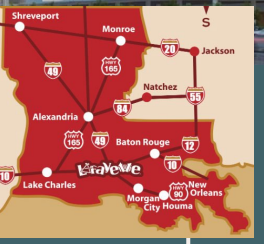

2026 Ochsner Neuroscience Symposium

Sleep in Neurological disorders

Kevin R Hargrave, MD MBA FAAN FAASM
Ochsner Lafayette General

Dr. Rao

JY Bordelon, MD

No disclosures

Sleep in Neurological disorders

- **Intro**
- What is normal sleep?
- Poor sleep?
- Sleep in Alzheimer's ds (AD)
- Sleep in Parkinson's ds (PD)
- Sleep in stroke
- Interventions
- Avoiding (iatrogenic) harm
- Thanks/ Questions / comments

Sleep is vital.

Sleep is vital.

What Genes Tell Us About Sleep | Ying-Hui Fu ...

It is the third most critical element for survival,

after air and water.

I heard this on TED talk by Ying Hui-Fu, PhD, and although I knew it to be true, as a practicing sleep neurologist for >25yrs, it still struck me as profound.

Sleep in Neurological disorders

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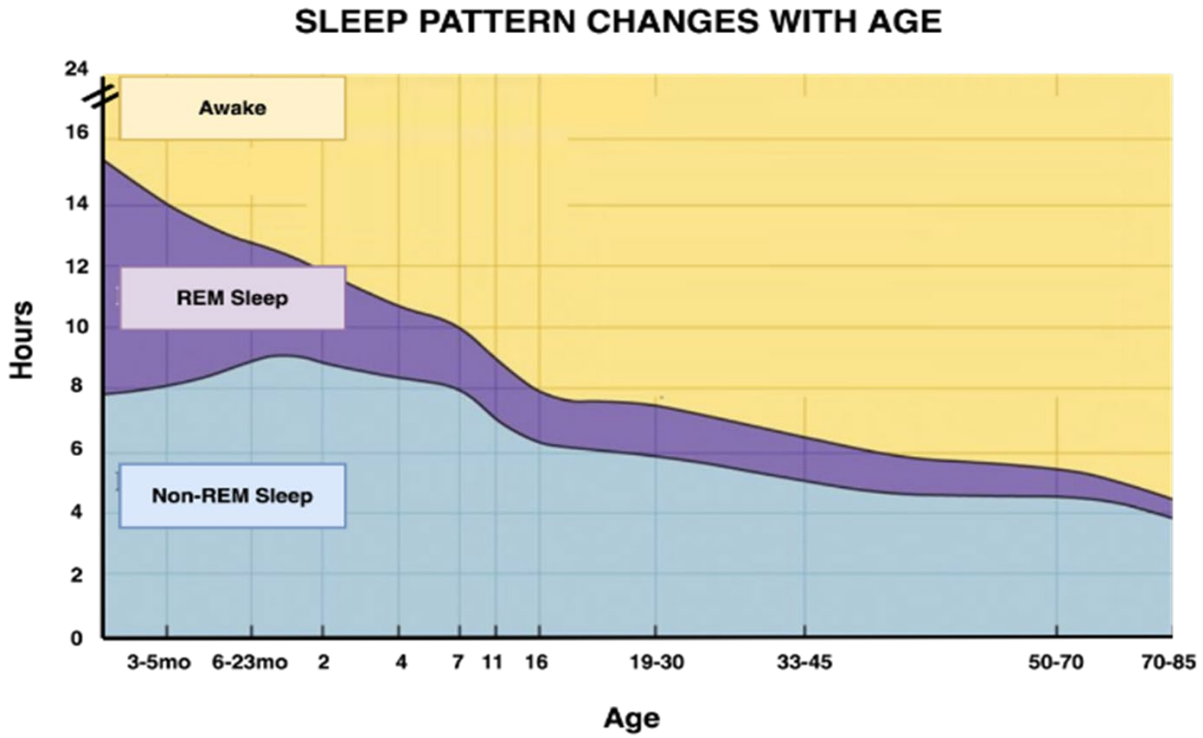
- Thanks/ Questions / comments

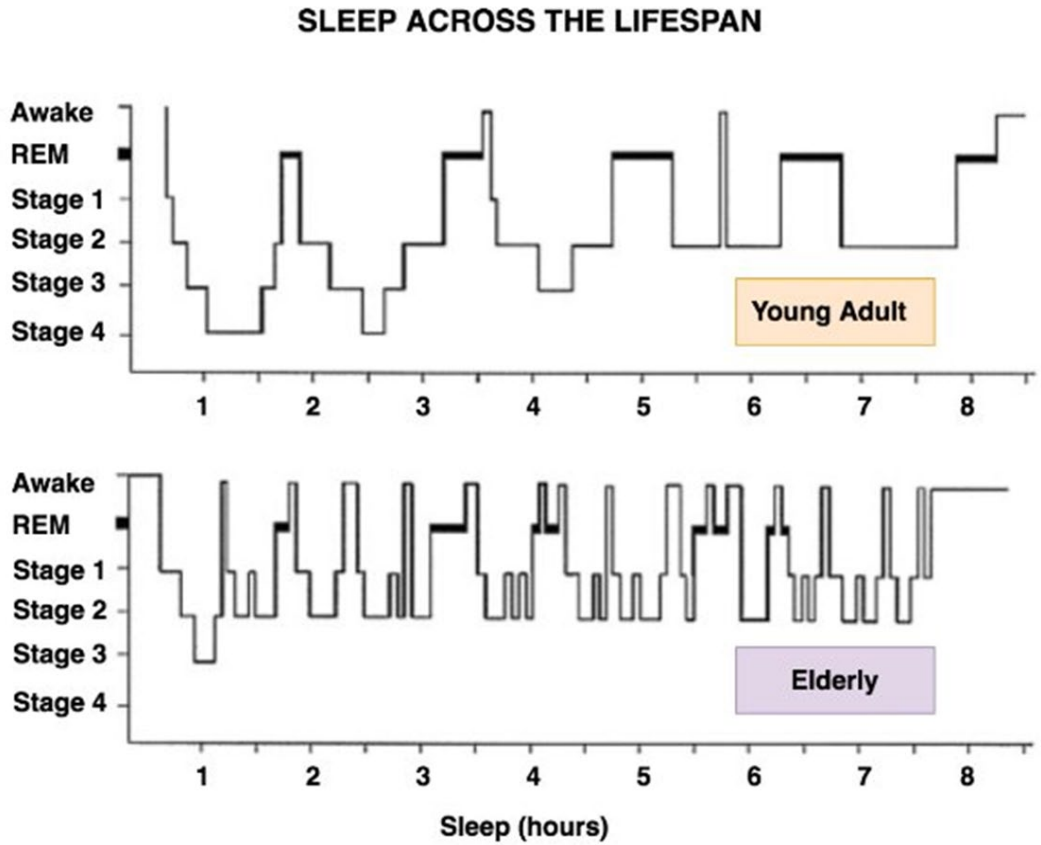
Normal sleep. Duration and 'architecture'

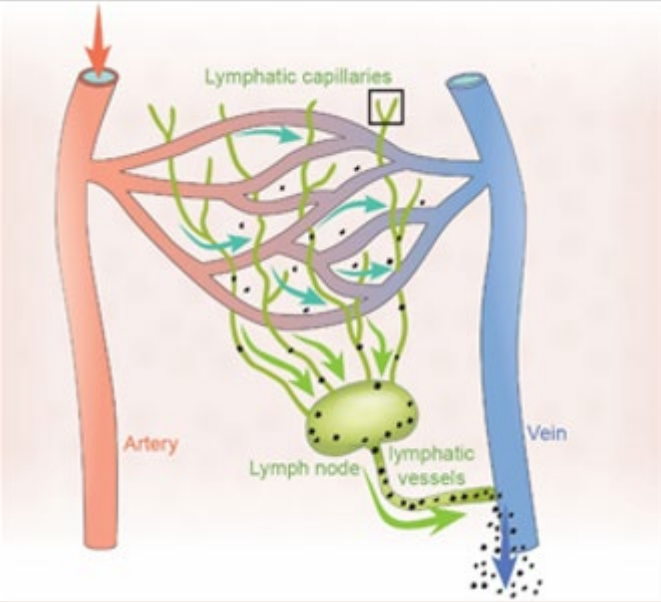
Normal sleep, for most of us, is **7 hours** or so of nocturnal sleep in one relatively uninterrupted episode.

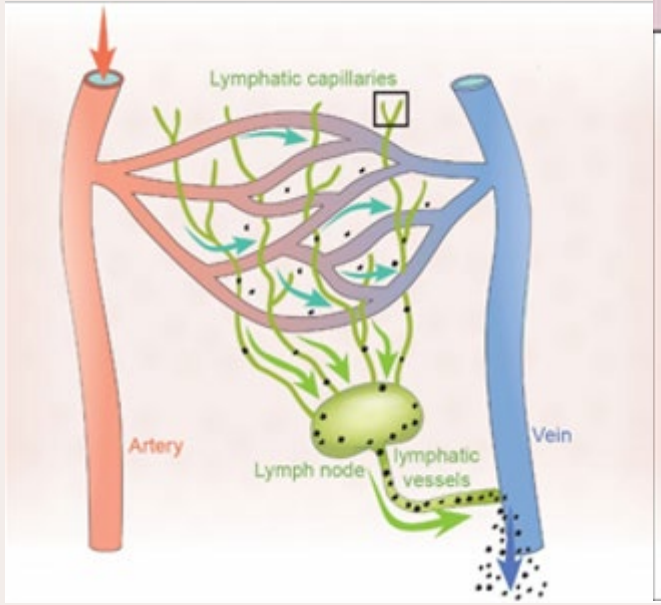
Most of us enjoy quick sleep onset, referred to in the sleep literature as sleep **latency**;
with good continuous sleep without awakening (sleep **efficiency**)
and have ≥30 minutes of slow wave (deep) sleep [SWS; N3] and dream sleep (REM).

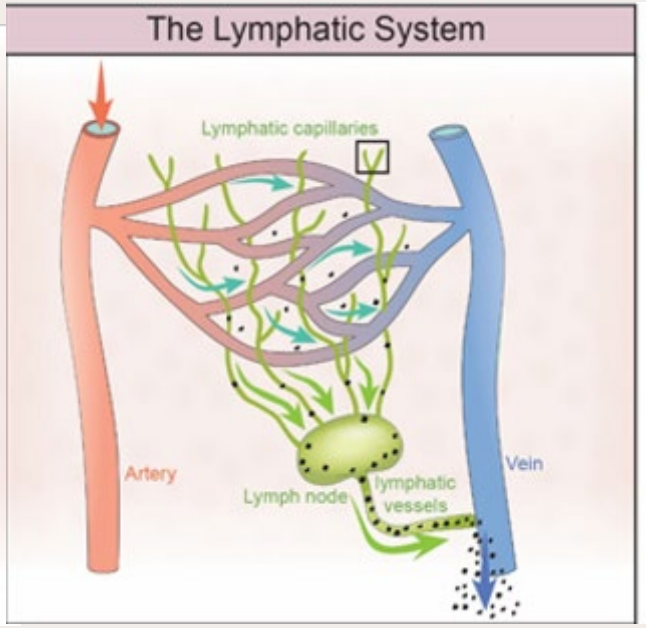
AGE

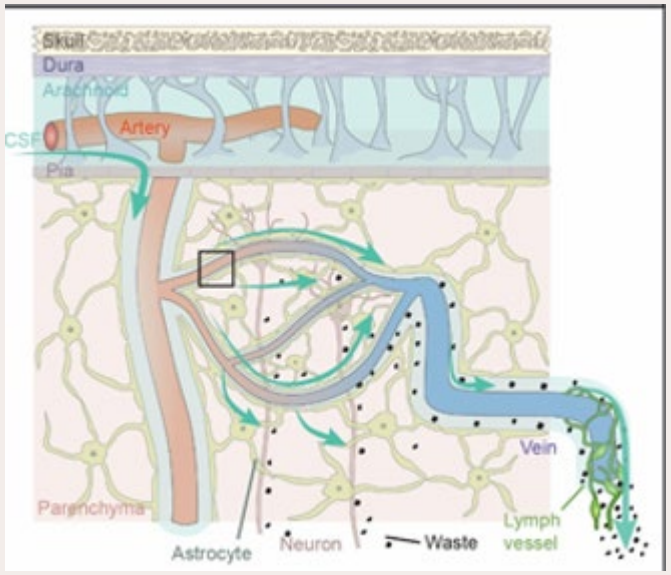

SLEEP PATTERN CHANGES WITH AGE
Awake
REM Sleep
Non-REM Sleep
Hours
24
16
14
12
10
8
6
4
2
0
3-5mo
6-23mo
2
4
7
11
16
19-30
33-45
50-70
70-85
Age

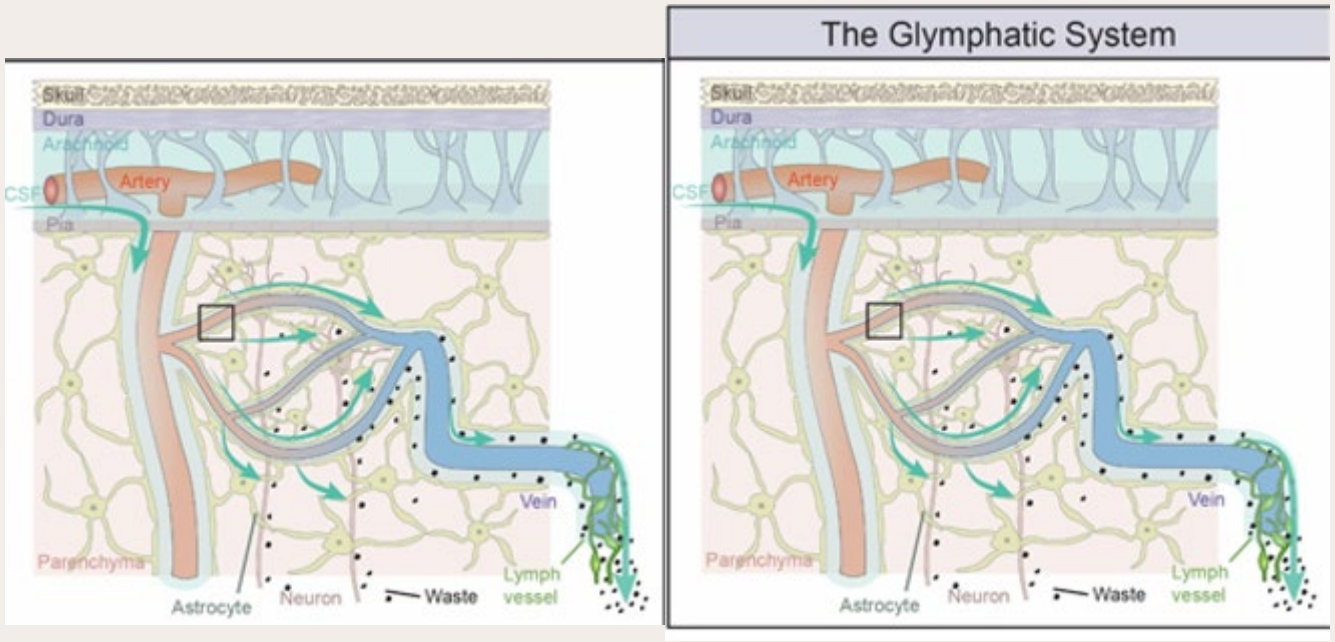

SLEEP ACROSS THE LIFESPAN
Awake
REM
Stage 1
Stage 2
Stage 3
Stage 4
Young Adult
1
2
3
4
5
6
7
8
Awake
REM
Stage 1
Stage 2
Stage 3
Stage 4
Elderly
1
2
3
4
5
6
7
8
Sleep (hours)


Lymphatic capillaries
Artery
Lymph node
lymphatic vessels
Vein

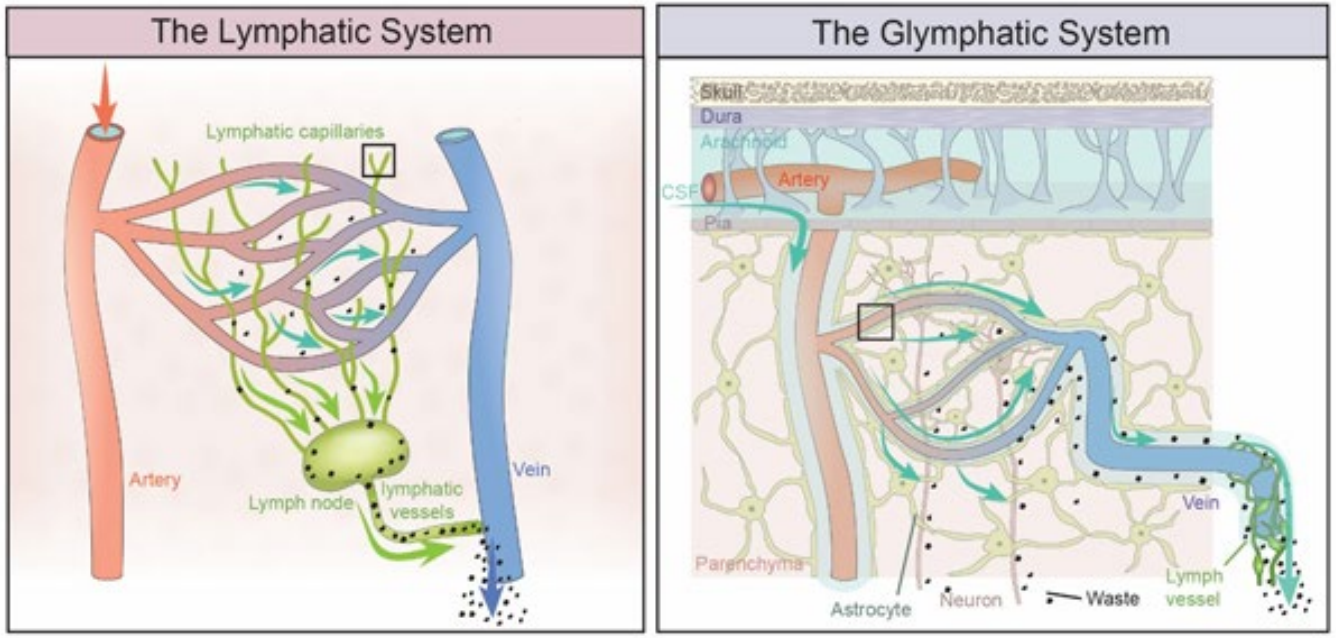

Lymphatic capillaries
Artery
Vein
Lymph node
lymphatic vessels


The Lymphatic System
Lymphatic capillaries
Artery
Vein
Lymph node
lymphatic vessels

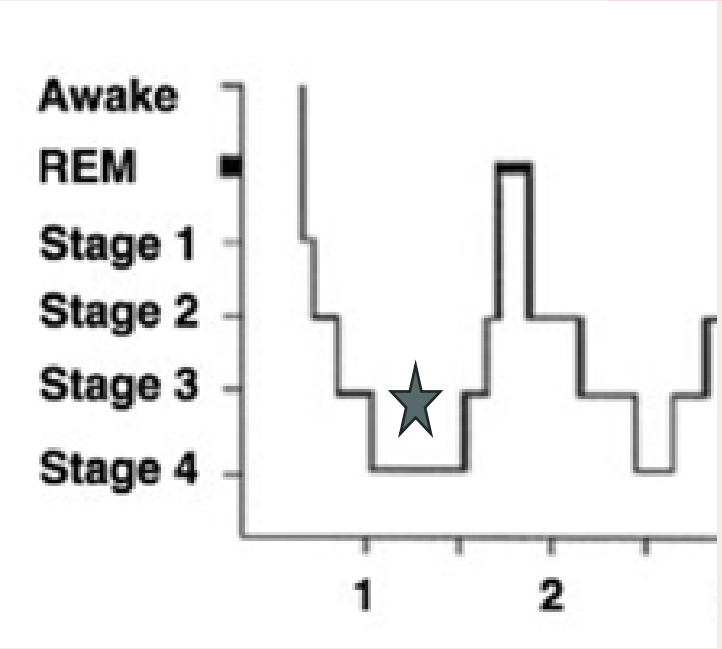

Skull
Dura
Arachnoid
Artery
CSF
Pia
Vein
Parenchyma
Lymph vessel
Astrocyte
Neuron
Waste


The Glymphatic System
Skull
Dura
Arachnoid
Artery
CSF
Pia
Vein
Parenchyma
Lymph vessel
Astrocyte
Neuron
Waste

Normal sleep/ N3 or SWS / glymphatic system



The lymphatic system in the periphery (left) and glymphatic system in the brain (right) are functionally homologous, enabling interstitial fluid movement, waste clearance, and immune surveillance of the tissue. Edited from: Hablitz and Nedergaard Current Biology 2021



Of interest, the glymphatic system is highly active during sleep and is disengaged mainly during wakefulness. This may contribute to the biological need for sleep that enables the elimination of potentially neurotoxic waste products. In an mouse model of AD, natural sleep or anesthesia was associated with a 60% increase in the interstitial space which correlated with increased convective exchange between the cerebrospinal fluid and interstitial fluid; this ultimately translated in an increased rate of β-amyloid clearance during sleep [6].

urmc.rochester.edu/labs/hablitz/projects/glymphatic-lymphatic-homology.aspx

sciencedirect.com/topics/veterinary-science-and-veterinary-medicine/glymphatic-system

Sleep in Neurological disorders

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- What is normal sleep?
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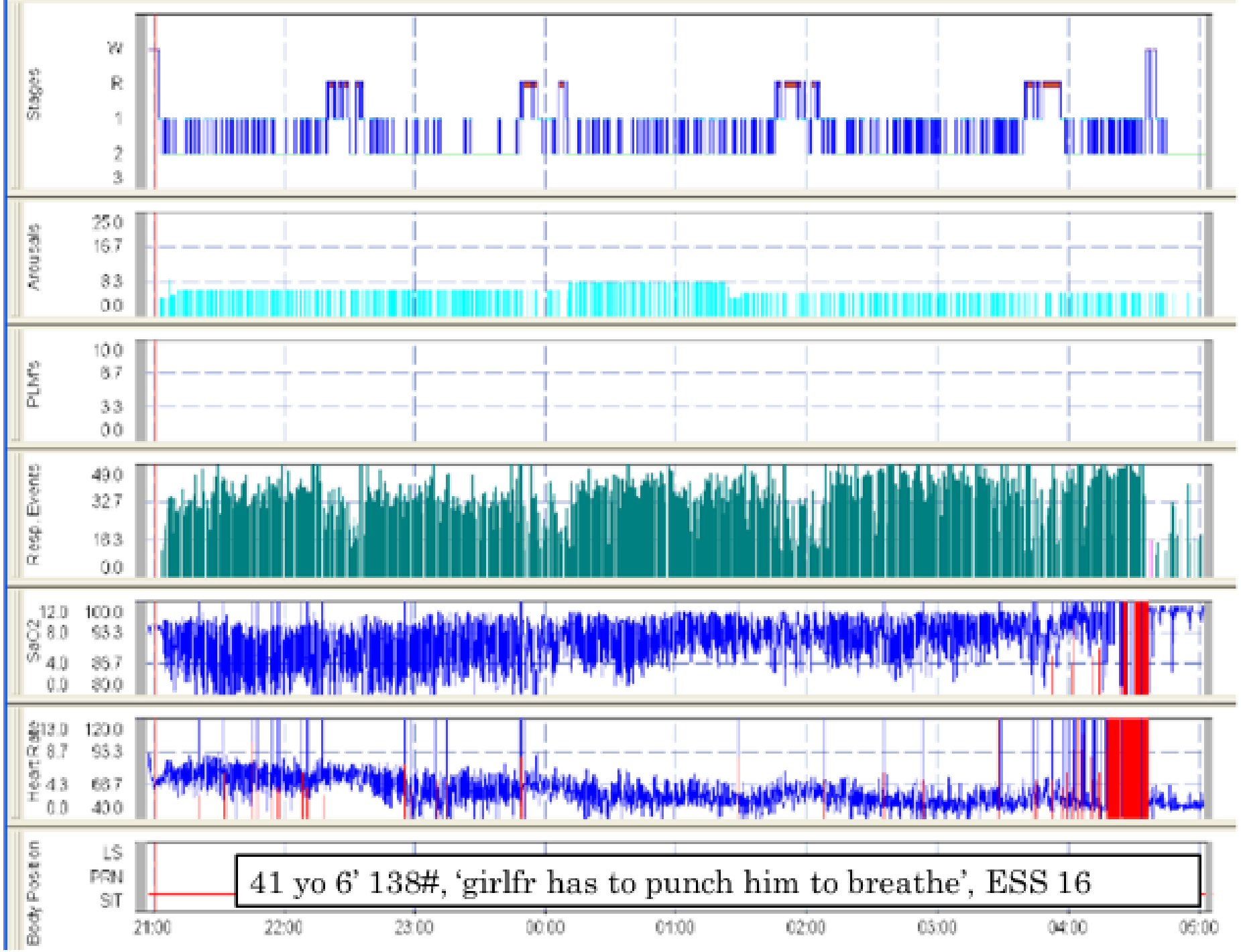
- Thanks/ Questions / comments



Polysomnogram (PSG)

Multi sleep stage changes; no N3 or R

Increase 'arousals' or near awakenings

Obstructions of airway

O2 desaturations

Hx:

CPAP titration

N3 and R rebound

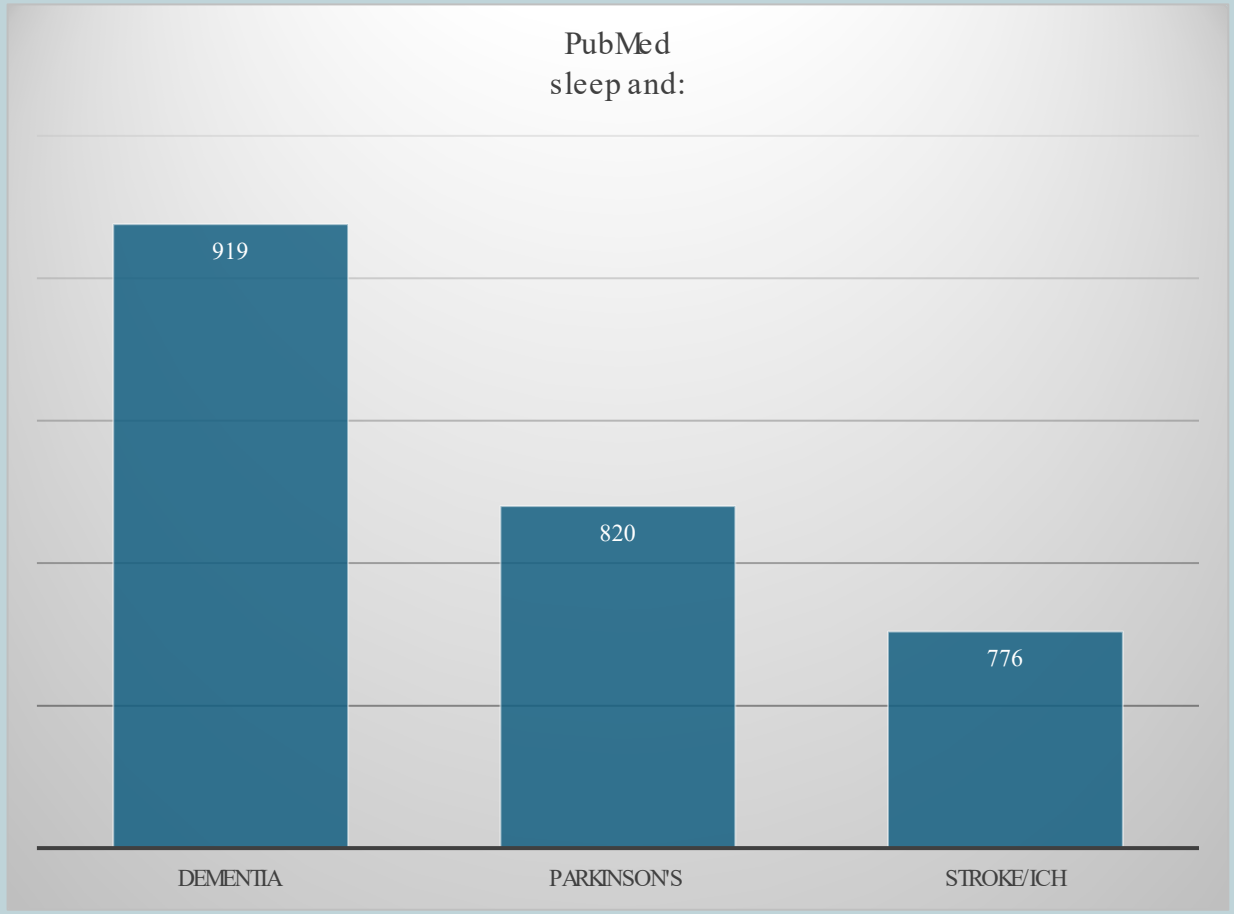
Osa early in night

desats early in night

PAP pressures *not shown*:

__-----

___ ----


PubMed
sleep and:
919
820
776
DEMENTIA
PARKINSON'S
STROKE/ICH

Sleep in Neurological disorders

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	Alzheimer’s	Parkinson's	Stroke
Prevalence	US: 7m; La: 70k		
Poor sleep as risk	yes		
Interventions available	Yes		
Do our interventions matter ?	yes		
Can we harm?	yes		

AD/sleep

GeroScience (2025) 47:3647–3664
https://doi.org/10.1007/s11357-024-01357-z

ORIGINAL ARTICLE

Disruption of sleep macro- and microstructure in Alzheimer's disease: overlaps between neuropsych neurophysiology, and neuroimaging

Anna Csilla Kegyes-Brassai · Robert Pierson-Bartel · Gergo Bolla · Anita Kamondi · Andras Attila Horvath

Less total sleep time
Lower sleep efficiency
Longer sleep latency
Less REM and N3/ SWS
Lower K complex density

Table 2 Group differences across the study groups

Parameter	AD	HC	*F* value	Nominal *p* value	Effect size
[a]Total sleep time (min), mean ± SD	301.41 ± 83.72	365.54 ± 48.87	13.13	0.001*	0.935566
[a]Sleep efficiency (%), mean ± SD	58.2 ± 14.65	78.73 ± 9.49	41.48	< 0.001*	5.907154
[a]Sleep latency (min), mean ± SD	39.52 ± 39.49	15.36 ± 8.12	10.78	0.002*	0.847486
[a]Relative S1 duration (%), mean ± SD	46.81 ± 12.36	7.58 ± 2.98	285.65	< 0.001*	4.363605
[a]Relative S2 duration (%), mean ± SD	25.45 ± 8.98	52.19 ± 7.88	150.35	< 0.001*	3.165275
[a]Relative S3 duration (%), mean ± SD	9.33 ± 4.93	18.72 ± 7.64	32.02	< 0.001*	1.460477
[a]Relative REM duration (%), mean ± SD	14.79 ± 9.57	21.51 ± 10.44	6.76	0.012	0.67103
[a]REM latency (min), mean ± SD	109.67 ± 64.81	108.74 ± 62.26	0.003	0.96	0.014635
[a]Number of sleep cycles (REM periods), mean ± SD	3.47 ± 1.36	3.6 ± 0.97	0.192	0.66	0.110057
[a]K-complex density (n/total sleep time), mean ± SD	0.484 ± 0.081	0.609 ± 0.096	0.22	< 0.001*	1.407385
[a]K-complex density (n/relative S2 duration), mean ± SD	0.5 ± 0.077	0.782 ± 0.091	0.39	< 0.001*	3.345546

Abbreviations *AD* group of people with AD, *HC* healthy controls, *SD* standard deviation, *REM* rapid eye movements

[a]Indexes age and sex weighted independent sample two-tailed *t* test

*Indicates statistically significant differences as *p* was set at 0.0045 applying Bonferroni correction for multiple comparisons

Alzheimer’s / dementia

Risk of dementia with sleep conditions:

- Chronic sleep deprivation <6hr was associated with a 30% increased risk of dementia Sabia. Nat Comm 2021

Alzheimer's / dementia

Risk of dementia with sleep conditions:

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- Obstructive sleep apnea 'OSA' associated with dementia

Alzheimer's / dementia

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Sleep conditions occurring **in dementia patients**:

- 50% of moderate to severe AD pt's have sleep disturbances

Alzheimer's / dementia

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Sleep conditions occurring **in dementia patients**:

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- AD pt's have reduced SWS, REM and incr arousals, N1

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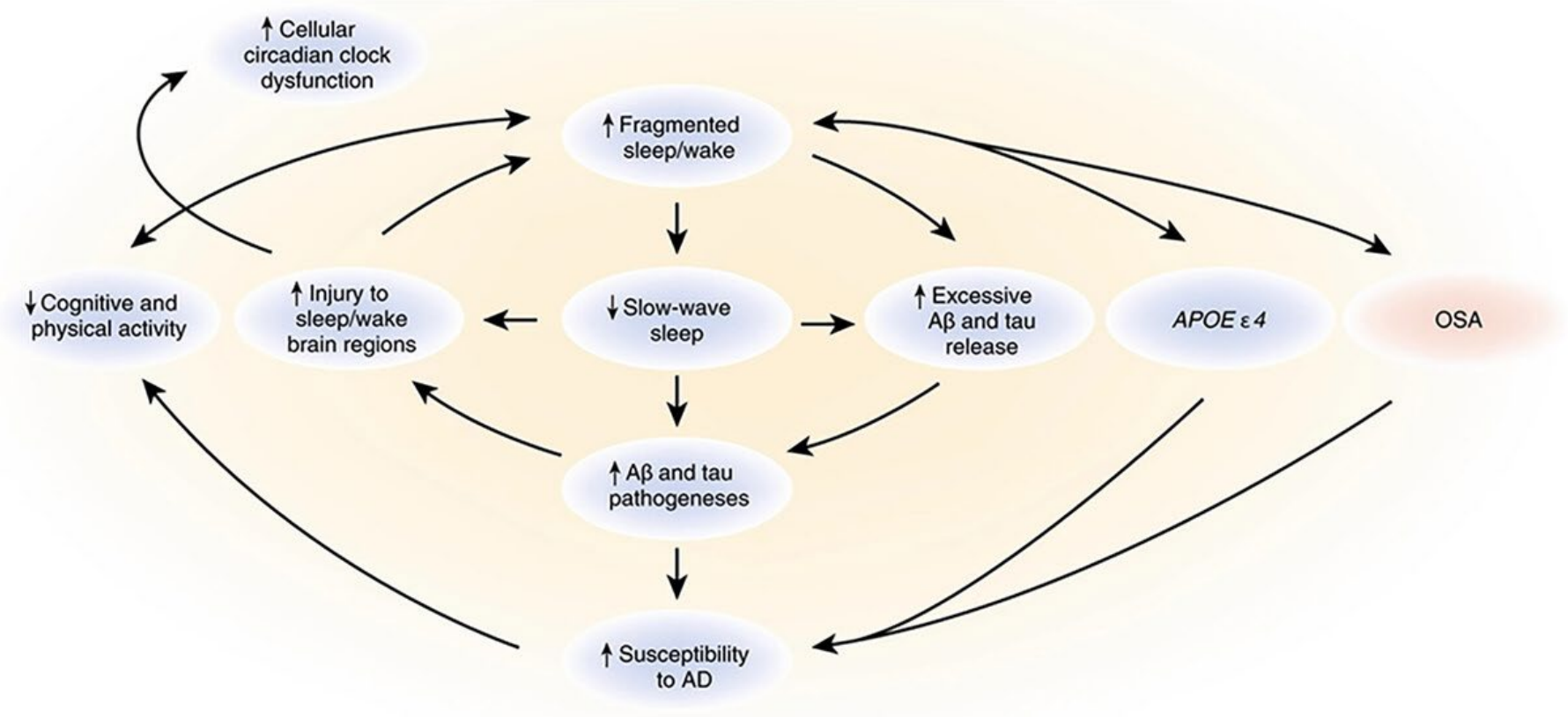
Sleep conditions occurring **in dementia patients**:

- 50% of moderate to severe AD pt's have sleep disturbances
- AD pt's have reduced SWS, REM and incr arousals, N1

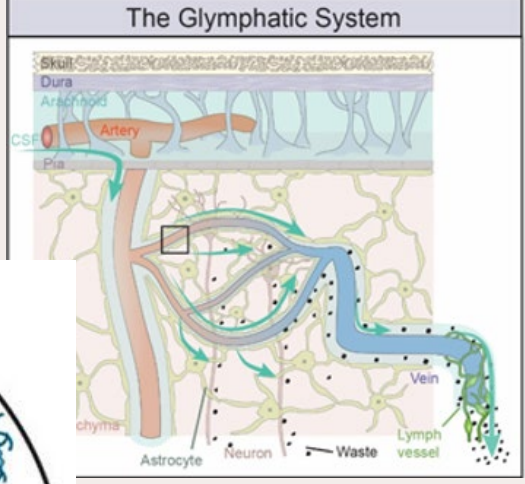
- An association has been also found between the ApoE-ε4 allele and OSA.
  Kadotani Jama 2001

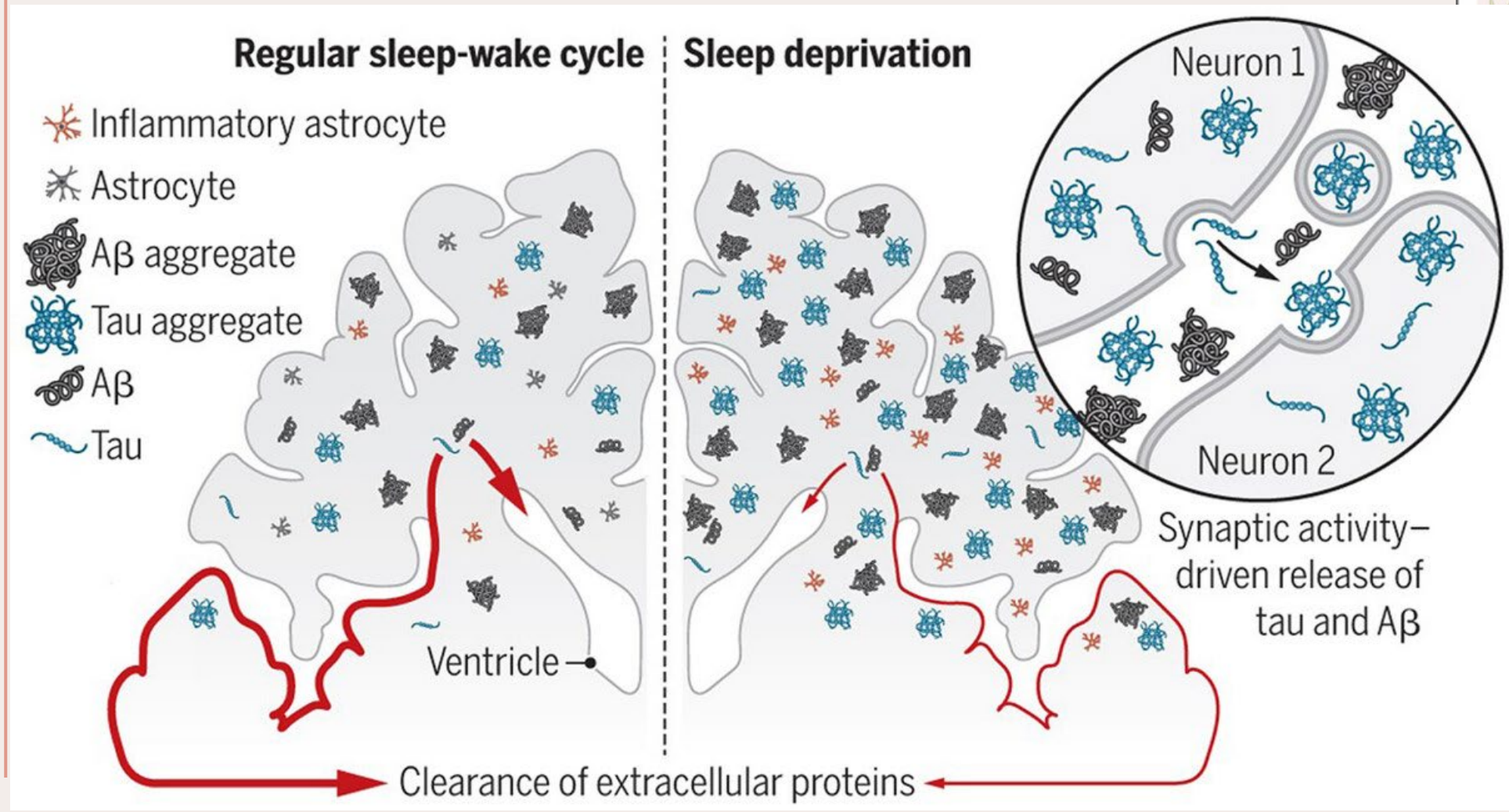
Sleep and Alzheimer's



Wang C, et al *Neuropsychopharmacol* 2020

AD/sleep: risk





Noble W and Spires-Jones TL. Sleep well to slow Alzheimers progression? *Science* 2019;363:813–814.

AD/sleep: risk

Received: 6 October 2025 | Revised: 27 December 2025 | Accepted: 22 January 2026

DOI: 10.1002/alz.71228

Alzheimer's & Dementia®
THE JOURNAL OF THE ALZHEIMER'S ASSOCIATION

RESEARCH ARTICLE

Longitudinal association between sleep and Alzheimer's pathology

Bery Mohammediyan[1,2] | Andrée-Ann Baril[1,2] | Alfonso Fajardo Valdez[3] | Frédéric St-Onge[3] | Alexa Pichet Binette[4,5,6] | Julie Carrier[1,7] | Maiya R. Geddes[3,8,9] | Simon Ducharme[3,10] | Maxime Montembeault[3,8] | Jean-Paul Soucy[10] | John Breitner[3,8,10] | Judes Poirier[3,8] | Sylvia Villeneuve[3,8,10] | for the PREVENT-AD Research Group

Highlights

- Greater day-to-day variability in actigraphy-based sleep measures was associated with higher amyloid and tau burden in cognitively unimpaired older adults at risk for Alzheimer's disease (AD).
- Greater day-to-day sleep variability—particularly variability in sleep efficiency—was also associated with faster amyloid accumulation over time.
- Sleep variability may serve as an early and sensitive marker of preclinical AD pathophysiology, highlighting its potential as a target for preventive interventions.

Whitehall 2 study

N=7959

If slept <6h, (compared to >7h)

risk of dementia greater by 30%

Sabia et al Natur Commun 2021

AD/sleep: risk

Obstructive sleep apnea (OSA) increases risk of various neurodegenerative dementias including:

- AD; Hazard ratio 1.3
- PD dementia; Hazard ratio 1.5
- LBD; Hazard ratio 2.1

Guay Gagnon et al. J Sleep Res 2022

AD/sleep: do our interventions matter?

- Cpap adherence is associated with lower odds of incident Alz's diagnosis (OR 0.65)

  J Amer Ger 2013

- Prolonged cpap use associated with delayed age at MCI onset, reduced progression to Alz's dx., and slower cognitive decline

  Shieu, Neurol 2022

BUT-

- Adherence an issue;

  predictors of poor adherence included

  apoe4 status

  unmarried pt's

AD/sleep: do our interventions matter?

A regular afternoon **exercise** program

(specifically, in a trial by Venturelli et al, 1 hour of walking with a caregiver)

has been demonstrated to reduce cortisol levels and simultaneously **reduce sundowning** behaviors.

Venturelli M, et al. *J Alzheimers Dis* 2016;53(4):1631–1640.

AD/sleep: can we harm?

- Benzo's or Z-drugs in dementia pt increase fall risk and hip fx risk (RR 3.1)

  J Amer Ger 2013

- Higher dose z-drugs increase stroke risk in dementia pt's (HR 1.9)

  BMC 2020

- Recommendations are to instead use melatonin, trazodone, or orexin antagonists

  (Cochrane)

BMJ 2014;349:g5205 doi: 10.1136/bmj.g5205 (Published 9 September 2014)

RESEARCH

Benzodiazepine use and risk of Alzheimer's disease: case-control study

OPEN ACCESS

Sophie Billioti de Gage *PhD student*[1], Yola Moride *professor*[2 3], Thierry Ducruet *researcher*[2], Tobias Kurth *director of research*[4 5], Hélène Verdoux *professor*[1 6], Marie Tournier *associate professor*[1 6], Antoine Pariente *associate professor*[1], Bernard Bégaud *professor*[1]

This case-control study based on 8980 individuals representative of elderly people living in the community in Quebec showed that the risk of Alzheimer's disease was increased by 43-51% among those who had used benzodiazepines in the past. Risk increased with density of exposure and when long acting benzodiazepines were used. Further adjustment on symptoms thought to be potential prodromes for dementia—such as depression, anxiety, or sleep disorders—did not meaningfully alter the results.

Archives of Gerontology and Geriatrics 134 (2025) 105850

Contents lists available at ScienceDirect

Archives of Gerontology and Geriatrics

journal homepage: www.elsevier.com/locate/archger

Clearing the confounding confusion: Benzodiazepines and the risk of dementia?

Kevin J Friesen [a], Jamie Falk [a], I Fan Kuo [b], Alexander Singer [c], Shawn Bugden [a,d,*]

Conclusions: Only a modest increase in dementia risk was seen in the high-dose benzodiazepine users. This association appears to be driven by the confounding due to higher rates of diabetes, cardiovascular disease, depression, and anxiety among users. Using restriction or HDPS to better control for confounding effects eliminates the association. While benzodiazepines do not appear to be a significant risk factor for dementia, tolerance, dependency and adverse effects caution against their long-term use.

RESEARCH ARTICLE

Alzheimer's & Dementia
Translational Research & Clinical Interventions

Published online: 5 July 2022

Benzodiazepine use and the risk of dementia

Geoffrey Joyce[1,2] | Patricia Ferido[1] | Johanna Thunell[1] | Bryan Tysinger[1,3] | Julie Zissimopoulos[1,3]

Discussion: We find little evidence of a causal relation between BZD use and dementia risk. Nonetheless, providers should limit the extended use in elderly populations.

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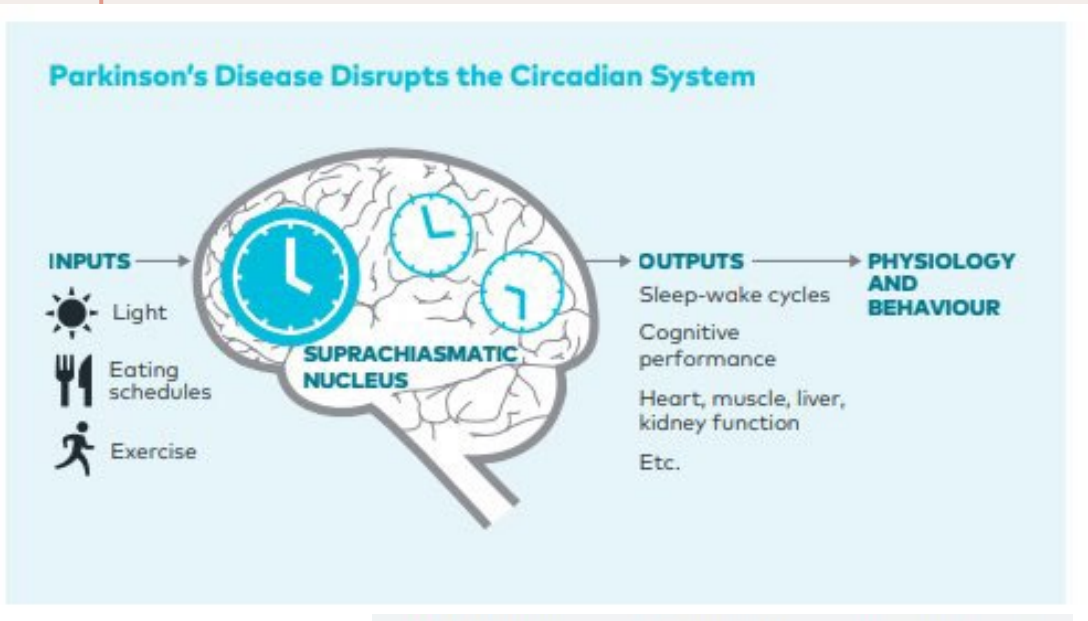
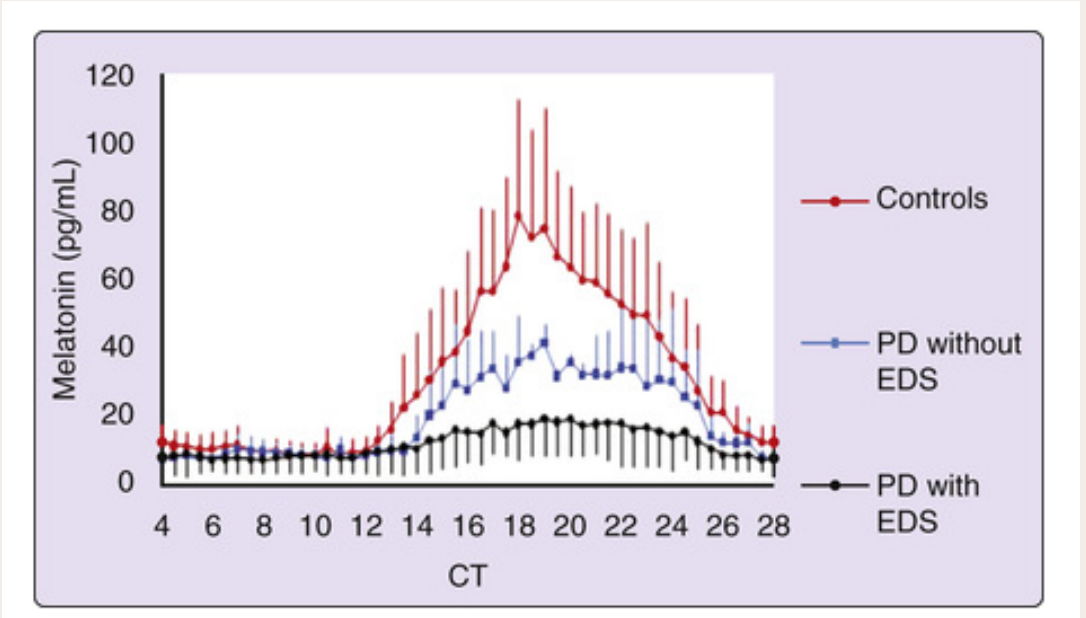
- **Sleep in Parkinson's ds (PD)**
- Sleep in stroke
- Interventions
- Avoiding (iatrogenic) harm
- Thanks/ Questions / comments

	Alzheimer’s	Parkinson's	Stroke
Prevalence		US 1m; La 4k	
Poor sleep as risk		yes	
Interventions available		yes	
Do our interventions matter ?		yes	
Can we harm?		yes	

Parkinson's

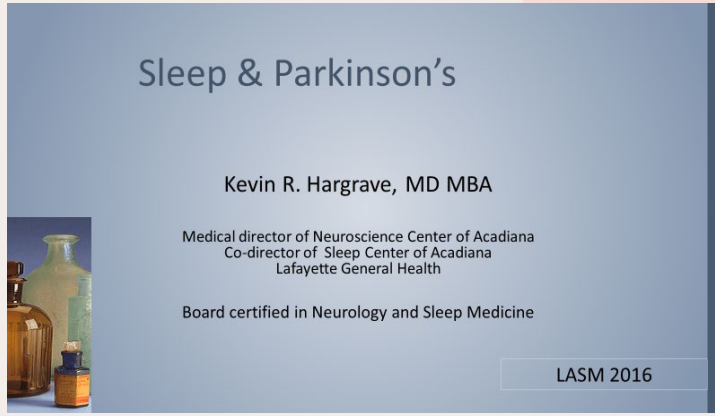


parkinson.org/sites/default/files/documents/sleep.pdf



SLEEP Kryger et al

Parkinson's



PD pt's have increased prevalence of

- insomnia,
- disrupted sleep,
- or other sleep problems (>60%)

Can have daytime sleep attacks made worse by dopamine agonists

1/3 at least 1 RBD episode per week

PDsleep

Less TST
Longer sleep latency
Less N3
Less REM
More WASO

Research Article

Journal of Parkinson's Disease
2025, Vol. 15(7) 1229–1239

DOI: 10.1177/18777182X251358279
journals.sagepub.com/home/pkn
Sage | IOS Press

Obstructive sleep apnea, periodic limb movements, and REM sleep without atonia are common in Parkinson's disease and correlate with motor symptom burden

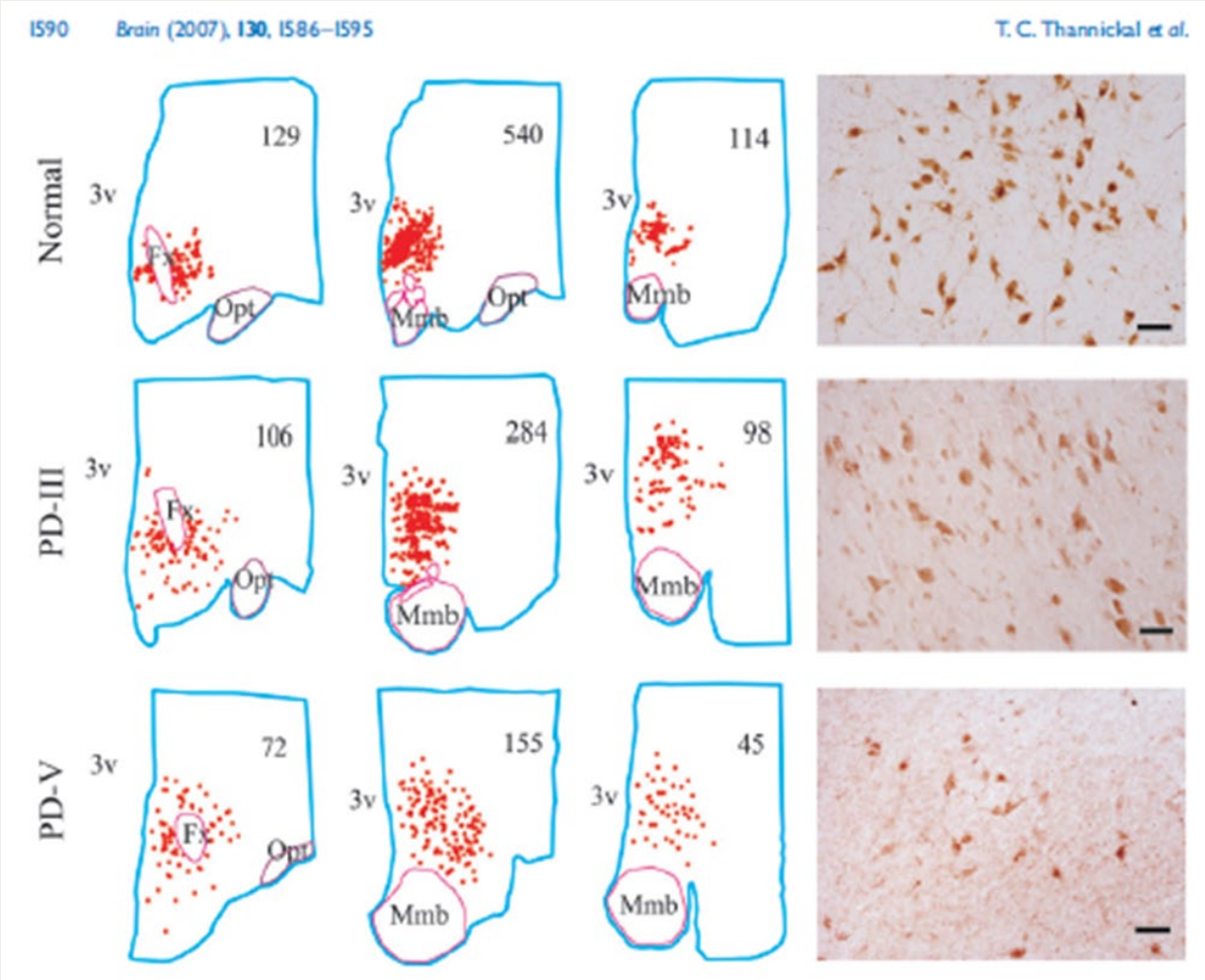
Matteo Carpi[1], Mariangela Pierantozzi[2,3], Mariana Fernandes[2], Natalia Manfredi[2], Raffaella Ludovisi[1], Michela Menegotti[1], Tommaso Schirinzi[2,3], Rocco Cerroni[3], Alessandro Stefani[2,3], Nicola Biagio Mercuri[1,2] and Claudio Liguori[1,3]

Table 1. Participants' demographic characteristics, clinical data, and PSG-measured sleep parameters.

Variable	PD ($n = 97$) Mean (SD)	CTRL ($n = 42$) Mean (SD)	Statistical test	p	Adjusted p	Cohen's d
Demographic variables						
Age	67.1 (7.9)	64.7 (9.7)	$t = 1.4$	0.165	0.202	0.27
Sex (n, % Male)	74 (76.3%)	28 (66.7%)	$\chi^2 = 1.4$	0.239	–	–
Clinical data						
BMI	26.3 (3.1)	26.3 (2.1)	$t = 0.02$	0.986	0.986	0.003
H&Y	2.2 (0.8)	–	–			
MDS-UPDRS-III	28.2 (12.9)	–	–			
Disease duration (years)	6.0 (4.0)	–	–			
LEDD	565.9 (382.1)	–	–			
Sleep parameters						
TST (min)	340.2 (68.2)	384.7 (47.8)	$t = -4.4$	<0.001	0.003	0.76
SE (%)	78.0 (13.9)	89.8 (4.2)	$t = -7.6$	<0.001	0.003	1.15
Sleep Latency (min)	15.3 (32.5)	8.6 (6.1)	$t = -1.2$[a]	0.250	0.275	0.19
REM Latency (min)	110.4 (84.7)	95.5 (24.4)	$t = 1.6$	0.120	0.165	0.24
N1 (%)	12.7 (8.3)	10.4 (5.7)	$t = -1.9$[a]	0.058	0.09	0.69
N2 (%)	55.8 (6.9)	51.0 (7.1)	$t = 3.7$	<0.001	0.003	0.52
N3 (%)	16.6 (5.3)	19.7 (6.4)	$t = -2.7$	0.008	0.018	0.38
REM (%)	14.8 (5.1)	16.6 (4.1)	$t = -2.2$	0.027	0.050	0.40
WASO (min)	101.1 (72.2)	43.5 (18.1)	$t = 7.3$	<0.001	0.003	1.09
RSWA [N (%)]	43 (44.3)	0 (0)	$\chi^2 = 27.0$	<0.001	–	–

[a] : t-test performed on log10-transformed values, back-transformed means are reported.
AHI: apnea-hypopnea index; BMI: body mass index; H&Y: modified Hoehn and Yahr stage score; LEDD: levodopa equivalent daily dose; N1 (%), N2 (%), N3 (%), REM (%): percentage of sleep time spent in stage 1, 2, 3 of non-REM, and REM sleep; RSWA: REM sleep without atonia; TST: total sleep time; MDS-UPDRS-III: Movement Disorder Society Unified Parkinson's Disease Rating Scale – part III; WASO: wakefulness after sleep onset.

Sleep and Parkinson's; narcolepsy 'lite'



Hcrt/orexin cell loss

Thannickal et al. Brain 2007

REM behavior disorder (RBD)

- MSA up to 90%*
- DLB up to 80%*
- PD 25-50%*
- PSP 20-30%*
- HD 8%*

Bed partner safety

Melatonin; Clonazepam

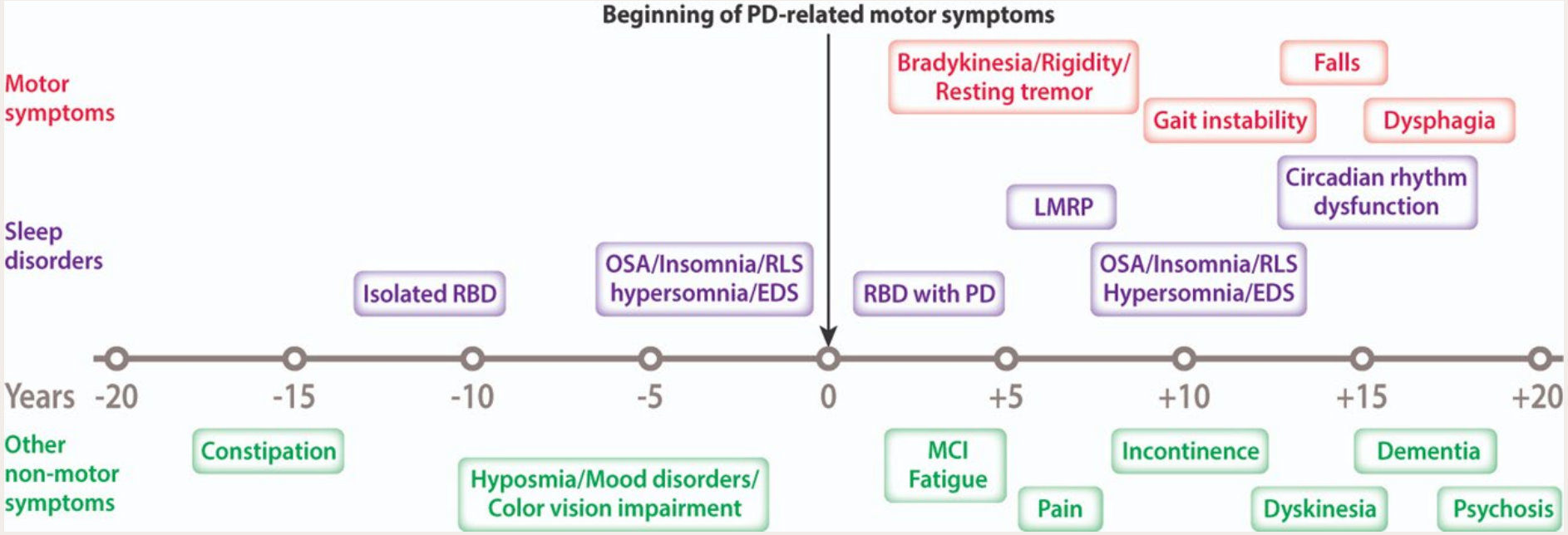
Antidepressants may cause or worsen

Male > female

*OE

Parkinson's

- About 50% of PD pt's >/= 2 SOREMs
- 70% if they hallucinate



Stone et al. PRACTICAL NEUROLOGY SEPTEMBER/OCTOBER 2025

In a study of over 6k pd pts 15% had had mva.

meindorfer et al mov d.o. 2005

Medicine®

OBSERVATIONAL STUDY

OPEN

Increased Risk of Parkinson's Disease in Patients With Obstructive Sleep Apnea

A Population-Based, Propensity Score-Matched, Longitudinal Follow-Up Study

Nai-Cheng Yeh, MD, Kai-Jen Tien, MD, Chun-Ming Yang, MD, Jhi-Joung Wang, MD, and Shih-Feng Weng, PhD

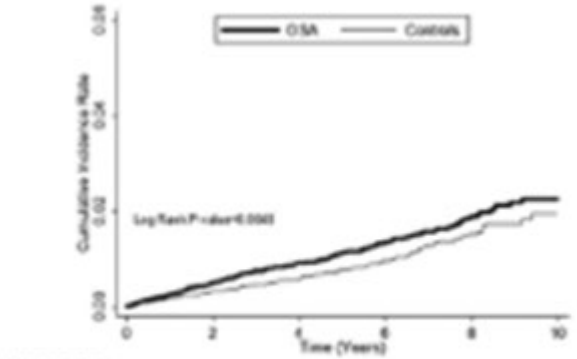


FIGURE 1. The cumulative incidence rate for Parkinson's disease for patients with obstructive sleep apnea (OSA) and controls (log-rank *P* value = 0.0048). OSA = obstructive sleep apnea.

Medicine • Volume 95, Number 2, January 2016

PD / Sleep: can we help?

Studies of DBS w various targets show improvements in sleep

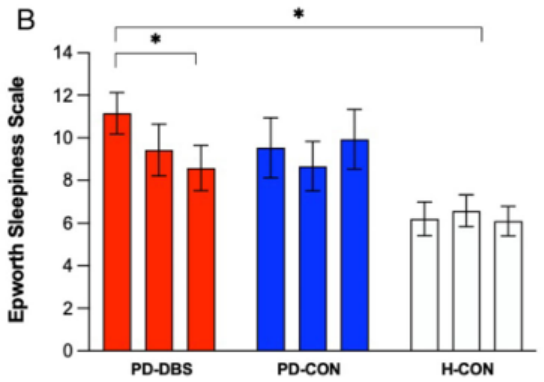
CPAP helps RBD

And, of course helps excessive daytime sleepiness

Movement Disorders
CLINICAL PRACTICE
RESEARCH ARTICLE

The Impact of Deep Brain Stimulation of the Subthalamic Nucleus on Sleep–Wake Function and Circadian Rhythms in Patients with Parkinson's Disease

Julia Steinhardt, PhD,[1,2] Laura Lokowandt, MD,[1,2] Cosima Xenia Schmidt, MSc,[2,3] Dirk Rasche, MD,[4] Henrik Oster, PhD,[2,3] Britta Wilms, PhD,[2,5,6] and Norbert Brüggemann, MD[1,2,*]



ESS improved; TST and TiB improved but not sleep efficiency

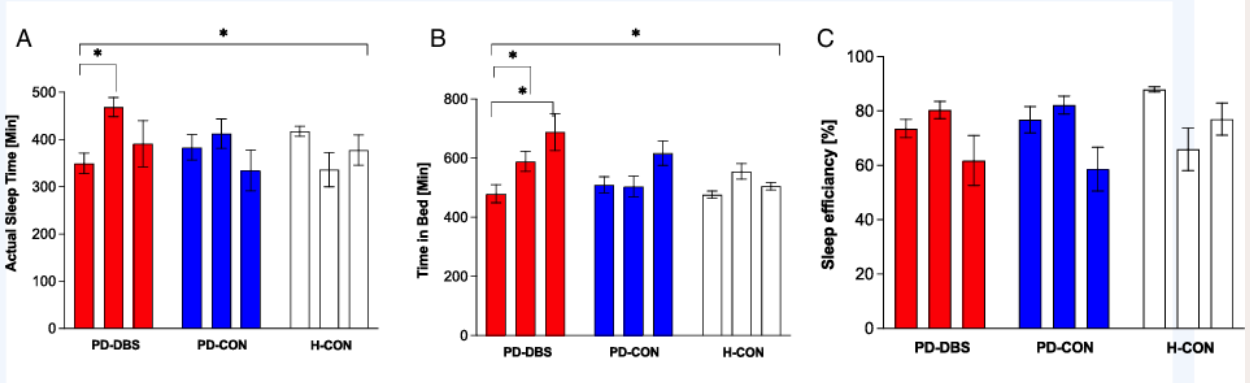


FIG. 2. Changes in total actual sleep time (A) and total time in bed. Mean change in actual sleep time and time spent in bed as a comparison between groups and time points: baseline (T_0, first bar per group), after six months (T_{6M}; second bar per group), and after 12 months (T_{12M}; third bar per group). PD-DBS, patients with STN DBS (red bars); PD-CON, PD patients under best medical treatment (blue bars); H-CON, healthy control subjects (white bars). Values are shown as mean values ± SEM.

2002; Monaca et al., 2004). Subthalamic nucleus (STN) DBS has been shown to increase total sleep time, decrease wakefulness after sleep onset, and increase time spent in non-rapid eye movement (NREM) stage 2 (N2) sleep (Arnulf et al., 2000; Monaca et al., 2004). Still, results are mixed, with other studies showing a trend towards a decrease in N2 sleep (though not reaching statistical significance; Iranzo et al., 2002), or no change in N2 sleep but an increase in NREM stage 3 (N3; Monaca et al., 2004).

Sleep Breath (2018) 22:825–830
DOI 10.1007/s11325-017-1563-9

EPIDEMIOLOGY • ORIGINAL ARTICLE

Prevalence of obstructive sleep apnoea in REM behaviour disorder: response to continuous positive airway pressure therapy

A. Gabryelska[1,2] · A. Roguski[1] · G. Simpson[1] · E. L. Maschauer[1] · I. Morrison[3] · Renata L. Riha[1]

Almost half (45.8%) of patients on CPAP noticed an improvement in their RBD symptoms with CPAP treatment supporting our hypothesis that CPAP may improve RBD concomitant with OSA. However, there was no significant difference in the subjective or objective compliance of individuals who experienced RBD improvement on CPAP therapy compared to those who did not. This suggests that degree of CPAP compliance does not affect severity of RBD symptoms.

CPAP IMPROVES SLEEP AND SLEEPINESS IN PARKINSON PATIENTS WITH SLEEP APNEA

http://dx.doi.org/10.5665/sleep.3332

Continuous Positive Airway Pressure Improves Sleep and Daytime Sleepiness in Patients with Parkinson Disease and Sleep Apnea

Ariel B. Neikrug, MS[1]; Lianqi Liu, MD[2]; Julie A. Avanzino[2]; Jeanne E. Maglione, MD, PhD[2]; Loki Natarajan, PhD[3]; Lenette Bradley, BS[2]; Alex Maugeri[2]; Jody Corey-Bloom, MD, PhD[4]; Barton W. Palmer, PhD[1,2,5]; Jose S. Loredo, MD[6]; Sonia Ancoli-Israel, PhD[1,2,6,7]

Conclusions: Therapeutic continuous positive airway pressure versus placebo was effective in reducing apnea events, improving oxygen saturation, and deepening sleep in patients with Parkinson disease and obstructive sleep apnea. Additionally, arousal index was reduced and effects were maintained at 6 weeks. Finally, 3 weeks of continuous positive airway pressure treatment resulted in reduced daytime sleepiness measured by multiple sleep latency test. These results emphasize the importance of identifying and treating obstructive sleep apnea in patients with Parkinson disease.

Sleep Medicine 139 (2026) 108766

Contents lists available at ScienceDirect

Sleep Medicine

journal homepage: www.elsevier.com/locate/sleep

Obstructive sleep apnea, biomarker profiles, and clinical progression in Parkinson's disease: Longitudinal effects of CPAP therapy

Shasha Zhu [1], Di An [1], Xiaoxi Liu [*]

Department of Neurology, Affiliated Hospital of Hebei University, Baoding, Hebei, China

Prospective cohort study
140 pt's w PD; 51% OSA (AHI>5); PAP naïve
Among PAP wearers 50% adherent (70% nights >4h)
Average ahi among OSA pt 25/h
O2 desat nadir .80 vs 88.4 and % time sats <.90 was 8.4% vs 2.1%
OSA pt had less SWS (N3) and REM

PD plus OSA pt's

- were heavier BMI 27.4 vs 25.9
- Slower TUGT 11.8 vs 10.5
- Worse EDS w ESS 10.9 vs 8.4
- Greater pain KPPS 13.5 vs 11.0
- Worse cogn MoCA 24.4 vs 25.8

- At baseline
  - had higher CSF pro inflamm and neurodeg biomarker levels IL-1b, IL-18
  - higher serum IL-6, CRP 3.8 vs 2.4
  - Had higher glial activation markers (GFAP, S100b, NfL)

PD plus OSA pt's

- AHI and O2 desaturation severity correlated with inflammatory activation and neuroaxonal damage
- Higher IL-6 levels correlated with worse UPDRS scores
- NfL was the strongest predictor of gait and postural dysf with a robust assoc with longer TUG times
- CRP and IL-6 levels were assoc with more severe fatigue
- S100B levels assoc with pain
- Higher NfL predicted lower MoCA

PD plus OSA pt's

CPAP adherence

- was associated with significant decreases in proinflammatoroy markers
  - annual reductions in
    - IL-6
    - TNFa
    - CRP

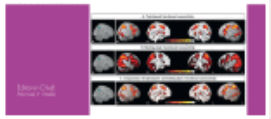
In contrast nonadherent pt's had stable or increasing levels, particularly for CRP

NfL levels remained stable in adh group but incr signif in nonadh group

Indicating that CPAP adher may attenuate or prevent neuroaxonal injury progression

Adherence to continuous positive airway pressure for the treatment of obstructive sleep apnea in neurodegenerative diseases: A systematic review

sleepmedicine REVIEWS



Sleep Medicine Reviews

Annie C. Lajoie; Yusing Gu; Andrew Lim; Andrea Benedetti; Marta Kaminska

Sleep Medicine Reviews, October 01, 2023, Volume 71, Article 101836, Copyright © 2023 Elsevier Ltd

Attrition rates ranged from 12% to 75%. In MCI/AD, adherence rates ranged from 28% to 61% (study duration range: 3 weeks to 3.3 years). Younger age, race (white) and better CPAP confidence scores at 1 week were associated with more CPAP use while APOE4 positive and unmarried individuals were more likely to abandon CPAP. In most studies, adherent patients had improvement in excessive daytime sleepiness, depressive symptoms, sleep quality, ability to manage daily activities and certain aspects of cognition (composite score or global cognition, psychomotor speed, executive function), as well as less cognitive decline over time. Caregiver satisfaction was also better in PAP adherent patients in one study. In PD, 15–25% of individuals refused treatment with PAP upfront, and attrition ranged from 8 to 75%. Adherent patients used their device for an average of 3h27 to 5h12 per night (study duration range: 6 weeks to 12 months).

Published in final edited form as:
Neurobiol Dis. 2023 January ; 176: 105963. doi:10.1016/j.nbd.2022.105963.

Parkinsonian Daytime Sleep-Wake Classification using Deep Brain Stimulation Lead Recordings

Ajay K. Verma[1], **Ying Yu**[1], **Sergio F. Acosta-Lenis**[1], **Tyler Havel**[1], **David Escobar Sanabria**[1], **Gregory F. Molnar**[1], **Colum D. MacKinnon**[1], **Michael J. Howell**[1], **Jerrold L. Vitek**[1], **Luke A. Johnson**[1,*]

[1]Department of Neurology, University of Minnesota, Minneapolis

Highlights

- Daytime sleepiness occurs in Parkinson's disease (PD), but treatment options remain lacking.
- DBS is an effective treatment option for PD motor signs.
- Daytime sleep-wake states can be classified based on DBS lead recordings with >85% accuracy.
- Results can guide closed-loop DBS systems for mitigating daytime sleepiness in PD.

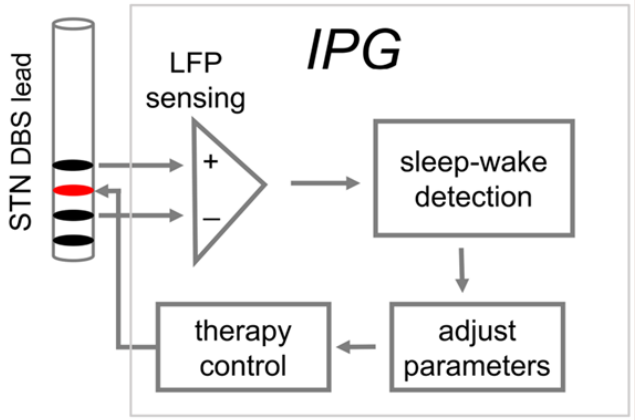


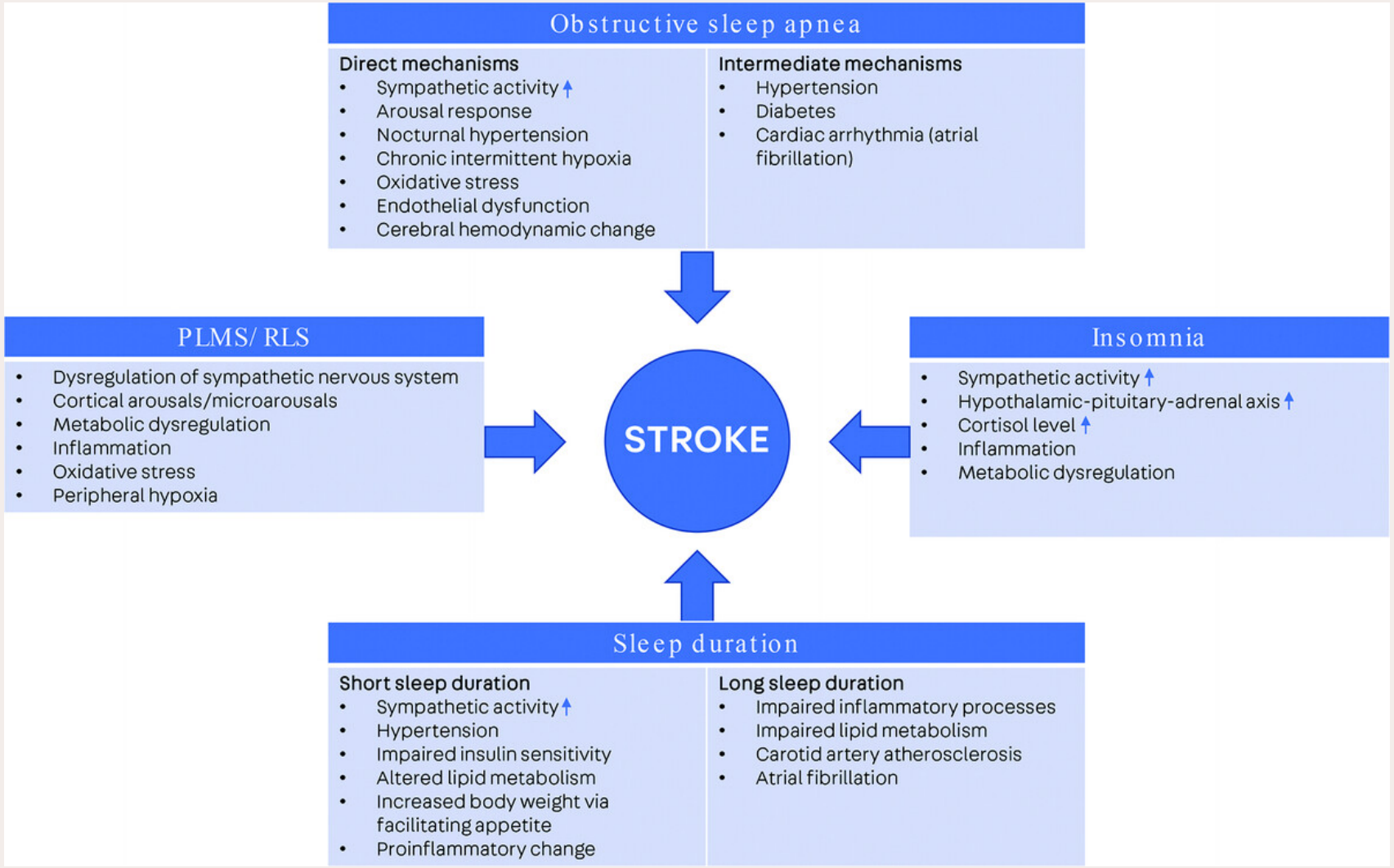
Figure 1.
An example of a closed-loop DBS paradigm for automatic detection and disruption of sleep-related neural oscillations. A major first step towards the realization of this paradigm will be a reliable identification of daytime sleep-wake states using DBS lead sensing. This

Sleep in Neurological disorders

- Intro
- What is normal sleep?
- Poor sleep?
- Sleep in Alzheimer's ds (AD)
- Sleep in Parkinson's ds (PD)
- **Sleep in stroke**
- Interventions
- Avoiding (iatrogenic) harm
- Thanks/ Questions / comments

	Alzheimer’s	Parkinson's	Stroke
Prevalence			US 6m; La 75k
Poor sleep as risk			yes
Interventions available			yes
Do our interventions matter ?			yes
Can we harm?			?

Sleep and Ischemic Stroke, Intracranial hemorrhage



Koo DL, et al *J Stroke* 2018

Frequency of Sleep Apnea in Stroke and TIA Patients: A Meta-analysis

Karin G. Johnson, M.D.[1]; Douglas C. Johnson, M.D.[2]

[1]*Baystate Medical Center, Springfield, MA;* [2]*Massachusetts General Hospital, Boston, MA*

Study Objectives: To determine the frequency of sleep disordered breathing (SDB) in ischemic and hemorrhagic stroke and transient ischemic attack (TIA) patients by meta-analysis.

Methods: A systematic literature search using Medline, EMBASE and CINAHL and a manual review of references through December 2008 was conducted using specific search terms. The frequency of SDB stratified by apnea hypopnea index (AHI) was extracted by the author. Weighted averages using a random-effects model are reported with 95% confidence intervals.

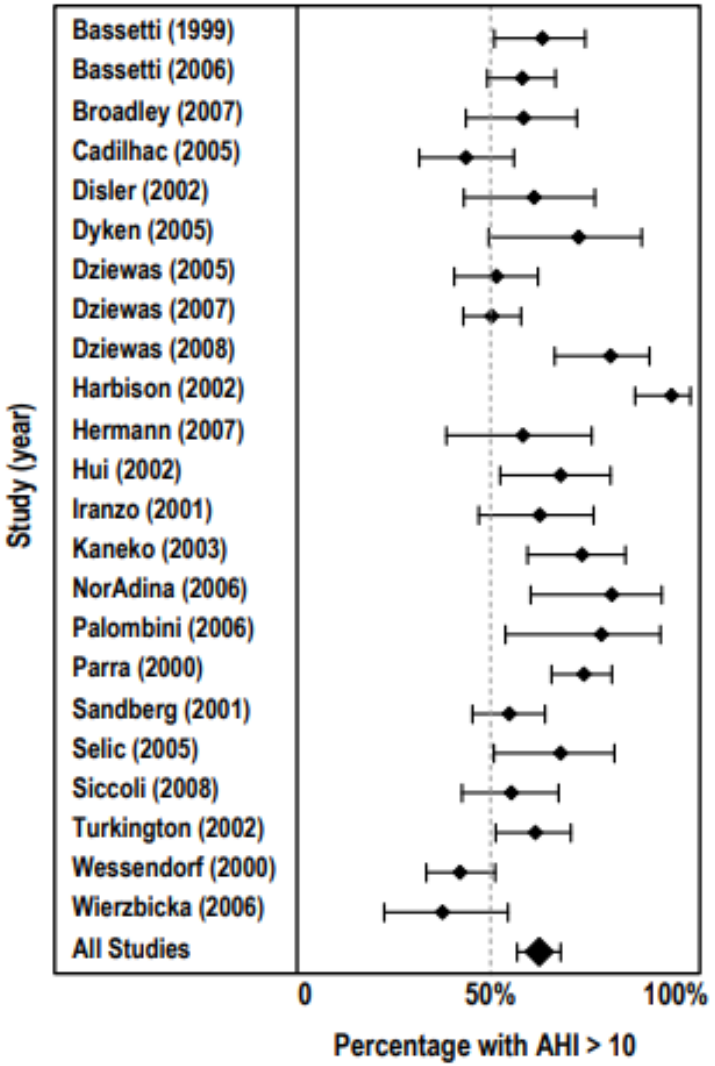
Results: Twenty-nine articles evaluating patients with auto-CPAP, limited-channel sleep study, or full polysomnography were included in this study. In meta-analysis of 2,343 ischemic or hemorrhagic stroke and TIA patients, the frequency of SDB with AHI > 5 was 72% and with AHI > 20 was 38%. Only 7% of the SDB was primarily central apnea. There was no significant difference in SDB prevalence by event type, timing after stroke, or type of monitoring. Males had a higher percentage of SDB (AHI > 10) than females (65% compared to 48% p = 0.001). Patients with recurrent strokes had a higher percentage of SDB (AHI > 10) than initial strokes (74% compared to 57% p = 0.013). Patients with unknown etiology of stroke had a higher and cardioembolic etiology a lower percentage of SDB than other etiologies.

Conclusions: SDB is very common in stroke patients irrespective of type of stroke or timing after stroke and is typically obstructive in nature. Since clinical history alone does not identify many patients with SDB, sleep studies should be considered in all stroke and TIA patients.

Keywords: Stroke prevention, all cerebrovascular disease/strok, sleep apne, prevalence studies, screening in epidemiology

Citation: Johnson KG; Johnson DC. Frequency of sleep apnea in stroke and TIA patients: a meta-analysis. *J Clin Sleep Med* 2010;6(2):131-137.

Figure 1—Forest plot of percentage of patients with AHI > 10 with 95% confidence intervals.



REVIEW ARTICLE | Originally Published 22 December 2020 |

Check for updates

Trials in Sleep Apnea and Stroke: Learning From the Past to Direct Future Approaches

Mark I. Boulos, MD, Laavanya Dharmakulaseelan, MEng, Devin L. Brown, MD, and Richard H. Swartz, MD | AUTHOR INFO & AFFILIATIONS

Stroke • Volume 52, Number 1 • https://doi.org/10.1161/STROKEAHA.120.031709

Table 2. Randomized Controlled Trials on CPAP Use on Vascular Outcomes Poststroke

Study	Inclusion criteria	N	N with ICH	Diagnosis of OSA
Bravata et al[18]	NIHSS score ≥2 AHI≥5	55	0	AutoPAP or ambulatory sleep test
Parra et al[19]	AHI≥20	140	0	Ambulatory sleep test
Parra et al[13]	AHI≥20	140	0	Ambulatory sleep test
McEvoy et al[25]	Oxygen desaturation ≥12	2687 (1324 with ischemic stroke or ICH)	Not reported	Ambulatory sleep test
Gupta et al[27]	AHI≥15	116	15 (7 in control group)	PSG
Bravata et al[26]	AHI≥5	252	0	Ambulatory sleep test

AHI indicates apnea-hypopnea index; CPAP, continuous positive airway pressure; ICH, intracerebral hemorrhage; NA, not applicable; NIHSS, National Institutes of Health Stroke Sc

REVIEW ARTICLE | Originally Published 22 December 2020 |

Check for updates

Trials in Sleep Apnea and Stroke: Learning From the Past to Direct Future Approaches

Mark I. Boulos, MD, Laavanya Dharmakulaseelan, MEng, Devin L. Brown, MD, and Richard H. Swartz, MD | AUTHOR INFO & AFFILIATIONS

Stroke • Volume 52, Number 1 • https://doi.org/10.1161/STROKEAHA.120.031709

Study	Mean CPAP adherence (hours/day)	CPAP initiation poststroke	Follow-up period	Conclusions
Bravata et al[18]	NA	Majority between 1 and 2 d	30 d	↓ recurrent events (not significant)
Parra et al[19]	5.3	3–6 d	2 y	No change in cardiovascular event-free survival
Parra et al[13]	5.3	3–6 d	5 y	↑ Cardiovascular event-free survival
McEvoy et al[25]	3.3	NA	3.7 y	No reduction in recurrent events
				No reduction in mortality
Gupta et al[27]	4.2	<6 mo	1 y	No reduction in recurrent events
Bravata et al[26]	3.9	1–4 wk	6–12 mo	No reduction in recurrent events

European Journal of Internal Medicine 133 (2025) 78–85

Contents lists available at ScienceDirect

European Journal of Internal Medicine

journal homepage: www.elsevier.com/locate/ejim

Original Article

Effect of continuous positive airway pressure on non-fatal stroke and paroxysmal atrial fibrillation recurrence in obstructive sleep apnoea elderly patients

Valentino Condoleo [a,1], Giandomenico Severini [b,1], Giuseppe Armentaro [a,*], Mattea Francica [b], Giulia Crudo [b], Mario De Marco [b], Francesco Maruca [b], Guglielmo Ciaccio [b], Carlo Fuoco [b], Carlo Alberto Pastura [b], Marcello Divino [b], Corrado Pelaia [b], Egidio Imbalzano [c], Mario Bo [d,2], Andrea Ungar [e,2], Angela Sciacqua [a,b,2]

[a] Geriatrics Division, "Renato Dulbecco" University Hospital of Catanzaro, Catanzaro 88100, Italy

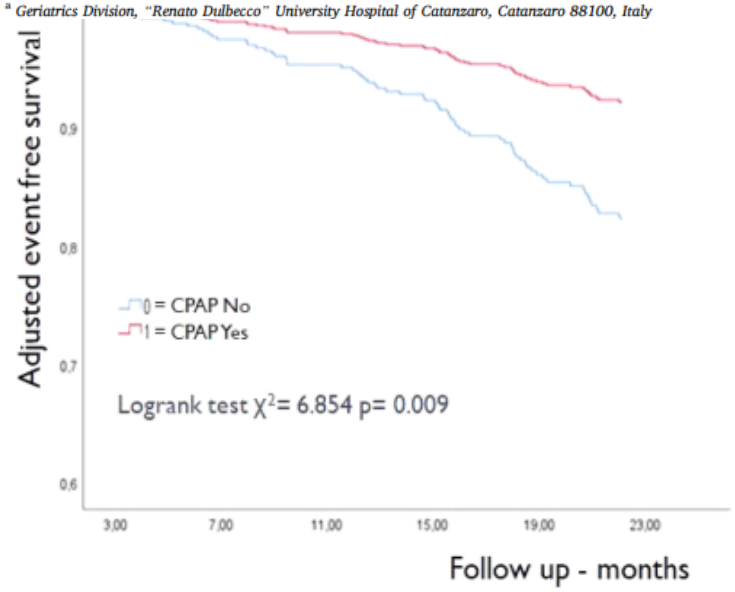
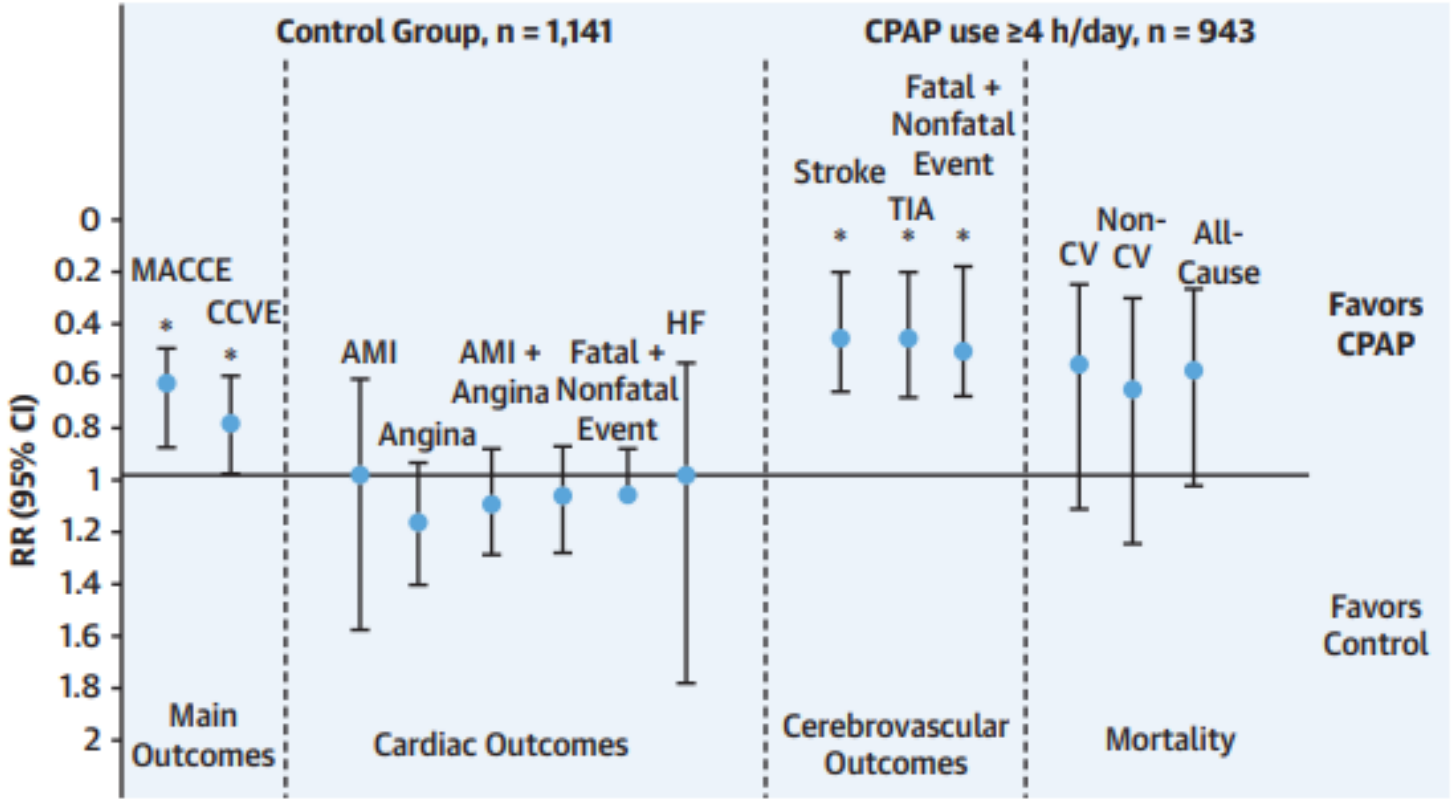


Fig. 3. Adjusted Kaplan-Meier on PAF recurrence, according to CPAP treatment.
Abbreviations: PAF: Paroxysmal Atrial Fibrillation, CPAP: Continuous positive airway pressure

Moreover, our study revealed that a CPAP use greater than 4h/ni
was associated with reduced risk of recurrence of PAF of 71 %.

FIGURE 4 Effective Use of CPAP Improves Cerebrocardiovascular Outcomes and All-Cause Mortality



The y-axis shows the risk ratio (RR) with 95% CI; the x-axis shows the different types of individual and composite cardiovascular (CV) events. *$P < 0.05$. Reprinted with permission of the American Thoracic Society.[111] AMI = acute myocardial infarction; CCVE = cardiocerebrovascular event; CPAP = continuous positive airway pressure; HF = heart failure; MACCE = major adverse cardiocerebrovascular events; TIA = transient ischemic attack.

Journal of Stroke and Cerebrovascular Diseases 34 (2025) 108204

Contents lists available at ScienceDirect

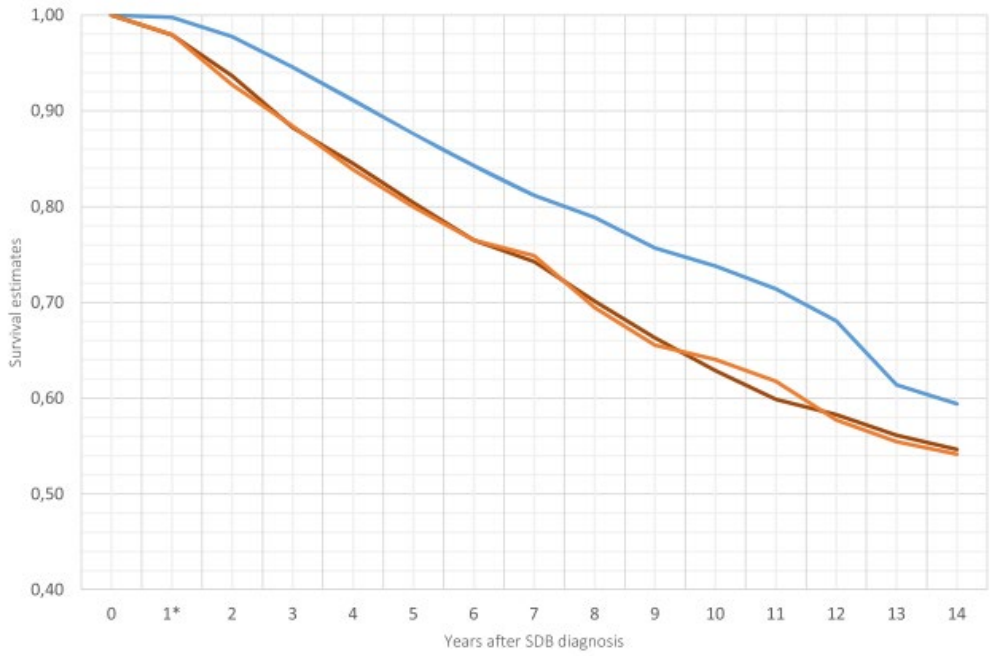
Journal of Stroke and Cerebrovascular Diseases

journal homepage: www.elsevier.com/locate/jstroke

Stroke recurrence and all-cause mortality in CPAP-treated sleep-disordered-breathing patients

Jeppe Suusgaard, MD [a], Anders Sode West, PhD, MD [b], Laura B. Ponsaing, PhD, MD [a], Helle Klingenberg Iversen, DMSC, Associate Professor [b,c], Katrin Rauen, DMSC [d,e,f], Poul Jørgen Jennum, DMSC, Professor [a,c,*]

[a] *Danish Center for Sleep Medicine, Department of Clinical Neurophysiology, Copenhagen University Hospital, Rigshospitalet, Denmark*



Numbers at risk (number censored)

CPAP users	845 (0)	770 (53)	199 (539)	31 (629)
CPAP-non-users	536 (0)	453 (39)	155 (265)	38 (331)
No CPAP treatment	440 (0)	369 (32)	170 (156)	84 (220)

PAP in acute stroke

Sleep in Neurological disorders

- Intro
- What is normal sleep?
- Poor sleep?
- Sleep in Alzheimer's ds (AD)
- Sleep in Parkinson's ds (PD)
- Sleep in stroke
- Interventions
- **Avoiding (iatrogenic) harm**
- Thanks/ Questions / comments

Iatrogenia in sleep care in AD PD stroke

- Benzo's and z drugs 'across all 3 conditions'
- DA's in PD 'a double-edged sword' [sleep attacks]
- SSRI's 'trigger or worsen' RBD
- Anticholinergics 'cognitive sabotage'
- Antipsychotics: 6mo NNH ranges from (26) Haldol to (50) quetiapine
- Circadian disruption from hospital environment and medications
- Donepezil can cause or worsen insomnia, nightmares, leg cramps

Pitfall	Stroke	Parkinson's Disease	Alzheimer's Disease	References
BZD/Z-drug overuse (falls, cognitive harm, respiratory depression)	High prevalence; worsens SDB	May worsen EDS	Worsens cognition, agitation	Drug Design, De... + 3
Dopaminergic medication effects on sleep	—	Insomnia, EDS, sleep attacks, hallucinations	—	Neurology
Anticholinergic burden (cognitive decline)	Increases vascular dementia risk	Worsens cognition	Antagonizes cholinesterase inhibitors	Neurology + 1
Antipsychotic use (mortality, cerebrovascular events)	—	Worsens parkinsonism	FDA boxed warning; NNH 26-50	Lancet + 2
Failure to screen for OSA	>50% prevalence; often missed	Common comorbidity	Common comorbidity	Drug Design, De... + 2
SSRIs/TCAs triggering RBD	—	Can worsen RBD	—	AJP
Sedative antidepressants worsening SDB	Aggravate apneas	—	—	American Geria... + 1

Original Investigation

Antipsychotics, Other Psychotropics, and the Risk of Death in Patients With Dementia
Number Needed to Harm

Donovan T. Maust, MD, MS; Hyungjin Myra Kim, ScD; Lisa S. Seyfried, MD, MS; Claire Chiang, PhD; Janet Kavanagh, MS; Lon S. Schneider, MD, MS; Helen C. Kales, MD

JAMA Psychiatry. 2015;72(5):438-445. doi:10.1001/jamapsychiatry.2014.3018
Published online March 18, 2015.

Table 1. Characteristics of 46 008 Patients[a]

Characteristic	No. (%)					
	Haloperidol (n = 1958)	Olanzapine (n = 1952)	Quetiapine (n = 4700)	Risperidone (n = 6471)	Valproic Acid (n = 914)	Antidepressant (n = 30 013)
Died within 180 d	407 (20.8)	271 (13.9)	553 (11.8)	900 (13.9)	111 (12.1)	2499 (8.3)

6mo NNH ranges from (26) Haldol to (50) quetiapine

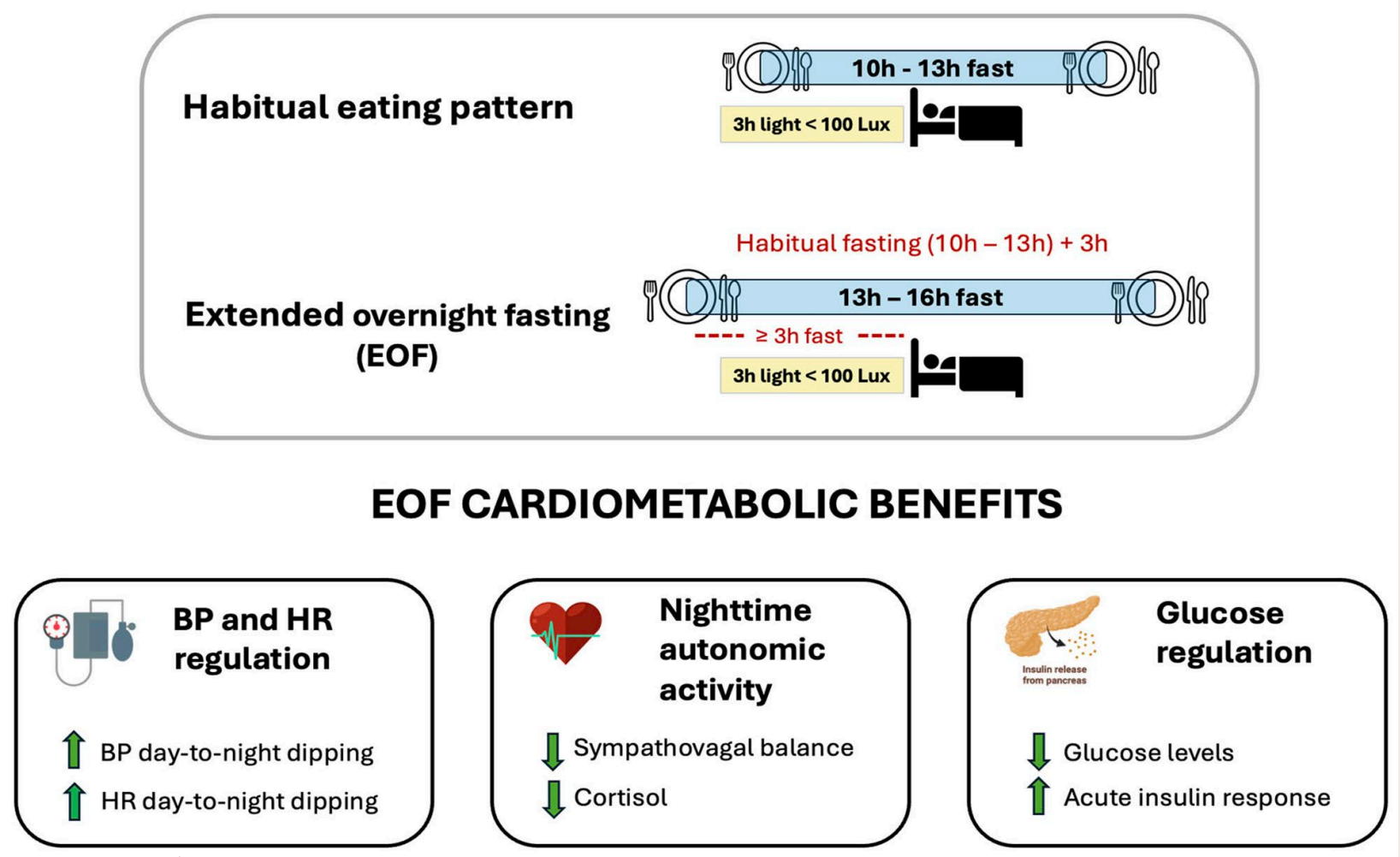
	Alzheimer’s	Parkinson's	Stroke
Prevalence	US: 7m; La: 70k	1m; 4k	6m; 75k
Poor sleep as risk	yes	yes	yes
Interventions available	yes	yes	yes
Do our interventions matter ?	yes	yes	yes
Can we harm?	yes	yes	

Optimal sleep is therapeutic, and we can help.

kevin.hargrave@ochsner.org
kh@cnsclinic.net
(337)351-5885

Thank you

Lagniappe
study just published on sleep restricted eating helping metabolic parameters



Daniela Grimaldi. Arteriosclerosis, Thrombosis, and Vascular Biology. Sleep-Aligned Extended Overnight Fasting Improves Nighttime and Daytime Cardiometabolic Function, Volume: 46, Issue: 4, Pages: e323355, DOI: (10.1161/ATVBAHA.125.323355)