Adolescent Sleep Health: What Schools, Parents, Teachers, and Students Can Do

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California Sleep Society

How do you feel when you are away and your cell phone is only half charged?

On June 29, 2007 the first IPhone released

Archives Gen Psych 1981

Delayed Sleep Phase Syndrome

A Chronobiological Disorder With Sleep-Onset Insomnia

Elliot D. Weitzman, MD; Charles A. Czeisler, MD, PhD; Richard M. Coleman, PhD; Arthur J. Spielman, PhD; Janet C. Zimmerman, PhD; William Dement, MD, PhD
With the Assistance of Gary Richardson, Charles P. Pollak, MD

Delayed sleep phase insomnia is proposed to be a disorder of the circadian sleep-wake rhythm in which the "advance" portion of the phase response curve is small.

Topics

- How sleep affects adolescent physical and mental health, suicide, and safety
- The biological basis for teenagers' later sleep and wake cycles
- Why sleep is even more important during the pandemic
- What schools, parents, teachers, and students can do to improve teens' sleep
- Why sleep-friendly school hours are essential for adolescent sleep health, learning, and equity, and how one superintendent of schools made them happen

SB 328 is the law

After 3 years of sharing PDF's with elected officials California becomes the first state to create a law to prioritize adolescent sleep health

California SB 328

- Began with a letter to the editor which was read by Sen. Portantino
- Bill proposed that all public middle schools start no earlier than 8 am and high schools start no earlier than 8:30 am by 2022
- Allows for earlier voluntary activities/ zero period
- Honors prior collective bargaining agreements
- Allows an exception for rural districts
- Opposed by proponents of "local control"

Kids falls asleep because they are bored: WRONG

Monotony does not cause sleepiness

Monotony does unmask sleepiness

U.S.News & WORLD REPORT HEALTH

Almost All U.S. Teens Are Sleep Deprived, Study Finds

HealthDay | Dec. 11, 2014 | 12:00 p.m. EST

Association of Delaying School Start Time With Sleep Duration, Timing, and Quality Among Adolescents. *JAMA Pediatr* 2020

Cohort from 5 public high schools in the metropolitan areas of Minnesota. Baseline data was collected from 455 students. Two of the schools delayed their starting time by 50 and 65 minutes, while the other schools kept the same schedule. They were studied for two years. Students who attended delayed-start schools had sustained more than 40 minutes of sleep per night during the two-years studied. Weekend sleep time decreased by about half an hour.

Delaying school start times is a durable strategy to extend adolescent school night sleep duration and lessen their need for catch-up sleep on weekends!

Delaying school start times to improve population health. Editorial JAMA Pediatrics 2020

The accompanying editorial in *JAMA Pediatrics* concurred with the need for school districts to change their high school start times, based on the overwhelming public health benefit for adolescents

Sleep & Immune System have a bidirectional relationship

- When you feel sick you we want to get in bed and when we are sleep deprived we are more prone to infections. This relationship has been studied for decades.
- People with sleep disorders are more likely to develop autoimmune disease
- Experimental studies in animals have proven causality for the role of sleep in infection outcome
- Lack of sleep is a stressor to the body and the body's reaction is described as being similar to a low-grade inflammation. It is easy to conceptualize why the body's defenses may be overwhelmed if it is also faced with an infection.
- Sleep is not only important for fighting infections induced by invading bacteria, but is also essential to keep in check usually harmless bacteria that naturally inhabit our body
- Using an experimental infection showed that people reporting a short sleep duration in the weeks before they received nasal drops containing a rhinovirus had an increased risk of developing a clinical cold
- Good sleep affects various immune parameters, is associated with a reduced infection risk, and can improve infection outcome and vaccination responses

Delayed high school start times later than 8:30 am and impact on graduation rates and attendance rates *Sleep Health* 2017

- 8 public school districts across 7 states (29 high schools, n=30,000 high school students)
- Delaying start times to ≥8:30am improved attendance by 4%, graduation by 9%
- In lowest performing districts, attendance jumped 18% (68-86%), graduation 17% (51-68%)

Adolescent sleep and school performance — the problem of sleepy teenagers. *Curr Opin Physiol* 2020

UK: They should achieve 8–10 hrs of sleep but a large proportion of adolescents worldwide are not achieving that amount. Adolescence is a time when the circadian clock drifts later, there are changes to the sleep homeostatic mechanisms, and individuals experience growing autonomy where poorer sleep behaviours can take hold. These changes drive bedtimes later and condense the opportunity for sleep. Sleep is essential for memory and learning and the shortening of sleep and subsequent sleepiness may impair an adolescent's opportunity to perform to the best of their ability in class. Numerous research groups and organisations are now striving to find ways to improve adolescent sleep including delaying school start times, providing sleep education, and utilising light therapy as a means to improve the health, wellbeing and academic performance of sleepy teenagers.

Most Teens are Night Owls

Country	Average Fall-Asleep Time on School Nights
Switzerland	11:37 p.m.
Austria	11:39 p.m.
Czech Republic	11:41 p.m.
Denmark	11:42 p.m.
Germany	11:44 p.m.
Australia	11:44 p.m.
Belgium	11:50 p.m.
United States	11:51 p.m.
New Zealand	11:52 p.m.
Sweden	11:54 p.m.
United Kingdom	11:58 p.m.
Finland	11:58 p.m.
Poland	11:59 p.m.

Country	Average Fall-Asleep Time on School Nights
France	12:01 a.m.
Mexico	12:02 a.m.
Norway	12:03 a.m.
Canada	12:04 a.m.
Netherlands	12:04 a.m.
Brazil	12:05 a.m.
Spain	12:11 a.m.
Italy	12:14 a.m.
Turkey	12:29 a.m.
China	12:30 a.m.
Russia	12:31 a.m.
Japan	12:44 a.m.
South Korea	1:20 a.m.

Source: SleepCycle App data, 2014.

Insufficient Sleep and Suicidality in Adolescents *Sleep 2012*

- 8,530 Korean teens, completed Beck Scale for Suicidal Ideation (SSI), Beck Depression Inventory (BDI), ESS, and sleep questionnaire
- 19% with BIISS (weekdays $\leq$ 7 hr; weekend oversleep $\geq$ 2 hr; ESS $\geq$ 9; no insomnia)
- BISS teens had ↑ SSI scores even after controlling for age, sex, and BDI score
- Longer weekend oversleep and shorter weekday sleep duration predicted a higher SSI score
- Korean teen suicide rate 10.7 per 100,000 (US 7.3)

CLINICAL REVIEW

Associations between sleep duration and suicidality in adolescents: A systematic review and dose–response meta-analysis

Hsiao-Yean Chiu [a, b], Hsin-Chien Lee [b, c, d], Pin-Yuan Chen [e, f], Ying-Fan Lai [a], Yu-Kang Tu

2018

Meta-analysis examined dose-response relationships between sleep duration and the risk of suicidality. Identified a total of 598,281 participants. Strong dose response associations were obtained for both suicidal ideation and attempts, with the lowest suicidal ideation and attempt risks at sleep durations of 8 – 9 h per day.

A dose-response relationship between sleep duration and suicide plans was obtained, indicating that the risk of suicide plans decreased by 11% for every 1-h increase in sleep duration. Depression did not moderate the association between sleep duration and suicidality in youths. "Sleep duration is an independent risk factor for the development of youth suicidality"

Sleep and the adolescent brain
Curr Opin Physiol 2020

Reviewed the maturation changes that occur in the adolescent brain. In both humans and mice, "adolescence is accompanied by increased risk-taking, novelty-seeking and peer-directed social interaction in both species. Biologically, a period of rapid synaptic pruning is seen, wherein the number of synaptic connections undergoes marked decline. Generally speaking, in both species this pruning commences around the time of puberty and continues to the end of the adolescence".

Why are motor vehicle crashes the leading cause of death of U.S. teens?

In 2018, almost 2,500 teens in the United States were killed, and about 285,000 were treated in emergency departments for injuries suffered in motor vehicle crashes. That means that every day, about seven teens died due to motor vehicle crashes, and hundreds more were injured. In addition, fatal and nonfatal motor vehicle crash injuries among teens resulted in about $11.8 billion in medical and work loss costs for crashes that occurred in 2018.

Source: CDC http://www.cdc.gov/MotorVehicleSafety/Teen_Drivers/

Studies report younger drivers more susceptible to sleep effects

- 17-24 yo with ≤6 hrs sleep more MVA *JAMA Peds '13*
- 40% of teens reported drowsy driving, O.R. 2.1 for MVA *JCSM '10*
- After sleep restriction younger drivers more lane deviations than elderly '*12*
- Young drivers sleepier while driving at night '*09*
- Hazard perception decreased in sleepy 17-24 yo compared to experienced drivers '*09*
- Younger males have higher frequency of drowsy driving and reported lowest perceived personal risk in regards to driving while drowsy *'11*

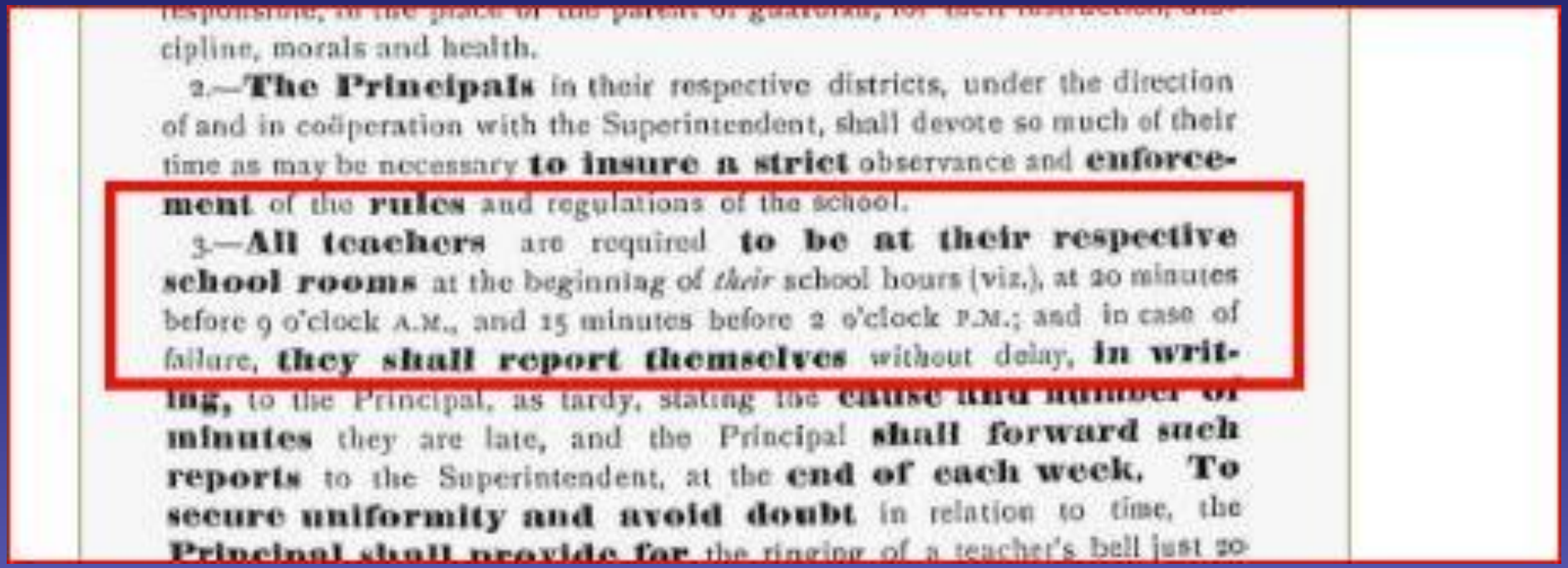
The effects of poor quality sleep on brain function and risk taking in adolescence *NeuroImage 2013*

- Examined how poor sleep quality relates to cognitive control and reward related CNS function during risk taking in 46 teens using fMRI
- Adolescents who reported poorer sleep also exhibited greater risk-taking. This association was paralleled by less recruitment of the dorsolateral prefrontal cortex during cognitive control, greater insula activation during reward processing, and reduced functional coupling between the DLPFC and affective regions including the insula and ventral striatum. These results suggest that poor sleep may exaggerate the normative imbalance between affective and cognitive control systems, leading to greater risk-taking in adolescents

School Start Times for Adolescents
AAP 2014

Insufficient sleep in adolescents as an important public health issue…the evidence strongly implicates earlier school start times (ie, before 8:30 am) as a key modifiable contributor to insufficient sleep…research has now demonstrated that delaying school start times is an effective countermeasure to chronic sleep loss. The AAP 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)

Until the mid-20th century, most schools started at about the same time, and rarely before 9 a.m.



cipline, morals and health.

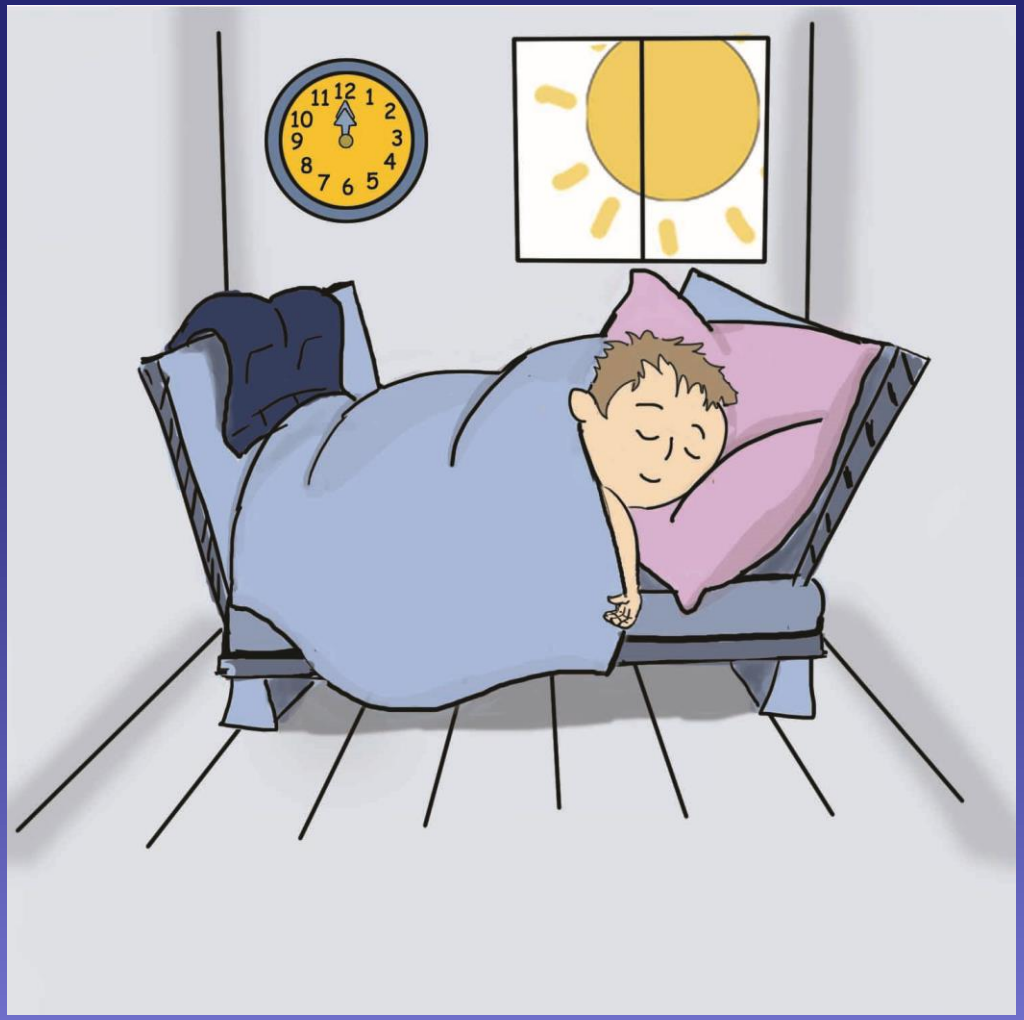
2.—**The Principals** in their respective districts, under the direction of and in coöperation with the Superintendent, shall devote so much of their time as may be necessary **to insure a strict** observance and **enforcement** of the **rules** and regulations of the school.

3.—**All teachers** are required **to be at their respective school rooms** at the beginning of *their* school hours (viz.), at 20 minutes before 9 o'clock A.M., and 15 minutes before 2 o'clock P.M.; and in case of failure, **they shall report themselves** without delay, **in writing,** to the Principal, as tardy, stating the **cause and number of minutes** they are late, and the Principal **shall forward such reports** to the Superintendent, at the **end of each week. To secure uniformity and avoid doubt** in relation to time, the **Principal shall provide for** the ringing of a teacher's bell just 20

Source: New Haven Public Schools. *Annual report of the Board of Education of the New Haven City School District.* 1878

They can catch up during the weekend: WRONG

Sleeping-in does not make biological sense



You cannot make up 5 days of sleep deprivation in 2 days!

Teens on average my need at least 8 hours of sleep but our children are not average: WRONG

Public Health and Economic Benefits of Delaying Bell Times Far Outweigh Costs – RAND, 2017

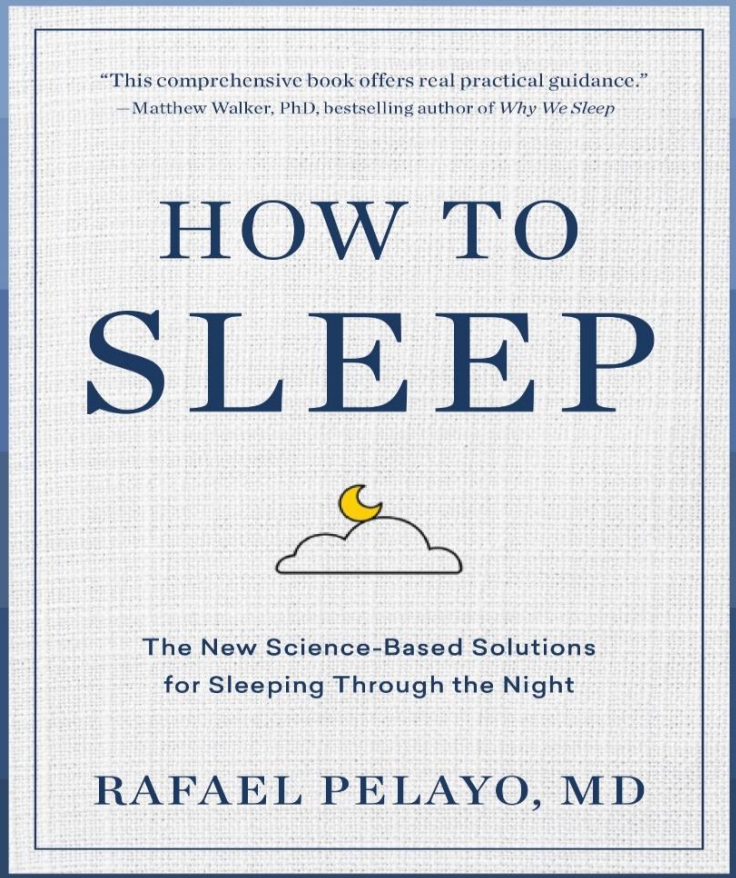
"*…delaying school start times is a cost-effective, population-level strategy which could have a significant impact on public health and the U.S. economy.*"

If all middle and high schools started at 8:30am or later, US economy would gain:

- $8.6 billion after 2 years (already outweighing costs of change)
- $83 billion after 10 years
- $140 billion after 15 years

These are likely underestimates

Additional Resources:



Available Dec 8, 2020

Additional Resources:

https://med.stanford.edu/psychiatry/education/training/sleep.html

Sleep and Fully Recharge Your Brain!