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The effect of Teenagers' Sleeping Deprivation on Cognition/Academic Outcome and Obesity

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ABSTRACT

Teenagers' sleep pattern change caused by puberty, academic demand, assignment, test, and earlier school start time is considered as a significant factor of sleeping deprivation.

27% of students are at risk for sleep disorders. More than 50% of students report significant daytime sleepiness and 66% of students feel sleepiness impacts their academic performance (Michigan Medicine, 2019).

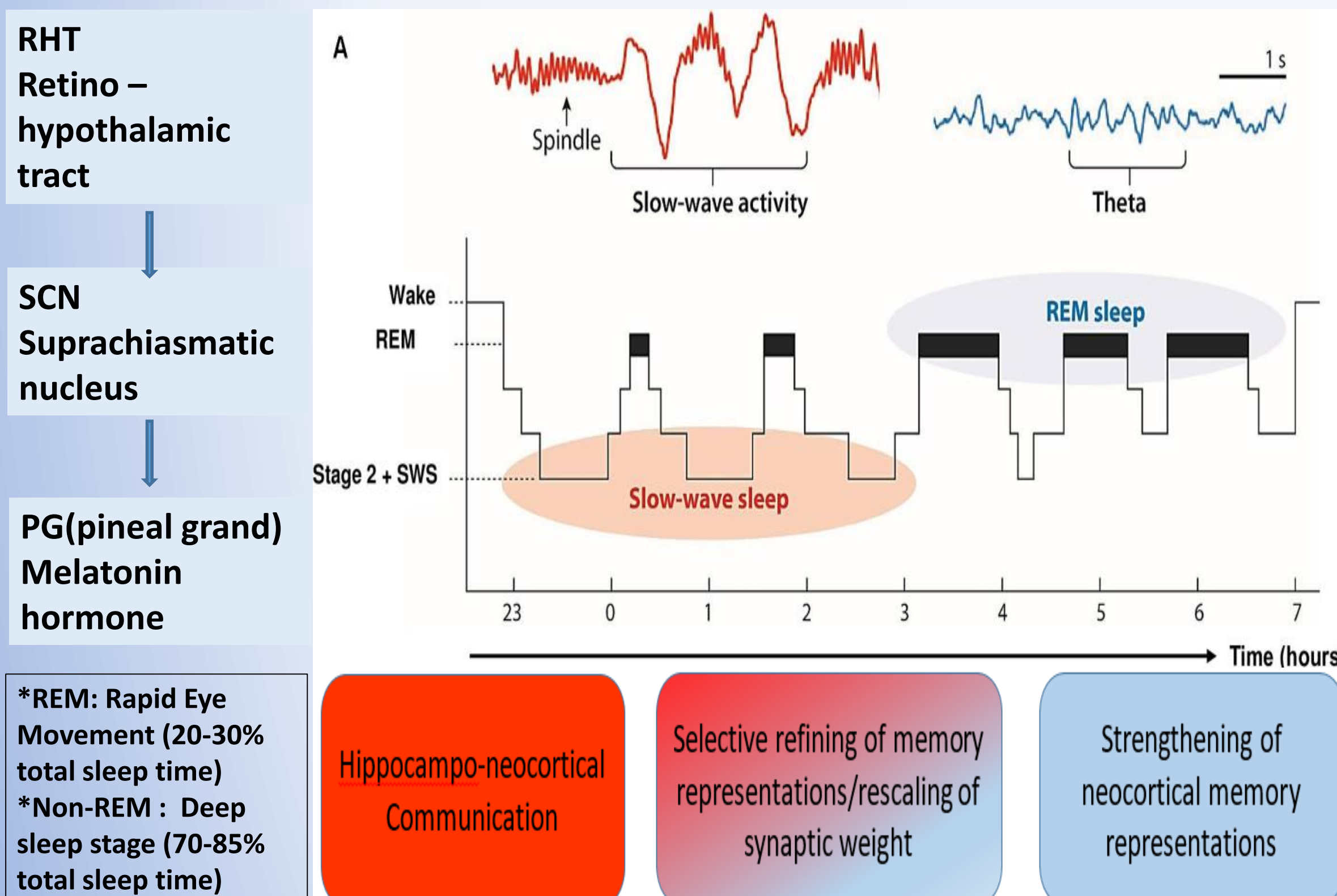
Sleeping disorder, deprivation, and deficient among teenagers are well known as a common significant factor which increases the risk of mental and physical health problems.

This literature research focused on the sleeping deprivation of teenagers and the effect of sleeping deprivation on memory loss, academic outcome and teenager' obesity.

There are statistically meaningful relation between teenagers' sleeping deprivation and cognitive, memory loss, and metabolic problems (diabetes, obesity, etc.).

Some research indicated that academic achievement and school performance is not linked with sleeping deprivation directly. But, lack of sleep provokes low attention in the class and memory-loss which are influence academic outcome and grades.

BACKGROUND: Sleeping Cycle/Hormone



Hormone Secretion during Sleeping

Brain: Growth Hormone, Antidiuretic Hormone, Melatonin, Oxytocin, Prolactin
Body: Leptin, Ghrelin, Insulin, Cortisol, Aldosterone.

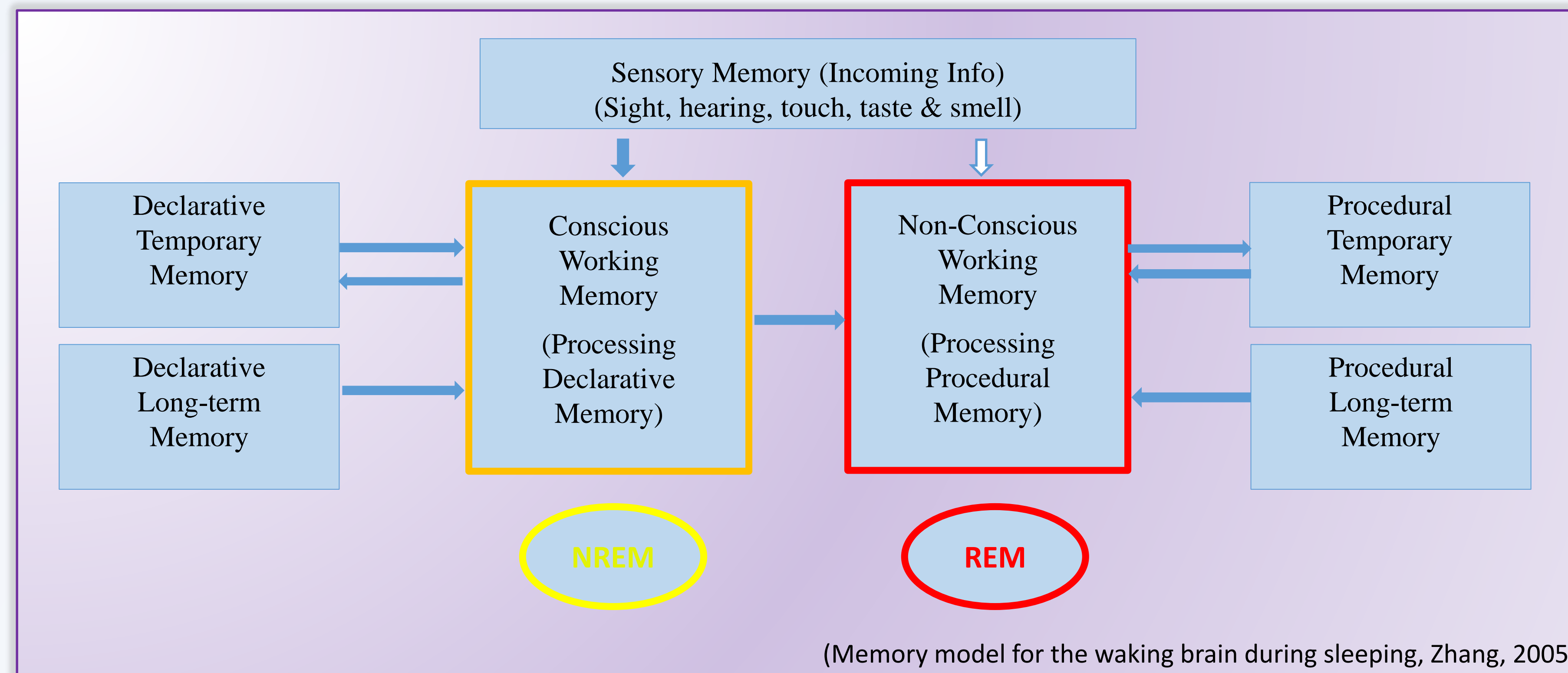
The reasons of sleeping problems

Adolescents suffer from increasing school schedule, academic activities, extracurricular activities, family and social pressure and from an environmentally induced delay of sleep timing, together with changes of intrinsic regulatory process (Curio et al. 2006, Penigneux et al. 2001).

School schedules are forcing students to lose sleep and to perform academically when they are at their worst (Stockman. 2007)

Biology	• Hormone Changing /Disrupted Circadian Regulation of Sleep (Barenes et al. 2016, Hagenauer et al. 2009, Telzeret al. 2015)
Technology	• SNS(Richter, 2015) /Blue light suppresses the production of melatonin (Garey & Claire, 2019)
Homework /Exam/Test	• (Conner et al. 2010, Alhola & Polo-Kantola, 2007)
Extracurricular activities	• (Minges & Redeker, 2016).
Earlier School Start Times	• (Maslowsky, & Ozer, 2013, Wolfson & Ziporyn, 2018)

Sleeping and Cognition / Memory pathway

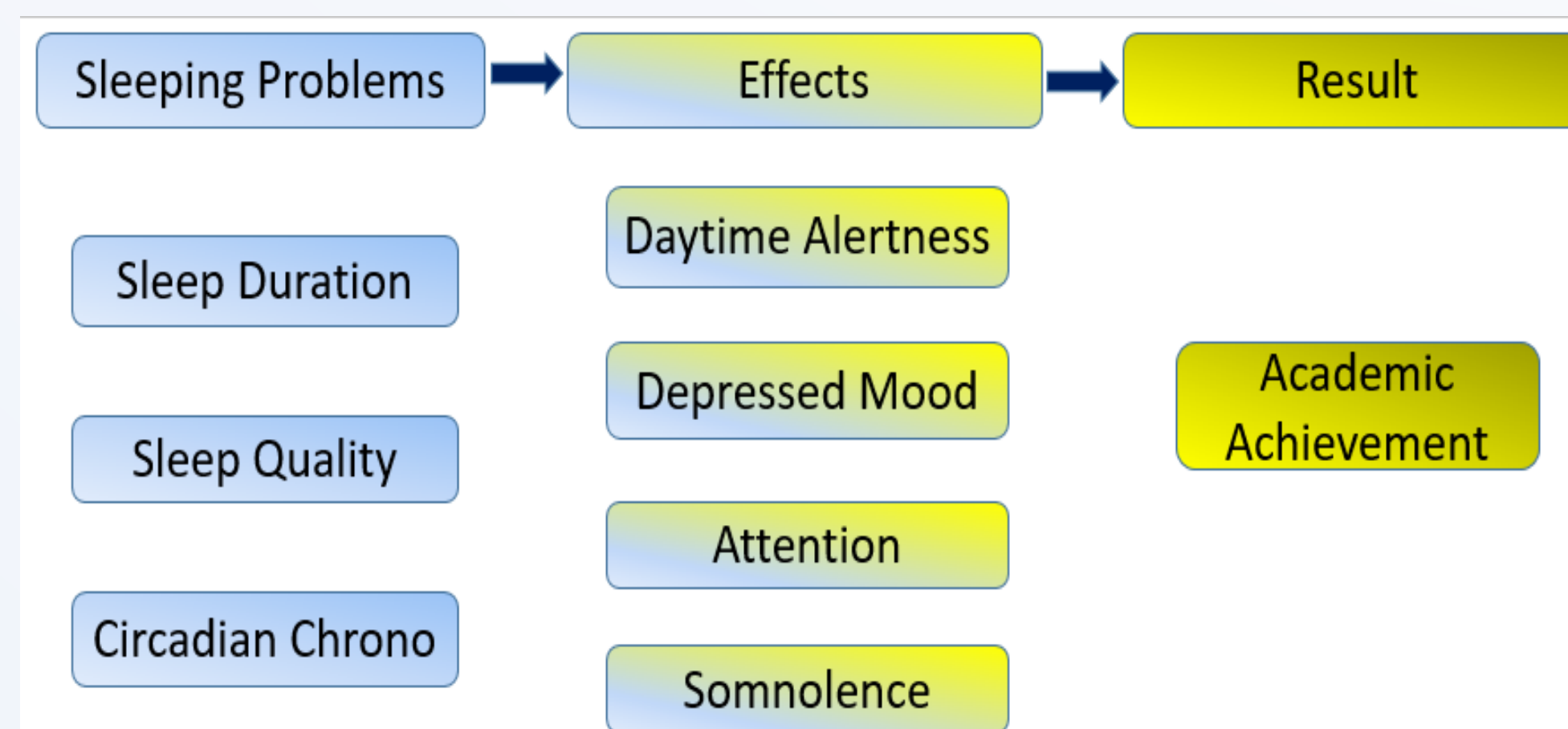


- The effect of sleep state on memory process would be task-dependent, with the **procedural memory gaining from REM sleep** and **declarative memory linked to NREM sleep** (Curio, Ferrara & Gennaro, 2006).
- Sufficient sleep is necessary to enable proper focus for **acquisition, expansion, and maintenance of neuronal connections** (Smith, 2001)
- Neuroimaging studies have shown that sleep allows the brain to **consolidate newly acquired memories and reinforces synaptic pathways** created during wakefulness through activity in the hippocampus (Gradisar, Gardner, & Dohnt, 2011)
- "Lack of sleep prevents the brain from being able to initially make new memories, brain shut down and can't commit new experiences to memory and can't make and create those new memory." (Matthew Walker, 2018)

* Sleep deprivation leads to a marked increase in sleepiness that usually facilitates cognitive, emotional, behavioral and academic failure.

Sleeping and Academic Outcome

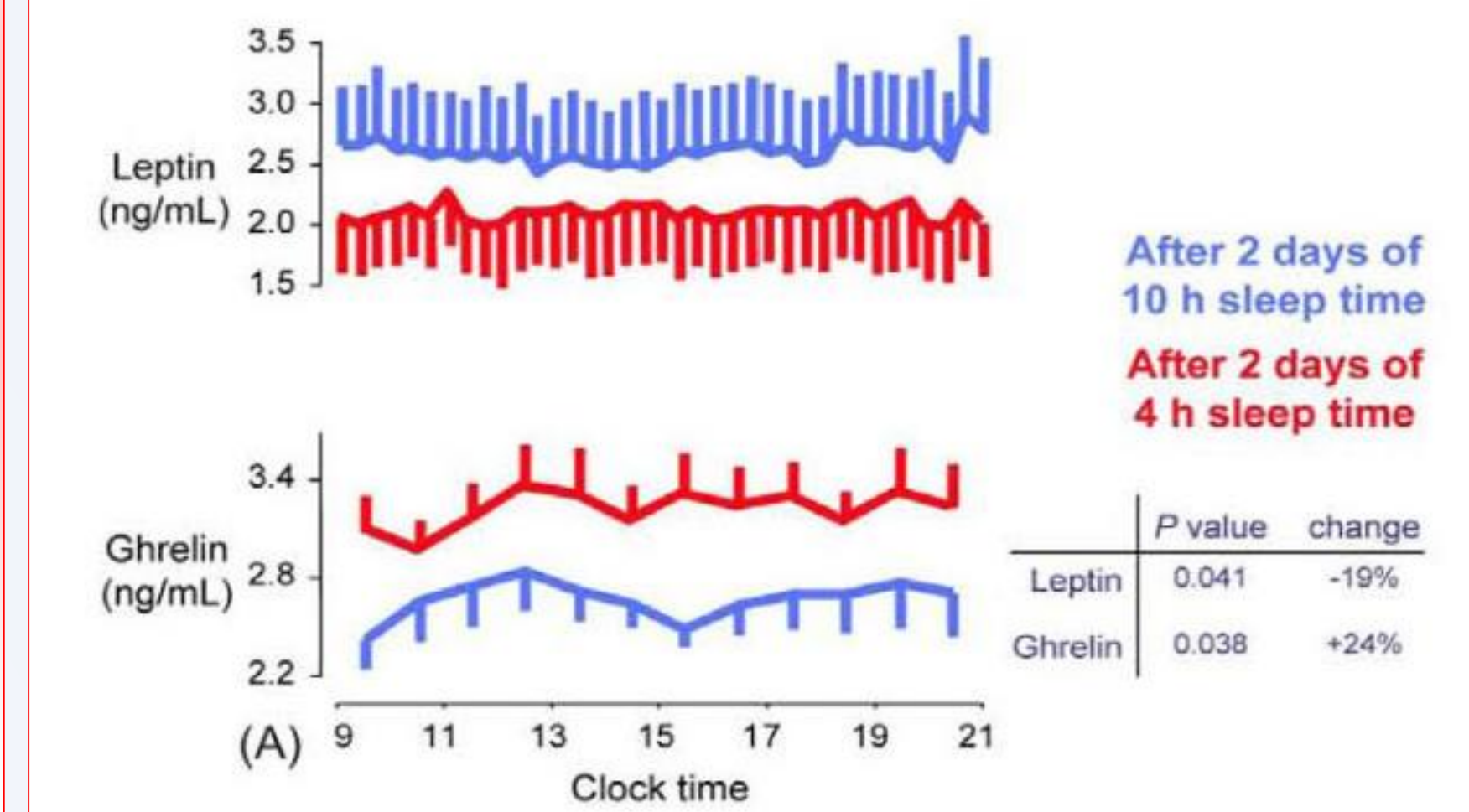
- Sleep duration has not significant relationship with academic performance.
- Short sleep duration would set up a **"chain reaction,"** with increased daytime somnolence and reduced attention as intermediate links leading to reduced academic efficiency. Somnolence if daytime are correlated negatively with academic performance (Perez-Lioret et al. 2013)



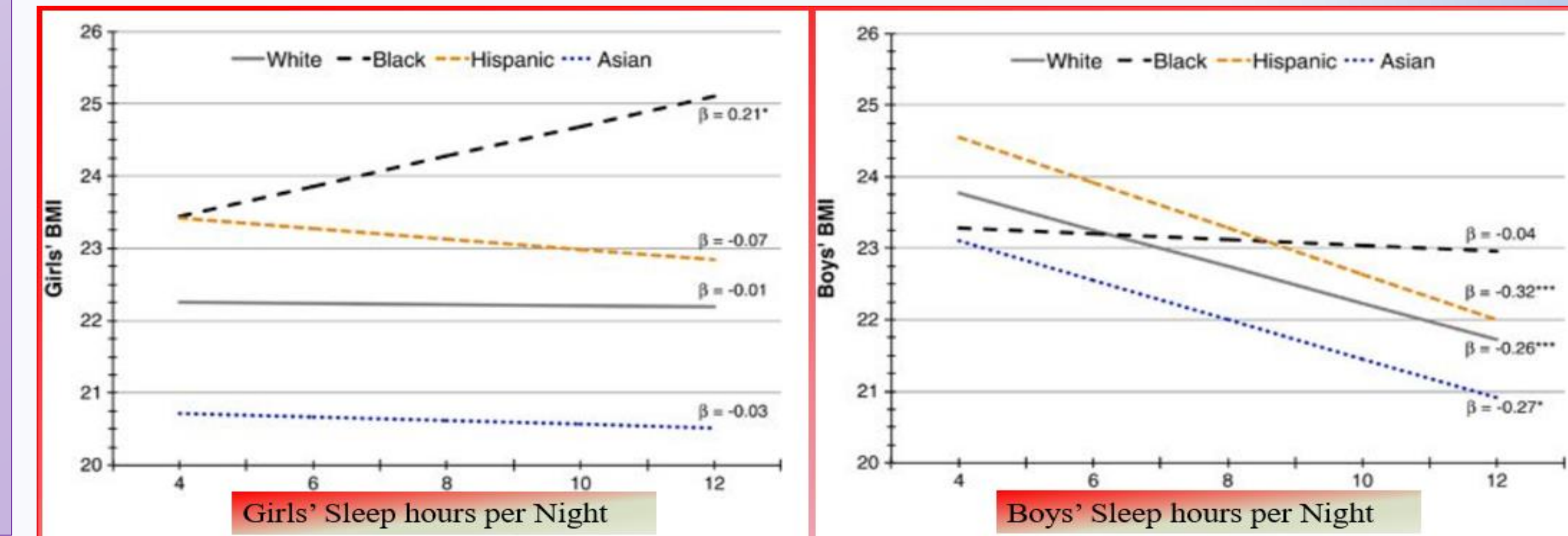
- Disrupted or poor sleep is usually followed by **inefficient daytime behavior and variability in performance.** Within these activities, academic performance and school achievement should be carefully taken into consideration (Curio, Ferrara & Gennaro, 2006).

Sleeping and Obesity/ BMI/ Diabetes

* Overweight during the teen years increases the risk of having unhealthy weight in adulthood and elevates the risk of having other physical health problems including hypertension, hypercholesterolemia, metabolic syndrome, type2 diabetes, osteoarthritis, and gallstone (Freedman et al., 1999, Sepiser et al., 2005).



- Sleep deprivation induces **insulin resistance** and **stimulates appetite (+Ghrelin, -Leptin)**, both of which contribute to increased body weight (Spiegel et al., 2004).
- Short sleep duration, poor sleep quality, and late bedtimes are all associated with **excess food intake, poor diet quality, and obesity in adolescents** (Chen, Beydoun, & Wang, 2008).
- Poor sleep quality is associated with an **increase in BMI among adolescents**, suggesting that researchers pay more attention to sleep quality in studies of childhood obesity and obesity prevention (Chen, Truong, & Tsai, 2013).



CONCLUSION

- NREM and REN contribute to increasing the memory capacity in the processing of procedural knowledge and declarative knowledge.
- Sleep deprivation induces insulin resistance and stimulates appetite both of which contribute to increased body weight
- Academic performance are not related with sleep deprivation directly but sleep problem influences students' cognition, and learning attitude.
- Sleep problems among adolescents need to pay more attention to prevent teenagers' overweight and memory ability.

SUGGESTION

- The **American Academy of Pediatrics** strongly supports the efforts of school districts to optimize sleep in students and urges high schools and middle schools to aim for start times that allow students the opportunity to achieve optimal levels of **sleep (8.5-9.5 hours)** (The American Academy of Pediatrics, 2014)
- **Delaying school start time** is an effective counter measure to chronic sleep loss and has a wide range of potential benefits to students with regard to physical and mental health, safety, and academic achievement. (The American Academy of Pediatrics, 2019, Minges & Redeker, 2016)

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