

Sleep Health: The Under-Rated Determinant of Brain Health

Chukwuemeka O EZE

Neurology unit, Internal Medicine Department, Alex Ekwueme Federal University Teaching Hospital Abakaliki (AEFUTHA), Ebonyi State, Nigeria

ABSTRACT

This is a review of sleep health as an often-undervalued determinant of brain health. It implores current research on the intricate relationship between sleep and cognitive function, emotional stability, and the prevention of neurological disorders. Neglecting sleep not only compromises daily functioning but poses long-term risks to neurological health, including an increased vulnerability to neurodegenerative diseases, mental health disorders, and other systemic diseases. Sleep health measurement involves assessing various sleep domains that are measurable and independently associated with overall well-being. They include sleep regularity, satisfaction, alertness, timing, efficiency, and duration (RU SATED). Optimal sleep health could be achieved by maintaining consistent sleep schedules, creating a conducive sleep environment, and addressing relevant lifestyle factors. The undervalued impact of sleep health on brain health can be improved by raising public awareness of the importance of sleep, integrating sleep education into the school curricula at different levels, and advocating for policies that prioritize sleep. The above recommendations could lead to profound improvements in individual and societal well-being and lasting benefits for cognitive vitality and overall health. This would culminate in the transformation of societal attitudes toward sleep and elevate its status as a cornerstone of brain health.

Keywords: Sleep health, Brain health, Under-rated, Determinant .

Access to the article



How to cite this article

Chukwuemeka O EZE. Sleep Health: The Under-Rated Determinant of Brain Health. *Orient J Med*, 2025;37(1-2). 1-7. DOI: 10.5281/zenodo.13640442

OPEN ACCESS

*Correspondence

Email: drezeconauth@yahoo.com
Tel: +234 703 343 2117

Specialty Section

Sciences section of OJM

Article Metrics

Submitted: 21 March 2024

Accepted: 30 June 2024

Published: July-Dec 2024

Journal Metrics

ISSN: p- 1115-0521, e- 3027-2890

Website: www.orientjom.org.ng

E-mail: info.editorojm@gmail.com

Publisher: cPrint, Nig. Ltd

Email: cprintpublisher@gmail.com

INTRODUCTION

Sleep health is the presence of measurable characteristics of sleep that are most clearly associated with physical, mental, and neurobehavioral well-being, and not merely the absence of sleep disorder.¹ In the pursuit of overall health, sleep health is often neglected, overshadowed by other facets of a healthy lifestyle.² However, emerging research and scientific findings increasingly highlight that sleep is a vital but

underrated determinant of brain health.^{3,4} Beyond merely providing rest and rejuvenation, sleep plays a multifaceted role in cognitive function, emotional well-being, and overall mental resilience.⁵ The modern lifestyle, characterised by hectic schedules, constant connectivity, and a culture that often prioritises productivity over rest, has led to a widespread underestimation of the impact of sleep on cognitive abilities.⁶ Sleep health encompasses not

only the duration of sleep but also its quality, consistency, and alignment with the body's natural circadian rhythm.⁷

Understanding the intricate relationship between sleep and brain health requires delving into the various physiological activities that occur during different sleep stages. Rapid Eye Movement (REM) sleep, for instance, is crucial for memory consolidation, learning, and emotional regulation while non-REM sleep aids in physical restoration, immune system support, and the removal of toxins from the brain.⁸

Neglecting sleep health can have profound consequences on cognitive performance, mood stability, and long-term brain function. Chronic sleep deprivation has been linked to an increased risk of neurodegenerative diseases, such as Alzheimer's, as well as mental health disorders like depression and anxiety.⁹

In this context, fostering sleep health is not just a matter of personal comfort but a strategic investment in cognitive capital. Individuals, organizations and societies stand to benefit from recognizing and prioritizing the symbiotic relationship between quality sleep and optimal brain function.

As we delve deeper into the intricacies of sleep health and its impact on the brain, it becomes evident that a paradigm shift is necessary. Elevating the status of sleep to its rightful place in discussions about overall well-being and cognitive performance can pave the way for a healthier, and more resilient society. This shift involves not only individual awareness and practice but also systemic changes that promote a culture of sleep consciousness.

In this exploration of the often-underrated link between sleep and brain health, we aim to shed light on the compelling reasons to prioritise and nurture healthy sleep patterns. From the molecular processes within the brain to the broader societal implications, understanding and valuing sleep health can be a transformative journey toward enhanced cognitive vitality and overall well-being.

Determinants of Brain Health

Brain health is defined as the preservation of optimal brain integrity, mental and cognitive functions at a given age in the absence of overt brain diseases that affect normal brain function.¹⁰ It is a multifaceted concept that is affected by many factors.

Proper nutrition is fundamental for brain health. Essential nutrients, such as omega-3 fatty acids, antioxidants, vitamins, and minerals, play crucial roles in supporting cognitive function and protecting the brain from oxidative stress.¹¹

Regular exercise has been linked to improved cognitive function, enhanced memory and a reduced risk of neurodegenerative diseases. Much evidence shows that physical exercise is a strong gene modulator that induces structural and functional changes in the brain, promotes blood flow to the brain, stimulates the release of neurotransmitters and encourages the growth of new neurons.¹²

Engaging in intellectually stimulating activities, such as reading, solving puzzles, learning new skills or pursuing educational interests helps to maintain cognitive function, and may contribute to the formation of new neural connections.¹³ Social interactions and maintaining strong social connections contribute to cognitive health.

Adequate and quality sleep is essential for memory consolidation, emotional regulation and overall cognitive performance.⁸ Sleep allows the brain to undergo essential processes like detoxification and the removal of waste products.⁸

Positive emotional well-being is associated with better cognitive function.¹⁴ Managing emotions effectively, seeking support when needed and cultivating a positive outlook contribute to overall brain health.

Proper hydration is essential for maintaining the balance of electrolytes and facilitating optimal brain function. Dehydration can impair concentration, memory and overall cognitive performance.¹⁵

Limiting or avoiding substances like alcohol, tobacco and recreational drugs is critical for brain health. These substances can have detrimental

effects on cognitive function and may contribute to the development of neurological disorders.^{16,17}

Monitoring and managing overall health through regular check-ups can help identify and address conditions that may impact brain health, such as hypertension, diabetes or cardiovascular disorders.¹⁸

Understanding the role of genetics and environmental factors in brain health is essential. Some individuals may be more predisposed to certain neurological conditions, making awareness and proactive measures crucial for maintaining brain health.

Considering these determinants holistically and incorporating them into one's lifestyle can contribute to the promotion of overall brain health and reduce the risk of cognitive decline as individuals age.

Measurement of Sleep Health

Sleep health measurement involves assessing various sleep domains that are measurable and independently associated with overall well-being. Buysse in 2014 identified regularity, satisfaction, alertness, timing, efficiency and duration (RUSATED) as the sleep dimensions critical to psychological and physical well-being.¹

Sleep regularity involves the alignment of sleep with the body's natural circadian rhythm. There may be inter-individual variability, but individual consistency is the key. This means that the individual sleeps at a regular time daily. Available evidence supports that regularity in sleep patterns with consistent bedtimes and wake-up times are favourably associated with health.¹⁹ Circadian rhythm disorders like Jet lag and shift work disorders could disrupt the body's internal clock, and cause difficulties in falling asleep, staying awake or maintaining a regular sleep-wake cycle.²⁰

Sleep satisfaction involves self-reported measures of sleep quality, that provide insights into an individual's perception of their sleep. Poor sleep satisfaction is associated with increased morbidity and mortality.^{21,22} Sleep-disorders like insomnia, obstructive sleep apnoea, and parasomnias could lead to poor sleep satisfaction.

Daytime alertness is assessed by determination of daytime functioning, including factors like daytime

sleepiness, fatigue, and cognitive performance. Daytime somnolence may reflect poor nighttime sleep or primary hypersomnolence sleep disorder. Poor daytime alertness can cause negative behavioural, physiologic, and cognitive consequences, which limit patients' function and quality of life.²³

Sleep timing is another identified sleep dimension. This highlights the time one sleeps within the day. Available evidence suggests that early sleep timing is associated with health.¹⁹

Sleep efficiency is the ratio of time spent asleep to the total time spent in bed. A higher sleep efficiency percentage indicates better sleep consolidation. Reduced sleep efficiency may result from sleep and medical disorders.

Sleep duration is the total amount of time an individual spends asleep. It is a fundamental measure of sleep health. The recommended duration varies by age, with adults generally needing 7-9 hours of sleep per night.²⁴

Keeping a sleep diary is another measure of sleep health and it involves recording sleep-related information, including bedtime, wake time, perceived sleep quality and lifestyle factors. It can provide a comprehensive overview of sleep habits over time.

Combining both subjective and objective measures provides a more comprehensive understanding of an individual's sleep health.

Consequences of Poor Sleep Health on Brain and General Health

Poor sleep health can have far-reaching consequences on both brain and general health. The impact extends beyond temporary tiredness or irritability and can lead to various short-term and long-term health issues.

The common short-term consequences of poor sleep health on brain health include interference with daily functioning due to fatigue, cognitive impairment, increased risk of accidents, anxiety, and mood changes.²⁵ The above could lead to reduced productivity and poor quality of life. The predictive effect of poor sleep health on long-term health

consequences is much stronger than on short-term health consequences.²⁶

The long-term consequences of poor sleep health include mental health conditions (anxiety disorders, depression, and worsening of existing mental health conditions),^{27,28} cognitive decline (increased risk of dementia or Alzheimer's disease),²⁹ cardiovascular disorders (high blood pressure, heart disease, heart attack, stroke, and irregular heartbeat),³⁰ and metabolic disorders (obesity, insulin resistance, and type 2 diabetes).³¹ Other long-term consequences include a weakened immune system,³² hormonal imbalances (infertility, irregular menstrual cycles, and reduced libido);³³ increased pain sensitivity, and Reduced Quality of Life.³⁴

How to Optimize Sleep Health for Better Brain and Overall, Health

Optimising sleep health is crucial for better brain function and overall well-being. Some strategies can promote healthy sleep.

Maintain a Consistent Sleep Schedule:³⁵

Maintenance of a regular bedtime and wakeup time, even on weekends is necessary for enhanced sleep health. This helps regulate the body's circadian rhythm.

Create a Relaxing Bedtime Routine:³⁶ Develop calming pre-sleep routines such as reading a book, taking a warm bath, or practising relaxation techniques. Avoid stimulating activities before bedtime.

Create a Comfortable Sleep Environment: The creation of a conducive bedroom atmosphere is necessary for improved sleep health. This includes a comfortable mattress and pillows, as well as a cool, dark and quiet environment.

Limit Exposure to Screens Before Bed: Reduction of exposure to electronic devices with screens such as smartphones and computers, at least an hour before bedtime is recommended. The blue light emitted can interfere with the production of the sleep hormone melatonin.³⁷

Manage Daytime Exposure to Light: More time should be spent outdoors during daylight hours to regulate the body's circadian rhythm. During the

evening, a reduction in exposure to bright lights signals to the body that it's time to wind down.

Maintain a healthy diet: Avoid heavy meals, caffeine and nicotine close to bedtime. These could disrupt sleep through reflux oesophagitis, aspiration pneumonitis, or could make it harder to fall asleep.³⁸
Regular Exercise: Regular exercise is recommended as a systematic review showed that it improves sleep quality.³⁹ Intense exercise close to bedtime may have adverse effects on sleep health.

Limit Naps: Daytime naps should be earlier in the day and should be limited to 20- 30 minutes.

Stress management: Proper stress management techniques such as mindfulness meditation, deep breathing or progressive muscle relaxation should be instituted as stress is known to interfere with sleep.

Reduction of Liquid Intake Before Bed: Liquid intake before bedtime should be reduced as it could impair sleep health. This will reduce the likelihood of waking up for bathroom trips during the night.

Adequate management of sleep disorders: Identified sleep disorders such as apnea or insomnia should be managed accordingly.

Cognitive Behavioural Therapy for Insomnia (CBT-I): CBT-I is a structured program that helps address the thoughts, behaviours, and routines that contribute to sleep problems.

Limit Use of Sleep Aids: Avoid regular use of hypnotic medications because they could lead to tolerance and dependence. They should be used cautiously and for short periods.

Implementing these strategies can contribute to better sleep health, leading to improved cognitive function, emotional well-being and overall health. It's important to recognise that individual sleep needs may vary, so finding a routine that works for everyone is key. If persistent sleep issues or concerns arise, seeking professional guidance is recommended.

CONCLUSION AND RECOMMENDATIONS

In conclusion, sleep health emerges as a critically underrated yet foundational determinant of brain health. The intricate relationship between quality sleep and optimal cognitive function, emotional well-being, and overall mental resilience cannot be overstated. Neglecting sleep not only compromises daily functioning but poses long-term risks to neurological health, including an increased vulnerability to neurodegenerative diseases and mental health disorders.

The recommendations include the integration of sleep education into school curricula, the promotion of good sleep hygiene, addressing lifestyle factors, integrating sleep health assessments into routine healthcare check-ups and further research on the relationship between sleep health and brain health. Implementing the above recommendations would lead to the transformation of societal attitudes toward sleep and elevate its status as a cornerstone of brain health. This will engender profound improvements in individual and societal well-being, with lasting benefits for cognitive vitality and overall health.

Conflict of interest: Nil

Financial support: Nil

REFERENCES

1. Buysse DJ. Sleep health: can we define it? Does it matter? *Sleep*. 2014 Jan 1;37(1):9-17. doi: 10.5665/sleep.3298. PMID: 24470692; PMCID: PMC3902880.
2. Yadav M. Diet, Sleep and Exercise: The Keystones of Healthy Lifestyle for Medical Students. *JNMA J Nepal Med Assoc*. 2022 Sep 1;60(253):841-843. doi: 10.31729/jnma.7355. PMID: 36705141; PMCID: PMC9794932.
3. Worley SL. The Extraordinary Importance of Sleep: The Detrimental Effects of Inadequate Sleep on Health and Public Safety Drive an Explosion of Sleep Research. P T. 2018 Dec;43(12):758-763. PMID: 30559589; PMCID: PMC6281147.
4. Eugene AR, Masiak J. The Neuroprotective Aspects of Sleep. *MEDtube Sci*. 2015 Mar;3(1):35-40. PMID: 26594659; PMCID: PMC4651462.
5. Goldstein AN, Walker MP. The role of sleep in emotional brain function. *Annu Rev Clin Psychol*. 2014;10:679-708. doi: 10.1146/annurev-clinpsy-032813-153716. Epub 2014 Jan 31. PMID: 24499013; PMCID: PMC4286245.
6. Killgore WD. Effects of sleep deprivation on cognition. *Prog Brain Res*. 2010;185:105-29. doi: 10.1016/B978-0-444-53702-7.00007-5. PMID: 21075236.
7. Boeve A, Halpin A, Michaud S, Fagan M, MacAulay RK. Specific Sleep Health Domains as Predictors of Executive Function in Older Adults. *J Neuropsychiatry Clin Neurosci*. 2022 Fall;34(4):422-427. doi: 10.1176/appi.neuropsych.21040112. Epub 2022 Mar 11. PMID: 35272490.
8. Miletínová E, Bušková J. Functions of Sleep. *Physiol Res*. 2021 Apr 30;70(2):177-182. doi: 10.33549/physiolres.934470. Epub 2021 Mar 8. PMID: 33676389; PMCID: PMC8820572.
9. Anghel L, Ciubară A, Nechita A, Nechita L, Manole C, Baroiu L, et al. Sleep Disorders Associated with Neurodegenerative Diseases. *Diagnostics (Basel)*. 2023 Sep 10;13(18):2898. doi: 10.3390/diagnostics13182898. PMID: 37761265; PMCID: PMC10527657.
10. Wang Y, Pan Y, Li H. What is brain health and why is it important? *BMJ*. 2020 Oct 9;371:m3683. doi: 10.1136/bmj.m3683. PMID: 33037002; PMCID: PMC7555053.
11. Puri S, Shaheen M, Grover B. Nutrition, and cognitive health: A life course approach. *Front Public Health*. 2023 Mar 27;11: 1023907. doi: 10.3389/fpubh.2023.1023907. PMID: 37050953; PMCID: PMC10083484.
12. Mandolesi L, Polverino A, Montuori S, Foti F, Ferraioli G, Sorrentino P, et al. Effects of Physical Exercise on Cognitive Functioning and Wellbeing: Biological and Psychological

- Benefits. *Front Psychol.* 2018 Apr 27;9:509. doi: 10.3389/fpsyg.2018.00509. PMID: 29755380; PMCID: PMC5934999.
13. Weaver AN, Jaeggi SM. Activity Engagement and Cognitive Performance Amongst Older Adults. *Front Psychol.* 2021 Mar 11;12:620867. doi: 10.3389/fpsyg.2021.620867. PMID: 33776844; PMCID: PMC7990770.
14. Allerhand M, Gale CR, Deary IJ. The dynamic relationship between cognitive function and positive well-being in older people: a prospective study using the English Longitudinal Study of Aging. *Psychol Aging.* 2014 Jun;29(2):306-18. doi: 10.1037/a0036551. PMID: 24955999; PMCID: PMC4196750.
15. Garcia-Garcia D. Health Promotion and Hydration: A Systematic Review About Hydration Care. *Florence Nightingale J Nurs.* 2022 Oct;30(3):310-321. doi: 10.5152/FNJN.2022.21313. PMID: 36106814; PMCID: PMC9623173.
16. Vore AS, Deak T. Alcohol, inflammation, and blood-brain barrier function in health and disease across development. *Int Rev Neurobiol.* 2022;161:209-249. doi: 10.1016/bs.irm.2021.06.009. Epub 2021 Aug 11. PMID: 34801170; PMCID: PMC9204474.
17. Hajdusianek W, Żórawik A, Waliszewska-Prośół M, Poręba R, Gać P. Tobacco and Nervous System Development and Function- New Findings 2015-2020. *Brain Sci.* 2021 Jun 16;11(6):797. doi: 10.3390/brainsci11060797. PMID: 34208753; PMCID: PMC8234722.
18. Liss DT, Uchida T, Wilkes CL, Radakrishnan A, Linder JA. General Health Checks in Adult Primary Care: A Review. *JAMA.* 2021 Jun 8;325(22):2294-2306. doi: 10.1001/jama.2021.6524. PMID: 34100866.
19. Chaput JP, Dutil C, Featherstone R, Ross R, Giangregorio L, Saunders TJ, et al. Sleep timing, sleep consistency, and health in adults: a systematic review. *Appl Physiol Nutr Metab.* 2020 Oct;45(10 (Suppl. 2)):S232-S247. doi: 10.1139/apnm-2020-0032. PMID: 33054339.
20. Liu C, Tang X, Gong Z, Zeng W, Hou Q, Lu R. Circadian Rhythm Sleep Disorders: Genetics, Mechanisms, and Adverse Effects on Health. *Front Genet.* 2022 Apr 29;13:875342. doi: 10.3389/fgene.2022.875342. PMID: 35571019; PMCID: PMC9099045.
21. Hublin C, Partinen M, Koskenvuo M, Kaprio J. Heritability, and mortality risk of insomnia-related symptoms: a genetic epidemiologic study in a population-based twin cohort. *Sleep.* 2011 Jul 1;34(7):957-64. doi: 10.5665/SLEEP.1136. PMID: 21731146; PMCID: PMC3119838.
22. Pyykkönen AJ, Isomaa B, Pesonen AK, Eriksson JG, Groop L, Tuomi T, et al. Subjective sleep complaints are associated with insulin resistance in individuals without diabetes: the PPP-Botnia Study. *Diabetes Care.* 2012 Nov;35(11):2271-8. doi: 10.2337/dc12-0348. Epub 2012 Jul 26. PMID: 22837368; PMCID: PMC3476879.
23. Roth T. Effects of excessive daytime sleepiness and fatigue on overall health and cognitive function. *J Clin Psychiatry.* 2015 Sep;76(9):e1145. doi: 10.4088/JCP.14019tx1c. PMID: 26455683.
24. Chaput JP, Dutil C, Sampasa-Kanyinga H. Sleeping hours: what is the ideal number, and how does age impact this? *Nat Sci Sleep.* 2018 Nov 27;10:421-430. doi: 10.2147/NSS.S163071. PMID: 30568521; PMCID: PMC6267703.
25. Medic G, Wille M, Hemels ME. Short- and long-term health consequences of sleep disruption. *Nat Sci Sleep.* 2017 May 19;9:151-161. doi: 10.2147/NSS.S134864. PMID: 28579842; PMCID: PMC5449130.
26. Tang NK, Fiecas M, Afolalu EF, Wolke D. Changes in sleep duration, quality, and medication use are prospectively associated with health and well-being: Analysis of the UK household longitudinal study. *Sleep* 40: zsw079, 2017. doi:10.1093/sleep/zsw079. Crossref | PubMed | ISI | Google Scholar

27. Chellappa SL, Aeschbach D. Sleep and anxiety: From mechanisms to interventions. *Sleep Med Rev.* 2022 Feb; 61:101583. doi: 10.1016/j.smrv.2021.101583. Epub 2021 Dec 8. PMID: 34979437.
28. Palagini L, Hertenstein E, Riemann D, Nissen C. Sleep, insomnia, and mental health. *J Sleep Res.* 2022 Aug;31(4): e13628. doi: 10.1111/jsr.13628. Epub 2022 May 4. PMID: 35506356.
29. Spira AP, Chen-Edinboro LP, Wu MN, Yaffe K. Impact of sleep on the risk of cognitive decline and dementia. *Curr Opin Psychiatry.* 2014 Nov;27(6):478-83. doi: 10.1097/YCO.000000000000106. PMID: 25188896; PMCID: PMC4323377.
30. Korostovtseva L, Bochkarev M, Sviryaev Y. Sleep and Cardiovascular Risk. *Sleep Med Clin.* 2021 Sep;16(3):485-497. doi: 10.1016/j.jsmc.2021.05.001. Epub 2021 Jun 25. PMID: 34325825.
31. Schipper SBJ, Van Veen MM, Elders PJM, van Straten A, Van Der Werf YD, Knutson KL, et al. Sleep disorders in people with type 2 diabetes and associated health outcomes: a review of the literature. *Diabetologia.* 2021 Nov;64(11):2367-2377. doi: 10.1007/s00125-021-05541-0. Epub 2021 Aug 16. PMID: 34401953; PMCID: PMC8494668.
32. Garbarino S, Lanteri P, Bragazzi NL, Magnavita N, Scoditti E. Role of sleep deprivation in immune-related disease risk and outcomes. *Commun Biol.* 2021; 4: 1304. <https://doi.org/10.1038/s42003-021-02825-4>
33. Beroukhim G, Esencan E, Seifer DB. Impact of sleep patterns upon female neuroendocrinology and reproductive outcomes: a comprehensive review. *Reprod Biol Endocrinol.* 2022; 20: 16. <https://doi.org/10.1186/s12958-022-00889-3>
34. Sivertsen B, Lallukka T, Petrie KJ, Steingrimsdóttir ÓA, Stubhaug A, Nielsen CS. Sleep and pain sensitivity in adults. *Pain.* 2015 Aug;156(8):1433-1439. doi: 10.1097/j.pain.000000000000131. PMID: 25915149.
35. Chaput JP, Dutil C, Featherstone R, Ross R, Giangregorio L, Saunders TJ, et al. Sleep timing, sleep consistency, and health in adults: a systematic review. *Appl Physiol Nutr Metab.* 2020 Oct;45(10 (Suppl. 2)): S232-S247. doi: 10.1139/apnm-2020-0032. PMID: 33054339.
36. Albakri U, Drotos E, Meertens R. Sleep Health Promotion Interventions and Their Effectiveness: An Umbrella Review. *Int J Environ Res Public Health.* 2021 May 21;18(11):5533. doi: 10.3390/ijerph18115533. PMID: 34064108; PMCID: PMC8196727.
37. Tähkämö L, Partonen T, Pesonen AK. Systematic review of light exposure impact on human circadian rhythm. *Chronobiol Int.* 2019 Feb;36(2):151-170. doi: 10.1080/07420528.2018.1527773. Epub 2018 Oct 12. PMID: 30311830.
38. Spadola CE, Guo N, Johnson DA, Sofer T, Bertisch SM, Jackson CL, et al. Evening intake of alcohol, caffeine, and nicotine: night-to-night associations with sleep duration and continuity among African Americans in the Jackson Heart Sleep Study. *Sleep.* 2019 Oct 21;42(11):zsz136. doi: 10.1093/sleep/zsz136. PMID: 31386152; PMCID: PMC6802565.
39. Banno M, Harada Y, Taniguchi M, Tobita R, Tsujimoto H, Tsujimoto Y, et al. Exercise can improve sleep quality: a systematic review and meta-analysis. *PeerJ.* 2018 Jul 11;6:e5172. doi: 10.7717/peerj.5172. PMID: 30018855; PMCID: PMC6045928.