

### Introduction

- Insufficient sleep affects about 35% of US population.
- Modern lifestyle and technology hinder quality sleep.
- Cognitive functions suffer attention, memory, problem-solving.
- This Review examines link between sleep and cognitive decline in middle-aged and older adults.
- Both lack and excess sleep impact cognitive health.
- Mechanisms include brain substance buildup (e.g., beta-amyloid), hormone changes, neurotransmitter alterations.
- Sleep habits (consistent schedule, bedtime routine) crucial for prevention.
- Adequate sleep improves attention, memory, problem-solving, supporting brain health.

### RULES OF HEALTHY SLEEP



Cartoon Rules of Healthy Sleep Concept Card Poster. Vector Stock Vector - Illustration of bedtime, graphic: 195160641. (n.d.). Dreamstime. from <https://www.dreamstime.com/cartoon-rules-healthy-sleep-concept-card-poster-vector-include-recommendation-advice-relaxation-illustration-image195160641>

Figure 1: highlighting fundamental sleep practices. Emphasizing benefits of maintaining regular sleep schedule, cultivating calming bedtime rituals, and creating an optimal sleep environment. Advising against late caffeine consumption, excessive screen exposure, and irregular sleep patterns.

### Methods

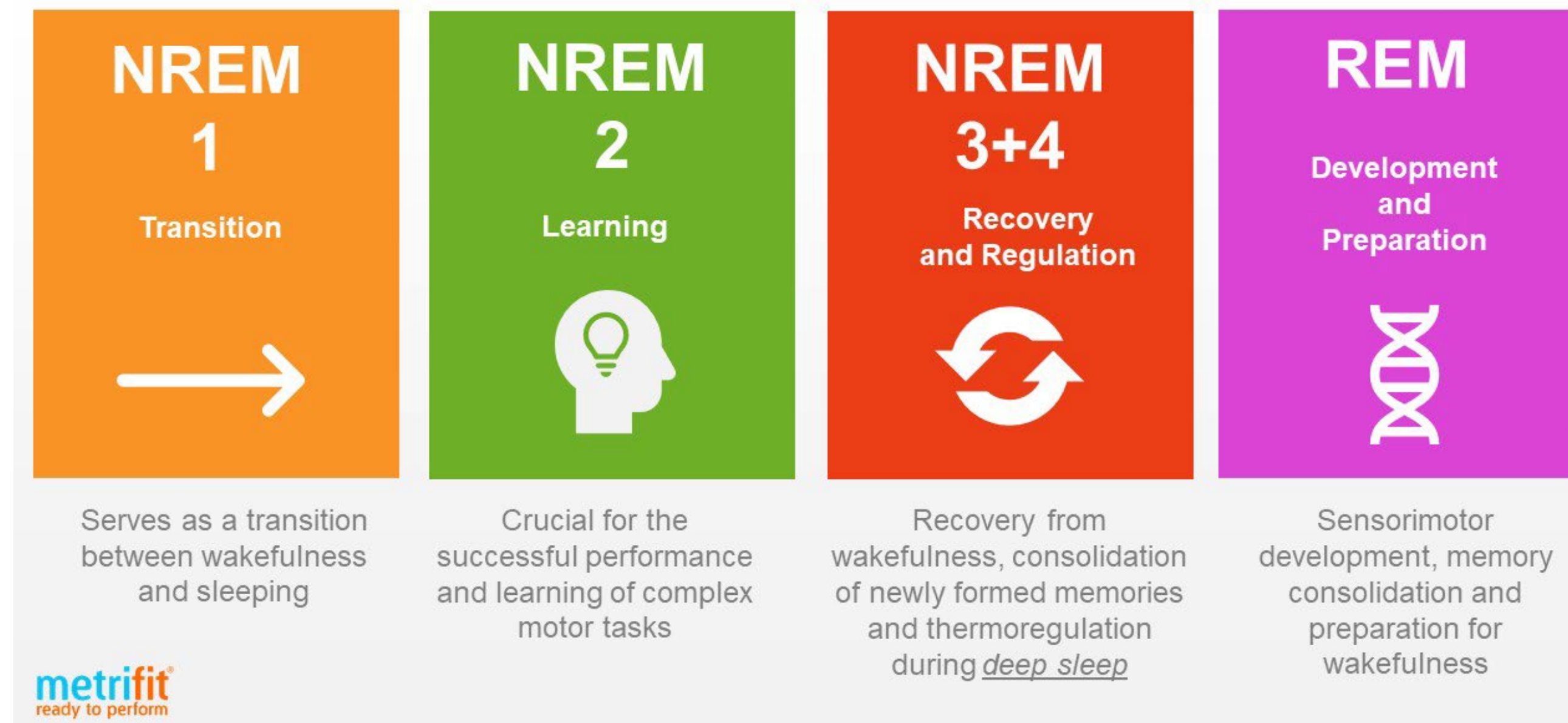
A thorough review of 23 peer-reviewed articles (2007-2021) explored the relationship between sleep duration, quality, and cognitive function, including neurodegenerative disorders. Diverse methodologies, including human studies and animal models, were analyzed. Government reports and reputable sources provided additional insights.

### Reference



### Sleep Stages Overview

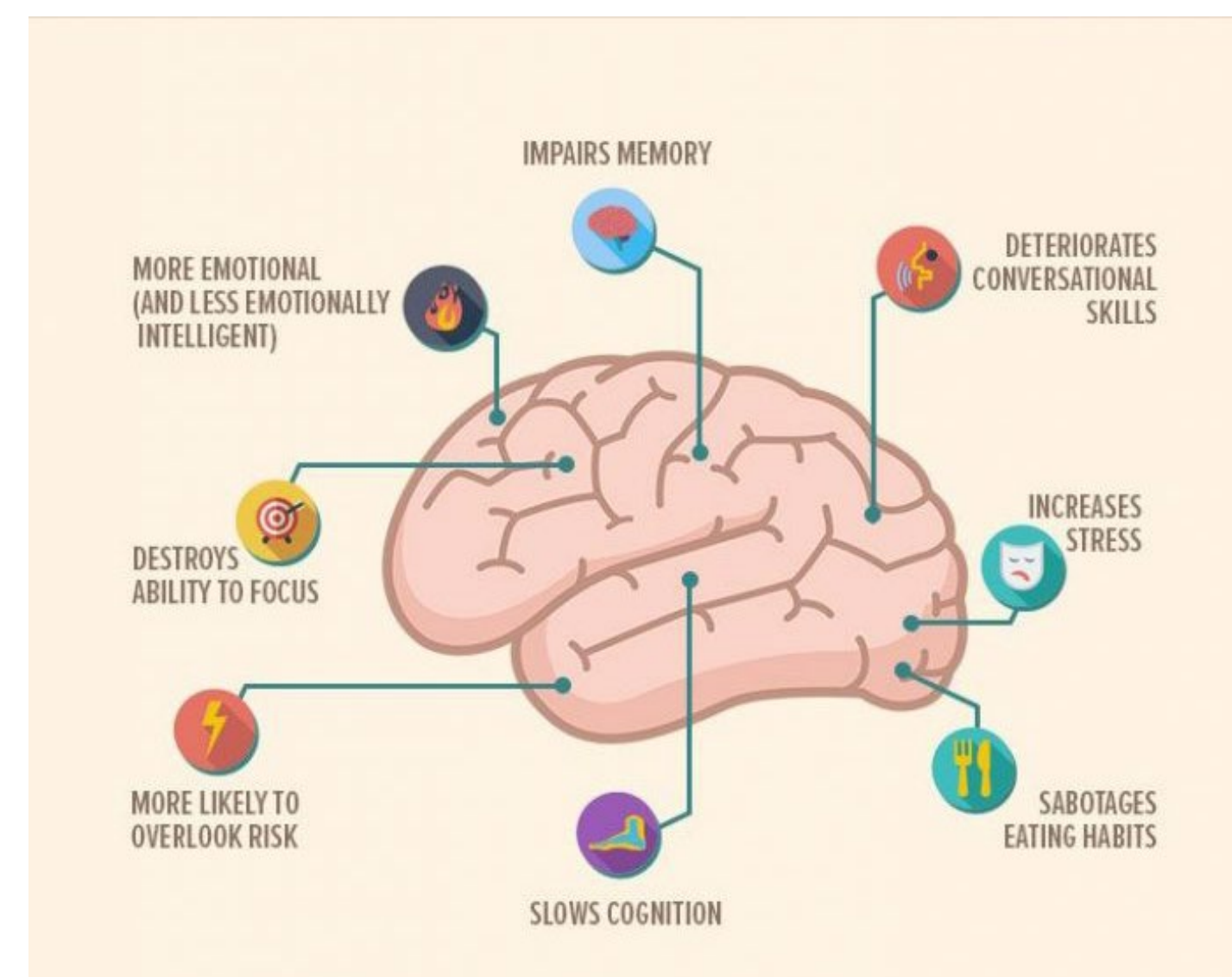
#### Sleep Stages and Functions



MetriFit. (2020, December 21). Prioritizing Sleep. MetriFit Ready to Perform. <https://metrifit.com/blog/prioritizing-sleep/>

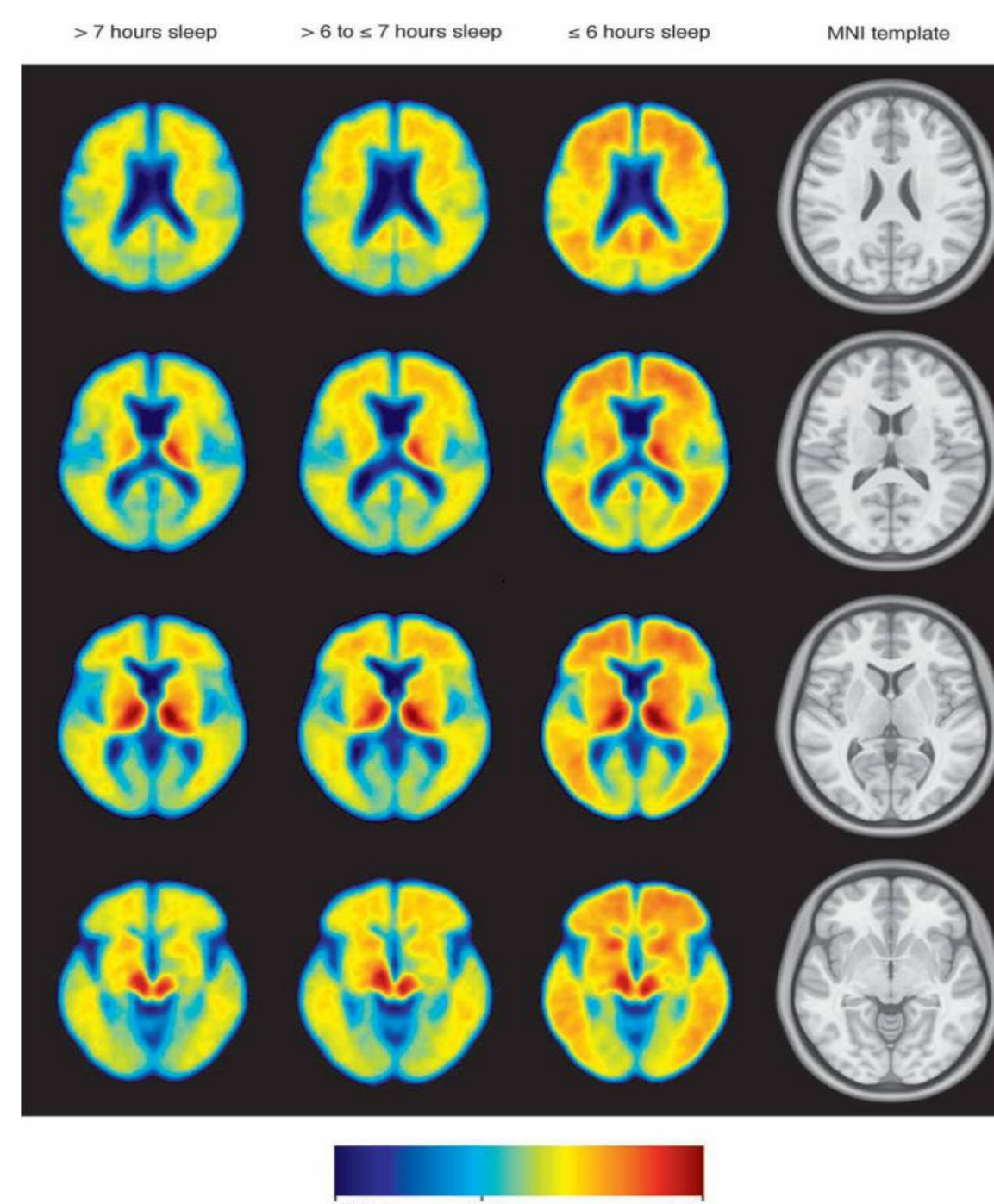
Figure 2: Showing the four primary NREM (non-rapid eye movement) and REM (rapid eye movement) sleep stages, accentuating their unique attributes, encompassing transitions from light sleep through deep sleep to REM sleep.

### Sleep and cognitive Decline



7 Ways Sleep Deprivation Wrecks Your Brain. (2016, July 14). Paleo Blog. <https://blog.paleohacks.com/sleep-deprivation/>

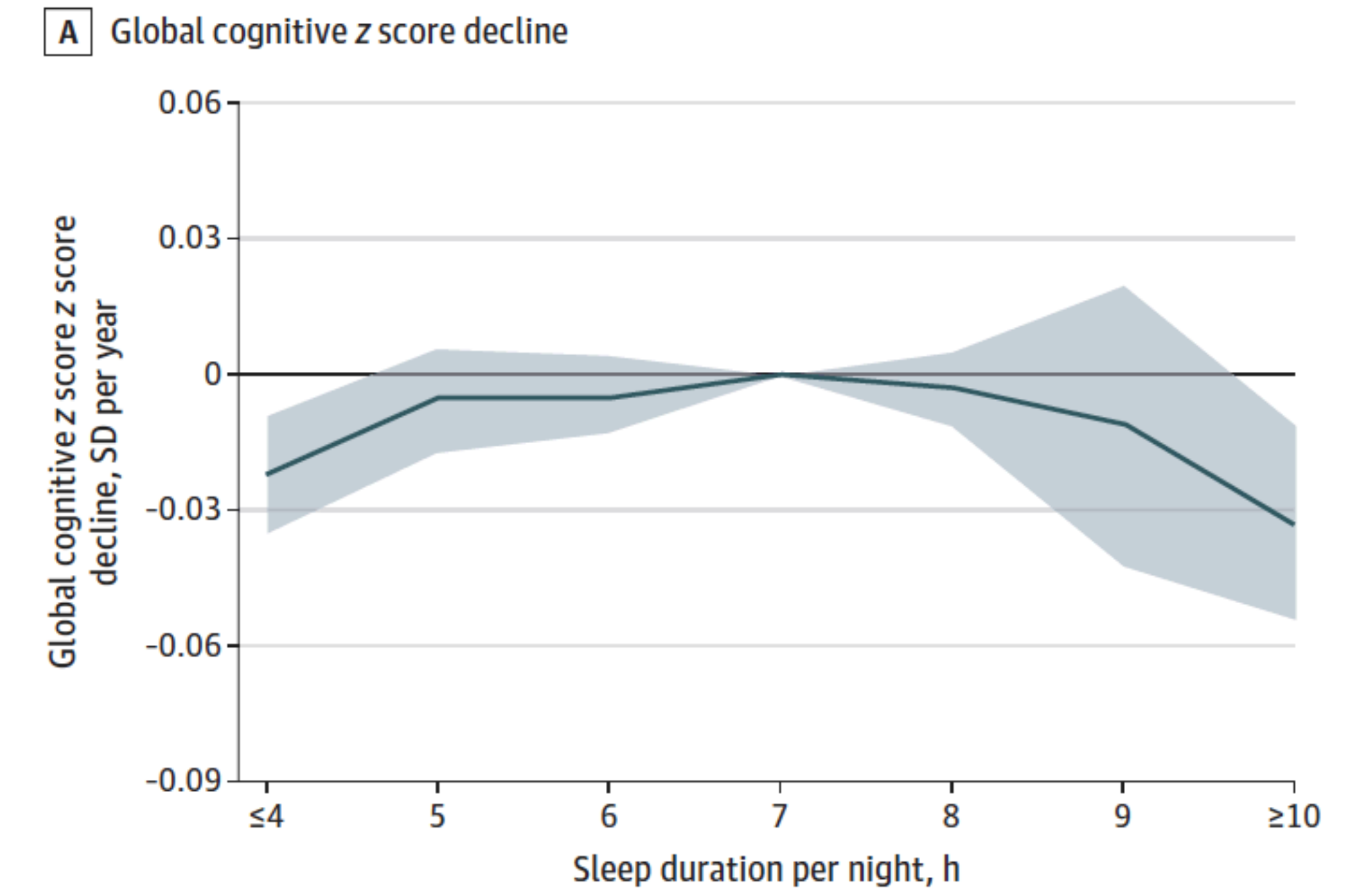
Figure 3: The visual representation effectively depicts the multitude of negative consequences that result from a lack of adequate sleep on brain health. In this illustrative depiction, a range of adverse effects is prominently showcased, including memory loss and a spectrum of detriments to overall well-being. This illustration unequivocally underscores and accentuates the critical significance of prioritizing and ensuring proper sleep as a fundamental means of averting these detrimental outcomes.



Spira, A. P., Gamaldo, A. A., An, Y., Wu, M. N., Simonsick, E. M., Bilgel, M., Zhou, Y., Wong, D. F., Ferrucci, L., & Resnick, S. M. (2013). Self-Reported Sleep and  $\beta$ -Amyloid Deposition in Community-Dwelling Older Adults. *JAMA Neurology*, 70(12), 1537-1543. <https://doi.org/10.1001/jamaneurol.2013.4258>

Figure 4: Picture display brain scans with more of a protein called amyloid (Amyloid is a protein that builds up in the brain, forming abnormal clumps-Linked to Alzheimer's) as sleep gets shorter. Best sleep (over 7 hours) has least amyloid, very little sleep (less than or equal to 6 hours) has most, and some sleep (more than 6 but less than or equal to 7 hours) is in-between. The last column shows normal brain images. This shows that Less sleep seems related to more amyloid buildup, potentially affecting Alzheimer's risk.

### Sleep Duration's Impact on Cognitive Function



Sleep Duration and Cognitive Decline - David Perlmutter, M.D. (2020, October 27). David Perlmutter M.D. <https://www.drperlmutter.com/sleep-duration-and-cognitive-decline/>

### Figure 4:

- Z-score compares individual cognition to group average, accounting for variability.
- Z-scores quantify cognitive function, assessing sleep duration's impact over time.
- $\leq 4$  and  $\geq 10$  hours sleep linked to lower cognition than around 7 hours.

### Conclusion

- Sleep impacts memory, attention, and cognitive skills.
- Disrupted sleep affects deep and dream-filled sleep stages.
- Amyloid beta is tied to sleep problems and cognitive issues.
- Brain's waste removal process is more effective during sleep.
- Maintaining consistent sleep patterns, creating a comfortable sleep environment, and practicing relaxation techniques can enhance sleep quality.
- Improving sleep might reduce the risk of cognitive disorders.

### Future Directions

- Investigate the relationship between sleep and specific cognitive functions.
- Explore interventions targeting the brain's waste removal system for cognitive well-being.
- Research the impact of physical exercise on the brain's waste removal system and cognitive health.
- Examine the role of genetics in the complex connection between sleep, brain health, and cognitive decline.