Zeldox); sedating antiepileptics: acetazolamide (Diamox), brivaracetam (Brivlera), carbamazepine (Tegretol), clobazam, divalproex (Epival), eslicarbazepine (Aptiom), ethosuximide (Zarontin), gabapentin (Neurontin), lacosamide (Vimpat), lamotrigine (Lamictal), levetiracetam (Keppra), nitrazepam (Mogadon), oxcarbazepine (Trileptal), perampanel (Fycompa), phenytoin (Dilantin), pregabalin (Lyrica), primidone (Mysoline), rufinamide (Banzel), steripentol (Diacom), topiramate (Topamax) valproic acid (Depakene), vigabatrin (Sabril); sedating antihistamines: brompheniramine (Dimetane), cetirizine (Zyrtec), chlorpheniramine (Chlor-Trimethon), celmastine (Tavist), diphenhydramine (Benadryl), fexofenadine (Allegra); and analgesics: codeine (Tylenol), fentanyl (Abstral), hydrocodone (Vicoprofen), buprenorphine (Butrans), hydromorphone (Dilaudid), meperidine (Demerol), methadone (Metadol), morphine (Doloral), oxycodone (Percocet), pentazocine (Talwin), tapentadol (Nucynta), tramadol (Ultram).

Sleep-related measures

Measure of sleep apnea was assessed via the following question: “Has anyone ever observed you stop breathing in your sleep?” Possible responses were: yes or no. Measure of possible RBD was assessed via the question: “Have you ever been told, or suspected yourself, that you seem to "act out your dreams" while asleep (for example, punching, flailing your arms in the air, making running movements, etc.)?” Possible responses were: yes or no. Measure of possible RLS was assessed via the following question: “Do you have, or have you sometimes experienced, recurrent, uncomfortable feelings or sensations in your legs while sitting or lying down?”, “Do you have, or have you sometimes experienced, a recurrent need or urge to move your legs while sitting or lying down?”, “Do these uncomfortable feelings or sensations in your legs, or the urge to move, disappear/improve when you are active or moving around?”, and “Are these uncomfortable feelings, or this urge to move, worse in the evening or at night compared with the morning?” Possible responses were: yes or no.



Supplementary Figure 1. Declarative memory (RAVLT) performance score over time by sex – Analysis 1.

RAVLT I = Rey Auditory Verbal Learning Test—Immediate Recall Phase; RAVLT II = Rey Auditory Verbal Learning Test—Delayed Recall Phase. Group 1 = NIS to NIS; Group 2 = NIS to ISO; Group 3 = NIS to PID. Adjusted for age, sex, a binary variable of total household income (>50,000 $, or ≤50,000 $), years of education, ethnicity, language, time to follow-up, and percentage loss to follow-up.
***p* < 0.01

Supplementary Table 1. Summary of data availability at baseline and follow-up 1

	Baseline *(n = 28,485)*	Follow-up 1 *(n = 26,363)*
Demographic, lifestyle, and medical characteristics	Available	Available
Sleep and insomnia		
Satisfaction with current sleep pattern	Available	Available
Number of sleep hours during the past month	Available	Available
Trouble falling asleep or staying asleep	Available	Available
Trouble staying awake (when they did not intend to sleep)	Available	Available
"Act out on dreams" or move while sleeping	Available	Available
Recurrent, uncomfortable feelings or sensations in the legs, or urges to move their legs while sitting or lying down.	Available	Available
Cognitive function		
Subjective memory decline	Not Available	Available
Self-reported physician diagnosed memory problem	Available	Available
Memory (RAVLT)	Available	Available
Executive function (MAT, STROOP, COWAT, AFT)	Available	Available
Psychomotor speed (CRT)	Available	Available
Prospective memory (TMT, PMT)	Available	Available

RAVLT = Rey Auditory Verbal Learning Test; MAT = Mental Alternation Test; COWAT = Controlled Oral Word Association Test; AFT = Animal Fluency Test; CRT = choice reaction time; TMT = Time-Based Prospective Memory Task; PMT = Event-Based Prospective Memory Task.

Supplementary Table 2. Summary of sleep and insomnia measures

Domain	Description	Question
1	Satisfaction with current sleep pattern	How satisfied or dissatisfied are you with your current sleep pattern?
2	Number of sleep hours during the past month	During the past month on average, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed.)
3	Trouble falling asleep or staying asleep	Over the last month, how often did it take you more than 30 minutes to fall asleep? For how long have you had this trouble going to sleep? To what extent do you consider your problem falling asleep to interfere with your daily functioning (for example, from daytime fatigue, ability to function at work/daily chores, concentration, memory, mood, etc.). For how long have you had this trouble with staying asleep? To what extent do you consider your problem staying asleep to interfere with your daily functioning (for example, from daytime fatigue, ability to function at work/daily chores, concentration, memory, mood, etc.)?
4	Trouble staying awake (when they did not intend to sleep)	Over the last month, how often do you find it difficult to stay awake during your normal waking hours when you want to? For how long have you had trouble staying awake? To what extent do you consider your problem staying awake to interfere with your daily functioning?
5	“Act out on dreams” or move while sleeping	Have you ever been told, or suspected yourself, that you seem to "act out your dreams" while asleep (for example, punching, flailing your arms in the air, making running movements, etc.)? For how long have you had this "acting out" of your dreams?
6	Recurrent, uncomfortable feelings or sensations in the legs, or urges to move their legs while sitting or lying down.	Do you have, or have you sometimes experienced, recurrent, uncomfortable feelings or sensations in your legs while sitting or lying down? Do you have, or have you sometimes experienced, a recurrent need or urge to move your legs while sitting or lying down? For how long have you had these uncomfortable feelings or urge to move? Over the last month, how many times (per week, on average) have you experienced these uncomfortable feelings or urge to move? Do these uncomfortable feelings or sensations in your legs, or the urge to move, disappear/improve when you are active or moving around? Are these uncomfortable feelings, or this urge to move, worse in the evening or at night compared with the morning?

Supplementary Table 3. Characteristics of dropouts at baseline

	% of category that were dropouts	% of dropouts (n = 2, 122) that were in each category
Age, years		
45-54	5.9	20.3
55-64	5.7	25.4
65-74	7.6	24.9
≥75	12.9	29.4
Insomnia Groups		
NIS	7.0	64.4
ISO	8.1	29.5
PID	12.1	6.1

Supplementary Table 4. Baseline demographic, lifestyle, and medical characteristics of participants with and without self-reported memory worsening at follow-up

"Do you feel like your memory is becoming worse?"	No n = 11,094	Yes n = 15,067	***P***
Age, years ± SD	64.82 (9.80)	65.91 (10.23)	***< 0.0001***
Sex, %F	49.9	52.7	***< 0.0001***
English, %	76.5	80.3	***< 0.0001***
Caucasian, %	95.6	96.0	0.121
>12 years education, %	85.2	86.4	0.052
Income >50,000$, %	69.0	69.8	0.122
BMI, kg m^2, SD	28.3 (5.2)	27.7 (5.1)	***< 0.0001***
Systolic BP, mmHg± SD	121.3 (16.7)	120.4 (16.3)	***< 0.0001***
Diastolic BP, mmHg± SD	74.4 (9.9)	73.5 (9.8)	***< 0.0001***
Smoker, %	6.7	5.9	***0.010***
Alcohol ≥4times per week, %	25.0	27.6	***< 0.001***
Cancer, %	13.5	15.8	***< 0.0001***
Diabetes mellitus, %	8.6	8.6	0.196
Current Anxiety disorder, %	7.1	9.2	***< 0.0001***
Current or history of Depression, %	13.7	17.6	***< 0.0001***
CESD score ± SD	4.3 (4.6)	5.5 (5.9)	***< 0.0001***
Chronic pain, %	31.8	38.4	***< 0.0001***
Daytime sleepiness, %	33.3	41.3	***< 0.0001***
Breathing stops in sleep, %	12.7	15.5	***< 0.0001***
Acting out on dreams while asleep, %	9.8	11.5	0.623
Uncomfortable feelings or sensations in the legs, or urges to move their legs while sitting or lying down, %	13.8	18.2	0.900
Taking sleep-related medication, %	7.0	8.6	***< 0.0001***
Taking hypnotic medication, %	1.7	1.9	0.453
Taking antidepressant medication, %	0.9	1.2	***0.016***
Taking antipsychotic medication, %	0.3	0.4	0.250
Taking antiepileptic medication, %	1.8	2.1	0.141
Taking antihistamine medication, %	0.4	0.6	***0.010***
Taking analgesic medication, %	3.2	3.9	***0.005***

CESD = Center for Epidemiologic Studies Depression Scale; BMI = body mass index; BP = blood pressure. Tukey's honest significance test or $\chi 2$ test, as appropriate. All analyses are FDR adjusted to correct for multiple comparisons.
Bold and italicized text refers to values that pass the FDR adjusted threshold for statistical significance.

Supplementary Table 5. Baseline demographic, lifestyle, and medical characteristics of participants with and without a self-reported diagnosed memory problem at follow-up

"Has a doctor ever told you that you have a memory problem?"	No n = 25,004	Yes n = 396	***p***
Age, years ± SD	65.36 (10.00)	67.65 (10.73)	***< 0.0001***
Sex, %F	51.6	48.0	0.225
English, %	78.3	77.8	0.976
Caucasian, %	95.8	96.5	0.656
>12 years education, %	86.1	82.1	***0.006***
Income >50,000$, %	69.9	53.5	***< 0.0001***
BMI, kg m^2, SD	27.9 (5.2)	28.3 (5.5)	0.195
Systolic BP, mmHg± SD	120.7 (16.4)	120.5 (15.7)	0.933
Diastolic BP, mmHg± SD	73.9 (9.8)	73.6 (10.3)	0.673
Smoker, %	6.1	7.8	0.420
Alcohol ≥4times per week, %	26.7	22.2	***0.023***
Cancer, %	14.7	20.7	***0.002***
Diabetes mellitus, %	8.4	14.4	***0.004***
Current Anxiety disorder, %	8.1	20.7	***< 0.0001***
Current or history of Depression, %	15.5	36.6	***< 0.0001***
CESD score ± SD	5.0 (5.2)	8.3 (7.7)	***< 0.0001***
Chronic pain, %	35.2	53.3	***< 0.0001***
Daytime sleepiness, %	37.9	47.7	***< 0.0001***
Breathing stops in sleep, %	14.0	26.8	***< 0.0001***
Acting out on dreams while asleep, %	10.7	17.9	0.672
Uncomfortable feelings or sensations in the legs, or urges to move their legs while sitting or lying down, %	16.2	21.2	0.933
Taking sleep-related medication, %	7.7	19.7	***< 0.0001***
Taking hypnotic medication, %	1.8	4.3	***< 0.0001***
Taking antidepressant medication, %	1.0	4.3	***< 0.0001***
Taking antipsychotic medication, %	0.3	2.5	***< 0.0001***
Taking antiepileptic medication, %	1.9	6.8	***< 0.0001***
Taking antihistamine medication, %	0.5	0.8	0.612
Taking analgesic medication, %	3.6	4.5	0.412

CESD = Center for Epidemiologic Studies Depression Scale; BMI = body mass index; BP = blood pressure. Tukey's honest significance test or $\chi 2$ test, as appropriate. All analyses are FDR adjusted to correct for multiple comparisons.
Bold and italicized text refers to values that pass the FDR adjusted threshold for statistical significance.

Supplementary Table 6. Baseline demographic, lifestyle, and medical characteristics of participants with <6 hours and ≥6 hours of sleep per night

	≥6 hours of sleep per night n = 22,991	<6 hours of sleep per night n = 3,320	***p***
Age, years ± SD	65.48 (10.07)	65.35 (10.05)	0.615
Sex, %F	50.7	57.1	***< 0.0001***
English, %	78.6	79.5	***0.041***
Caucasian, %	96.2	93.1	***< 0.0001***
>12 years education, %	86.6	80.9	***< 0.0001***
Income >50,000$, %	70.7	60.5	***< 0.0001***
BMI, kg m^2, SD	27.8 (5.1)	28.8 (5.7)	***< 0.0001***
Systolic BP, mmHg± SD	120.6 (16.3)	122.3 (17.1)	***< 0.0001***
Diastolic BP, mmHg± SD	73.8 (9.8)	74.5 (10.3)	***< 0.0001***
Smoker, %	5.9	8.4	***< 0.0001***
Alcohol ≥4times per week, %	27.3	20.9	***< 0.0001***
Cancer, %	14.8	14.9	0.940
Diabetes mellitus, %	8.1	11.8	0.260
Current Anxiety disorder, %	8.0	10.3	***< 0.0001***
Current or history of Depression, %	15.4	19.3	***< 0.0001***
CESD score ± SD	4.7 (5.2)	7.5 (6.1)	***< 0.0001***
Chronic pain, %	33.7	48.1	***< 0.0001***
Daytime sleepiness, %	36.4	48.2	***< 0.0001***
Breathing stops in sleep, %	13.8	17.5	***< 0.0001***
Acting out on dreams while asleep, %	10.6	12.1	0.701
Uncomfortable feelings or sensations in the legs, or urges to move their legs while sitting or lying down, %	15.3	23.1	0.940
Taking sleep-related medication, %	7.4	11.1	***< 0.0001***
Taking hypnotic medication, %	1.7	2.7	***< 0.0001***
Taking antidepressant medication, %	1.0	1.3	0.302
Taking antipsychotic medication, %	0.4	0.3	0.758
Taking antiepileptic medication, %	1.9	2.7	***0.002***
Taking antihistamine medication, %	0.5	0.5	0.967
Taking analgesic medication, %	3.3	5.5	***< 0.0001***

CESD = Center for Epidemiologic Studies Depression Scale; BMI = body mass index; BP = blood pressure. Tukey's honest significance test or $\chi 2$ test, as appropriate. All analyses are FDR adjusted to correct for multiple comparisons.
Bold and italicized text refers to values that pass the FDR adjusted threshold for statistical significance.

Supplementary Table 7. Baseline demographic, lifestyle, and medical characteristics of participants by sex

	Men n = 13,579	Women n = 12,784	***p***
Age, years ± SD	65.31 (10.06)	65.63 (10.06)	***0.015***
English, %	78.5	78.9	***< 0.001***
Caucasian, %	96.3	95.3	***< 0.001***
>12 years education, %	84.2	87.7	***< 0.0001***
Income >50,000$, %	62.6	76.5	***< 0.0001***
BMI, kg m^2, SD	27.7 (5.7)	28.2 (4.6)	***< 0.0001***
Systolic BP, mmHg± SD	119.3 (17.1)	122.3 (15.6)	***< 0.0001***
Diastolic BP, mmHg± SD	71.7 (9.4)	76.2 (9.8)	***< 0.0001***
Smoker, %	6.3	6.2	0.107
Alcohol ≥4times per week, %	21.5	31.8	***< 0.0001***
Cancer, %	15.1	14.6	0.226
Diabetes mellitus, %	7.2	10.1	***< 0.001***
Current Anxiety disorder, %	10.3	6.2	***< 0.0001***
Current or history of Depression, %	20.4	11.2	***< 0.0001***
CESD score ± SD	5.5 (5.7)	4.5 (5.0)	***< 0.0001***
Chronic pain, %	40.1	30.7	***< 0.0001***
Daytime sleepiness, %	36.2	39.7	***< 0.0001***
Breathing stops in sleep, %	8.8	20.20	***< 0.0001***
Acting out on dreams while asleep, %	8.6	13.1	***< 0.0001***
Uncomfortable feelings or sensations in the legs, or urges to move their legs while sitting or lying down, %	19.9	12.5	***< 0.0001***
Taking sleep-related medication, %	9.5	6.2	***< 0.0001***
Taking hypnotic medication, %	2.2	1.4	***< 0.0001***
Taking antidepressant medication, %	1.6	0.5	***< 0.0001***
Taking antipsychotic medication, %	0.4	0.3	0.226
Taking antiepileptic medication, %	2.2	1.9	0.107
Taking antihistamine medication, %	0.6	0.5	0.185
Taking analgesic medication, %	4.4	2.8	***< 0.0001***

CESD = Center for Epidemiologic Studies Depression Scale; BMI = body mass index; BP = blood pressure. Tukey's honest significance test or $\chi 2$ test, as appropriate. All analyses are FDR adjusted to correct for multiple comparisons.
Bold and italicized text refers to values that pass the FDR adjusted threshold for statistical significance.

Supplementary Table 8. Estimated fixed effects for declarative memory – Analysis 1

Memory		Estimates of fixed effects				
RAVLT I						
Model 1	Parameter	Estimate (SE)	*df*	*t*	*p*	95% CI
	Time (Baseline vs. Follow-up)	0.709 (0.02)	13,630	42.101	< 0.0001	0.68 – 0.74
	Group 2	-0.031 (0.03)	14,600	-1.047	0.426	-0.09 – 0.03
	Group 3	-0.036 (0.09)	14,550	-0.426	0.691	-0.20 – 0.13
	Group 2 : Time	0.041 (0.04)	13,640	1.108	0.419	-0.03 – 0.11
	Group 3 : Time	0.027 (0.10)	13,520	0.258	0.819	-0.18 – 0.23
		Estimates of fixed effects				
RAVLT II						
Model 1	Parameter	Estimate (SE)	*df*	*t*	*p*	95% CI
	Time (Baseline vs. Follow-up)	0.600 (0.02)	13,510	33.654	< 0.0001	0.57 – 0.64
	Group 2	-0.054 (0.03)	14,620	-1.599	0.267	-0.12 – 0.01
	Group 3	-0.198 (0.10)	14,550	-2.040	0.108	-0.39 – -0.01
	Group 2 : Time	0.030 (0.04)	13,510	0.751	0.582	-0.05 – 0.11
	Group 3 : Time	-0.162 (0.11)	13,400	-1.457	0.373	-0.38 – 0.06

SE = standard error; 95% CI = 95% confidence intervals.
RAVLT I = Rey Auditory Verbal Learning Test—Encoding Phase; RAVLT II = Rey Auditory Verbal Learning Test—Recall Phase.
Group 1 = NIS to NIS; Group 2 = NIS to ISO; Group 3 = NIS to PID.
Model 1 = adjusted for age, sex, a binary variable of total household income (>50,000 $, or ≤50,000 $), years of education, ethnicity, language, time to follow-up, and percentage loss to follow-up.
All analyses are FDR adjusted to correct for multiple comparisons.

Supplementary Table 9. Estimated fixed effects for executive functions and psychomotor speed – Analysis 1

Executive function		Estimates of fixed effects				
MAT†						
Model 1	Parameter	Estimate (SE)	*df*	*t*	*p*	95% CI
	Time (Baseline vs. Follow-up)	0.011 (0.002)	12,150	5.5985	< 0.0001	0.008 – 0.015
	Group 2	-0.005 (0.003)	13,110	-1.735	0.154	-0.011 – 0.001
	Group 3	-0.008 (0.009)	13,150	-0.885	0.457	-0.025 – 0.009
	Group 2 : Time	0.009 (0.004)	12,160	2.065	0.078	0.000 – 0.017
	Group 3 : Time	-0.008 (0.012)	12,160	-0.631	0.634	-0.031 – 0.016
Model 2	Time (Baseline vs. Follow-up)	0.011 (0.002)	10,300	5.553	< 0.0001	0.007 – 0.015
	Group 2	-0.005 (0.003)	11,040	-1.526	0.278	-0.012 – 0.001
	Group 3	-0.007 (0.010)	11,050	-0.695	0.677	-0.026 – 0.013
	Group 2 : Time	0.007 (0.005)	10,300	1.441	0.327	-0.002 – 0.016
	Group 3 : Time	0.001 (0.013)	10,320	0.079	0.937	-0.025 – 0.027
STROOP INTERFERENCE‡						
Model 1	Time (Baseline vs. Follow-up)	-0.007 (0.007)	13,530	-1.060	0.426	-0.020 – 0.006
	Group 2	0.013 (0.011)	13,600	1.146	0.426	-0.009 – 0.035
	Group 3	0.008 (0.032)	13,600	0.260	0.901	-0.054 – 0.071
	Group 2 : Time	-0.000 (0.015)	13,530	-0.001	0.999	-0.029 – 0.029
	Group 3 : Time	-0.006 (0.041)	13,510	-0.147	0.941	-0.087 – 0.075
Model 2	Time (Baseline vs. Follow-up)	-0.011 (0.007)	11,130	-1.508	0.341	-0.025 – 0.003
	Group 2	0.001 (0.012)	11,150	0.073	0.989	-0.023 – 0.025
	Group 3	-0.042 (0.037)	11,160	-1.142	0.483	-0.114 – 0.030
	Group 2 : Time	0.012 (0.016)	11,130	0.712	0.760	-0.020 – 0.044
	Group 3 : Time	-0.021 (0.048)	11,120	-0.430	0.875	-0.114 – 0.073
Psychomotor speed						
CRT†						
Model 1	Time (Baseline vs. Follow-up)	0.001 (0.001)	14,350	1.378	0.286	-0.000 – 0.003
	Group 2	0.004 (0.001)	14,620	3.106	0.006	0.002 – 0.007
	Group 3	0.006 (0.004)	14,570	1.553	0.240	-0.002 - 0.014
	Group 2 : Time	0.003 (0.002)	14,350	1.462	0.273	-0.001 – 0.006
	Group 3 : Time	0.003 (0.005)	14,270	0.631	0.760	-0.007 – 0.013
Model 2	Time (Baseline vs. Follow-up)	0.000 (0.001)	12,030	0.327	0.865	-0.001 – 0.002
	Group 2	0.004 (0.002)	12,220	2.461	0.063	0.001 – 0.007
	Group 3	0.004 (0.005)	12,170	0.777	0.674	-0.006 – 0.013
	Group 2 : Time	0.002 (0.002)	12,030	1.178	0.486	-0.001 – 0.006
	Group 3 : Time	0.002 (0.006)	11,950	0.287	0.885	-0.009 – 0.013

SE = standard error; 95% CI = 95% confidence intervals; MAT = Mental Alternation Test; CRT = choice reaction time.

Group 1 = NIS to NIS; Group 2 = NIS to ISO; Group 3 = NIS to PID.

Model 1 = adjusted for age, sex, a binary variable of total household income (>50,000 $, or ≤50,000 $), years of education, ethnicity, language, time to follow-up, and percentage loss to follow-up; Model 2 = adjusted for age, sex, a binary variable of total household income (>50,000 $, or ≤50,000 $), years of education, ethnicity, language, time to follow-up, and percentage loss to follow-up, BMI, alcohol consumption (≥4 times per week), diagnosis of cancer, anxiety disorder, clinical depression, or hypertension, current level of smoking, presence of chronic pain, activity level, a report of daytime sleepiness, a witness report of breathing interruption during sleep, a self-report of RBD, a self-report of RLS, a report of using sleep-related medications including hypnotics, antidepressants, antipsychotics, antiepileptics, antihistamines and analgesics, as well as insufficient sleep (<6 hours per night).

All analyses are FDR adjusted to correct for multiple comparisons.

† MAT and CRT scores were log-transformed prior to analysis.

‡ Stroop interference score is calculated as a ratio of Stroop 3/Stroop 1, see supplementary material.

Supplementary Table 10. Estimated fixed effects for declarative memory – Analysis 2

Memory		Estimates of fixed effects				
RAVLT I						
Model 1	Parameter	Estimate (SE)	*df*	*t*	*p*	95% CI
	Time (Baseline vs. Follow-up)	0.704 (0.01)	18,160	48.293	< 0.0001	0.68 – 0.73
	Symptom-free group	-0.050 (0.03)	19,400	-1.793	0.146	-0.10 – 0.00
	Worsening symptoms group	-0.077 (0.03)	19,420	-2.305	0.048	-0.14 – -0.01
	Symptom-free : Time	0.012 (0.04)	18,110	0.321	0.792	-0.06 – 0.08
	Worsening symptoms : Time	0.054 (0.04)	18,130	1.284	0.312	-0.03 – 0.14
		Estimates of fixed effects				
RAVLT II						
Model 1	Parameter	Estimate (SE)	*df*	*t*	*p*	95% CI
	Time (Baseline vs. Follow-up)	0.594 (0.02)	17,970	38.261	< 0.0001	0.56 – 0.62
	Symptom-free group	-0.051 (0.03)	19,410	-1.636	0.218	-0.11 – 0.01
	Worsening symptoms group	-0.110 (0.04)	19,430	-2.926	0.012	-0.18 – -0.04
	Symptom-free : Time	0.023 (0.04)	17,940	0.600	0.753	-0.05 – 0.10
	Worsening symptoms : Time	0.034 (0.04)	17,960	0.763	0.668	-0.05 – 0.12

SE = standard error; 95% CI = 95% confidence intervals.
RAVLT I = Rey Auditory Verbal Learning Test—Encoding Phase; RAVLT II = Rey Auditory Verbal Learning Test—Recall Phase.
Model 1 = adjusted for age, sex, a binary variable of total household income (>50,000 $, or ≤50,000 $), years of education, ethnicity, language, time to follow-up, and percentage loss to follow-up.
All analyses are FDR adjusted to correct for multiple comparisons.

Supplementary Table 11. Estimated fixed effects for executive functions and psychomotor speed – Analysis 2

Executive function		Estimates of fixed effects				
MAT†						
Model 1	Parameter	Estimate (SE)	*df*	*t*	*p*	95% CI
	Time (Baseline vs. Follow-up)	0.012 (0.002)	16,270	7.063	< 0.0001	0.008 – 0.015
	Symptom-free group	0.003 (0.003)	17,520	0.978	0.394	-0.003 – 0.008
	Worsening symptoms group	-0.004 (0.003)	17,520	-1.093	0.341	-0.010 – 0.003
	Symptom-free : Time	-0.003 (0.004)	16,240	-0.698	0.582	-0.011 – 0.005
	Worsening symptoms : Time	0.005 (0.005)	16,260	1.062	0.358	-0.004 – 0.014
Model 2	Time (Baseline vs. Follow-up)	0.011 (0.002)	13,780	6.400	< 0.0001	0.008 – 0.015
	Symptom-free group	0.003 (0.003)	14,760	0.930	0.529	-0.003 – 0.009
	Worsening symptoms group	-0.003 (0.004)	14,760	-0.829	0.568	-0.010 – 0.004
	Symptom-free : Time	-0.001 (0.004)	13,770	-0.257	0.870	-0.010 – 0.008
	Worsening symptoms : Time	0.006 (0.005)	13,770	1.088	0.436	-0.004 – 0.016
STROOP INTERFERENCE‡						
Model 1	Time (Baseline vs. Follow-up)	-0.007 (0.005)	18,280	-1.226	0.340	-0.017 – 0.004
	Symptom-free group	0.009 (0.010)	18,380	0.932	0.497	-0.010 – 0.029
	Worsening symptoms group	0.020 (0.012)	18,380	1.683	0.194	-0.003 – 0.044
	Symptom-free : Time	0.000 (0.013)	18,270	0.027	0.979	-0.026 – 0.027
	Worsening symptoms : Time	0.001 (0.016)	18,270	0.086	0.958	-0.029 – 0.032
Model 2	Time (Baseline vs. Follow-up)	-0.011 (0.006)	15,080	-1.817	0.201	-0.023 – 0.001
	Symptom-free group	0.013 (0.011)	15,120	1.179	0.450	-0.008 – 0.034
	Worsening symptoms group	0.010 (0.013)	15,120	0.737	0.669	-0.016 – 0.036
	Symptom-free : Time	-0.003 (0.015)	15,070	-0.174	0.930	-0.032 – 0.026
	Worsening symptoms : Time	0.007 (0.017)	15,070	0.409	0.847	-0.027 – 0.041
Psychomotor speed						
CRT†						
Model 1	Time (Baseline vs. Follow-up)	0.001 (0.001)	19,080	1.335	0.309	-0.000 – 0.002
	Symptom-free group	0.001 (0.001)	19,470	0.780	0.584	-0.002 – 0.004
	Worsening symptoms group	0.005 (0.002)	19,470	3.282	0.004	0.002 – 0.008
	Symptom-free : Time	0.000 (0.002)	19,100	0.006	0.995	-0.003 – 0.003
	Worsening symptoms : Time	0.003 (0.002)	19,090	1.376	0.304	-0.001 – 0.006
Model 2	Time (Baseline vs. Follow-up)	0.000 (0.001)	15,990	0.366	0.816	-0.001 – 0.002
	Symptom-free group	0.001 (0.001)	16,280	1.021	0.482	-0.001 – 0.004
	Worsening symptoms group	0.005 (0.002)	16,270	2.893	0.017	0.002 – 0.008
	Symptom-free : Time	-0.001 (0.002)	16,010	-0.313	0.848	-0.004 – 0.003
	Worsening symptoms : Time	0.002 (0.002)	16,000	0.767	0.649	-0.003 – 0.006

SE = standard error; 95% CI = 95% confidence intervals; MAT = Mental Alternation Test; CRT = choice reaction time.

Model 1 = adjusted for age, sex, a binary variable of total household income (>50,000 $, or ≤50,000 $), years of education, ethnicity, language, time to follow-up, and percentage loss to follow-up; Model 2 = adjusted for age, sex, a binary variable of total household income (>50,000 $, or ≤50,000 $), years of education, ethnicity, language, time to follow-up, and percentage loss to follow-up, BMI, alcohol consumption (≥4 times per week), diagnosis of cancer, anxiety disorder, clinical depression, or hypertension, current level of smoking, presence of chronic pain, activity level, a report of daytime sleepiness, a witness report of breathing interruption during sleep, a self-report of RBD, a self-report of RLS, a report of using sleep-related medications including hypnotics, antidepressants, antipsychotics, antiepileptics, antihistamines and analgesics, as well as insufficient sleep (<6 hours per night).

All analyses are FDR adjusted to correct for multiple comparisons.

† MAT and CRT scores were log-transformed prior to analysis.

‡ Stroop interference score is calculated as a ratio of Stroop 3/Stroop 1, see supplementary material.

Supplementary Table 12. Associations between insomnia and subjective memory decline at follow-up by sex – Analysis 1

Subjective Memory Self-reported memory worsening		Group 2 *versus* Group 1†	Group 3 *versus* Group 1†	Group 3 *versus* Group 2†
Men	OR [95% CI]	***1.20**** [1.06 – 1.37]	***1.92**** [1.19 – 3.12]	1.60 [0.99 – 2.59]
Women	OR [95% CI]	***1.19**** [1.05 – 1.34]	***1.58**** [1.12 – 2.25]	1.33 [0.94 – 1.88]
Self-reported diagnosed memory problem		**Group 2 *versus* Group 1†**	**Group 3 *versus* Group 1†**	**Group 3 *versus* Group 2†**
Men	OR [95% CI]	0.93 [0.47 – 1.85]	1.65 [0.31 – 8.78]	1.76 [0.33 – 9.28]
Women	OR [95% CI]	0.47 [0.18 – 1.23]	***4.13**** [1.31 – 12.99]	***8.86***** [2.53 – 31.04]

OR = odds ratio; 95% CI = 95% confidence intervals.
Group 1 = NIS to NIS; Group 2 = NIS to ISO; Group 3 = NIS to PID.
Adjusted for age, a binary variable of total household income (>50,000 $, or ≤50,000 $), years of education, ethnicity, language, time to follow-up, and percentage loss to follow-up, BMI, alcohol consumption (≥4 times per week), diagnosis of cancer, anxiety disorder, clinical depression, or hypertension, current level of smoking, presence of chronic pain, activity level, a report of daytime sleepiness, a witness report of breathing interruption during sleep, a self-report of RBD, a self-report of RLS, a report of using sleep-related medications including hypnotics, antidepressants, antipsychotics, antiepileptics, antihistamines and analgesics, as well as insufficient sleep (<6 hours per night).
Bold and italicized text refers to values that pass the threshold for statistical significance.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
† Reference group.

Supplementary Table 13. Associations between insomnia and subjective memory decline at follow-up by sex – Analysis 2

Subjective Memory Self-reported memory worsening				
		Symptom-free *versus* Improving symptoms†	Worsening symptoms *versus* Improving symptoms†	Worsening symptoms *versus* Symptom-free†
Men	OR [95% CI]	0.98 [0.88 – 1.09]	***1.18**** [1.03 – 1.35]	***1.20**** [1.06 – 1.36]
Women	OR [95% CI]	1.01 [0.90 – 1.13]	***1.24**** [1.09 – 1.42]	***1.23***** [1.10 – 1.38]
Self-reported diagnosed memory problem				
		Symptom-free *versus* Improving symptoms†	Worsening symptoms *versus* Improving symptoms†	Worsening symptoms *versus* Symptom-free†
Men	OR [95% CI]	0.99 [0.54 – 1.81]	0.97 [0.46 – 2.04]	0.98 [0.51 – 1.88]
Women	OR [95% CI]	1.31 [0.56 – 3.05]	1.12 [0.44 – 2.81]	0.85 [0.40 – 1.80]

OR = odds ratio; 95% CI = 95% confidence intervals.
Adjusted for age, a binary variable of total household income (>50,000 $, or ≤50,000 $), years of education, ethnicity, language, time to follow-up, and percentage loss to follow-up, BMI, alcohol consumption (≥4 times per week), diagnosis of cancer, anxiety disorder, clinical depression, or hypertension, current level of smoking, presence of chronic pain, activity level, a report of daytime sleepiness, a witness report of breathing interruption during sleep, a self-report of RBD, a self-report of RLS, a report of using sleep-related medications including hypnotics, antidepressants, antipsychotics, antiepileptics, antihistamines and analgesics, as well as insufficient sleep (<6 hours per night).
Bold and italicized text refers to values that pass the threshold for statistical significance.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
† Reference group.

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