Science of Sleep and School Start Times

sleep  research  teen
music  sleep  sports
school  homework  job  study
research  teen
mental health  teen  job  school  activities  school  homework

Amy R. Wolfson, Ph.D.
Prof. of Psychology
Loyola University Maryland
4/7/20
Zits

by Jerry Scott and Jim Borgman

Jeremy?

It's time to get up.

Z

Jeremy?

It's 7:15.

Z

Knock!

Knock!

Knock!

Rise and shine!

Knock!

Knock!

Knock!

Let's go!

Let's go!

Bam!

Bam!

I don't mean to be critical, but if you'd get me up earlier, we wouldn't have to race to school like this every day.
I read a recent scientific study that said high schools should start at a later hour... Ya think?!
Governor Signs SB 328 CALIFORNIA to Lead the Nation on School Start Time Policy Children Will Sleep More & Excel With Later Start Times

Monday, October 14 2019
Sacramento, California – Our Kids win today as State Senator Anthony J. Portantino’s (D – La Cañada Flintridge) school start time bill SB 328 has been signed by Governor Gavin Newsom. California will become the first state in the country to mandate that high schools and middle schools start later in the morning. The bill is based on over three decades of research on teen health, sleep patterns and brain chemistry. SB 328 seeks to align school start times with the biology of teens. Overwhelming research shows that when the school day starts later, our children are significantly healthier and perform better in school. The California PTA sponsored and supported SB 328. While pediatricians and researchers from across the country united behind the bill, it faced stiff opposition. That opposition led to a veto from Gov. Brown last year. This year, Gov. Newsom appropriately saw things differently and put our children’s health and welfare at the forefront of education policy.

“Today, Governor Newsom displayed a heartwarming and discerning understanding of the importance of objective research and exercised strong leadership as he put our children’s health and welfare ahead of institutional bureaucracy resistant to change. Generations of children will come to appreciate this historic day and our Governor for taking bold action. Our children face a public health crises. Shifting to a later start time will improve academic performance and save lives because it helps our children be healthier. The PTA, researchers, doctors, educational advocates and every parent and child who worked tirelessly and passionately on this three-year effort should take pride in what we have accomplished with the passage of SB 328. When I heard the good news I literally got choked up because of the overwhelming positive impact this will have on our children and for the deep appreciation for everyone who took this journey together. I am beyond excited that now our work begins to implement this necessary educational and public health reform,” commented Senator Portantino.

Beginning over three decades ago in Minneapolis, researchers began studying the brain chemistry of teens. They found that teens require almost 10 hours of sleep per night to be healthy but receive far less in today’s complicated society. By moving school start time later teens achieve more sleep and consequently are healthier and happier. SB 328 was sponsored by the California PTA, EdVoice, and Start School Later. It has near unanimous support from the healthcare community and is based on the recommendation of the American Academy of Pediatrics. Assemblymember Todd Gloria was a stalwart supporter of SB328 helping to shepherd it through the State Assembly.
Campus changes will welcome students, Monday: New start time is 8:35 a.m. for some

**News**

**MMSD shifts school start times to improve student performance**

By: Kaley Arthur  
Posted Aug 27, 2019 01:44 AM EDT  
Updated: Aug 27, 2019 08:35 AM EDT

Bells will ring later at JCHS and JCMS

In addition to the moving of the new envelopes added school, one of the major changes for the 2019-2020 public school will be that all four have now moved from 7:30 to 7:45 a.m. to help with student's performance.

**Some NYC Schools are Testing Starting Their Day Later**

By: Jillian Jorgensen  
NEW YORK CITY  
Published 03:22 PM EDT Aug 19, 2019

What happens when students get to hit the snooze button and start class later in the day? The New York City Education Department and the City Council want to find out.

"I taught a 7:30 in the morning Regents high school class, where many kids would come in routinely late," Brooklyn Councilmember Mark Treyger said. "Because they have to travel very far distances, come class deprived."

Most city middle and high schools begin classes between 8 and 8:20 a.m., but about 50 start the school day even earlier.

**Newton High Schools to Cut School-Day Length, Delay Start Times**

By: Ashley Fair  
Aug 26, 2019

New push in California for later middle, high school start times

Legislative committee will consider whether state should set school start times

**San Diego Unified kicks off school year with healthy start times and new plant-based menu options**

**Governor Murphy Signs Legislation Requiring Mental Health Education and Establishing a Pilot Program Testing Later Start Times In New Jersey Schools**

**As a new academic year begins, parents and researchers call for later high school start times**

**EdSource**

**HOME > METRO > Newton High Schools to Cut School-Day Length, Delay Start Times**

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FOR IMMEDIATE RELEASE: August 15, 2019 (Updated August 17, 2019)

More Teens Going Back to School at Healthy Hours:
Schools in at least 22 states to delay bell times this year

School districts in at least 22 states plan to delay morning bells this year according to the national non-profit Start School Later (SSL). Topping the list are 5 districts in Ohio, 5 in Pennsylvania, and 4 in Massachusetts and Colorado.

“Every year, we see more districts moving bell times back to more reasonable hours in response to the research,” observes SSL’s Executive Director Terra Ziporyn Snider, PhD. “Health professionals have been telling us for years that teenagers cannot get healthy sleep when they have to wake at 5 or 6 a.m. for class. It’s gratifying to see so many communities prioritizing student health and safety by turning these recommendations into school policy.”

The many organizations calling for later start times include the American Academy of Pediatrics, the American Medical Association, the Centers for Disease Control and Prevention, and (with endorsement by both the National Education Association and National PTA) the Society for Behavioral Medicine. All of these groups recommend that middle and high schools start classes no earlier than 8:30 a.m. While not every district delaying bell times this year meets this goal, notes Snider, all are moving to schedules that are healthier and safer for many more students.

Districts announcing plans to start school later for the 2019/2020 school year include, by state:

California: Francis Parker, San Diego USD, Vallejo City
Colorado: Boulder Valley, Coronado, Fort Collins (Poudre School District), Mesa County Valley
Connecticut: Rocky Hill
Delaware: Christina School District
Florida: Pinellas County, Volusia County
Georgia: Jefferson County
Illinois: Woodland District 50
Indiana: Concord, Noblesville, Westfield, Washington
Massachusetts: Belmont, Mashpee, Scituate, Wayland
Minnesota: Brooklyn Center School District, St. Paul, Westoak
Mississippi: Oxford School District
Missouri: Affton School District
New York: Katonah-Lewisboro, Webster Central
Ohio: Ashtabula, Brecksville-Broadview Heights City Schools, Cincinnati, Mason City, North Ridgefield
Oklahoma: Bixby Public Schools
Oregon: Bend, Centennial School District
Pennsylvania: Phoenixville, Pines-Richland, Radnor, South Middletown, Tredyffrin/Easttown
Rhode Island: Barrington
Tennessee: Wilson County
Texas: San Angelo ISD
Washington: Anacortes, Tacoma, Walla Walla
Wisconsin: Big Foot, Madison
1. Adolescents would go to sleep earlier if parents just made them.

2. Some teens might need 9 hrs of sleep, but my child needs only 6 hours (and so do I!)

3. If school starts later, adolescents will just stay up later!

4. Adolescents can make up lost sleep by sleeping in on weekends or going to school later one day/week.

5. Adolescents need to learn to get up early; that’s real life!

6. They’ll survive!
The Perfect Storm

Caffeine, Vaping, & Other Drugs

Crowley, Wolfson et al., 2018

CONSEQUENCES
Accidents, Depression/Anxiety, Suicide risk, learning challenges, health concerns......
Adolescents’ “Real World” Sleep Schedules

- Report less sleep than younger children.
- Report markedly delayed bed and rise times, especially weekends.
- School-night sleep duration declines over adolescent years, weekend sleep changes less.
- Report different school vs. weekend-night schedules, known as social jetlag.
- Report school rise times based on school start times and commute times.
- Size of school-night-to-weekend discrepancy & insufficient sleep tied to poor academic performance, depressed mood, other negative outcomes.
Factors Affecting Sleep Patterns

Behavior and Circumstances
  e.g., family life-style, health, sports, school schedule, socializing, digital technology use, etc.

Biological Processes
  Process S: Sleep Pressure
  Process C: Circadian Timing
Two-Process Model of Sleep Regulation (Borbely, 1982)

• Sleep propensity increases as waking accumulates and dissipates during sleep (Process S)

• Sleep propensity oscillates with a circadian variation (Process C)
Sleep Pressure and Circadian Alerting System (in Teens)
Adolescent Development: Sleep and Circadian Timing
Circadian Changes

- Biological clock is delayed during adolescent development
- Phase preference (chronotype) is later (more Owl-like)
- Internal day is longer

Result: late nights are favored (so, too, late mornings)

Carskadon & Acebo, 2005; Crowley et al, 2011; Roenneberg et al., 2004; Crowley et al., 2018
Sleep Pressure Changes

• Need for sleep is stable at close to 9.2 hours
• Accumulation of sleep pressure slows
• Staying awake longer is easier (sleep over problem!)

Result: Late nights, all-nighters seem possible, but still need 9 hours sleep!!!!!

e.g., Carskadon, Wolfson, et al., 1998; Jenni & Carskadon, 2004; Taylor et al., 2005; Jenni & LeBourgeois, 2006; Crowley et al., 2018
Sleep and Sleep Behaviors Deteriorate...

- BT & RT misaligned with school start times.
- Erratic school vs. weekend sleep patterns.
- Jet Lag effect or Social Jet Lag every Monday morning!

Result: Total Sleep Duration declines!
Percentage of High School Students Who Got 8 or More Hours of Sleep on Average School Night by Sex, Grade, † and Race/Ethnicity

†9th > 10th, 9th > 11th, 9th > 12th, 10th > 11th, 10th > 12th, 11th > 12th (Based on t-test analysis, p < 0.05.)
All Hispanic students are included in the Hispanic category. All other races are non-Hispanic.
Note: This graph contains weighted results.

CDC, National Youth Risk Behavior Survey, 2017
Percentage of High School Students Who Got 8 or More Hours of Sleep on Average School Night

CDC State Youth Risk Behavior Surveys, 2017
Nearly 79% of PA High School Students Reported they Didn’t Get 8+ Hours of Sleep on Average School Night
Zzzzzz.... SLEEPY KIDS
MOST STUDENTS NEED MORE SLEEP

KIDS 6–12 YEARS NEED
9 TO 12 HOURS

TEENS 13–18 YEARS NEED
8 TO 10 HOURS

6 OUT OF 10
MIDDLE SCHOOLERS
DON'T GET ENOUGH SLEEP

7 OUT OF 10
HIGH SCHOOLERS
DON'T GET ENOUGH SLEEP
The Perfect Storm

Caffeine, Vaping, & Other Drugs

CONSEQUENCES
Accidents, Depression/Anxiety, Suicide risk, learning challenges, health concerns......

Crowley, Wolfson et al., 2018
Consequences!

- Excessive Daytime sleepiness
- Learning and attention deficits
- Mood instability
- Substance use/abuse
- Suicides
- Motor vehicle accidents
- Weight gain, colds, other health concerns
Sleep Prepares for & Enhances Learning

Information acquisition

Consolidation/stabilization/strengthening/filtering

Information retrieval
Health and Safety

LIKELIHOOD OF DRIVING DROWSY BY AGE

71% 52% 19%
18-29 30-64 65+

Source: National Sleep Foundation

THE HUFFINGTON POST
Insufficient Sleep and Suicide

• Over 60 studies report associations between chronic insufficient sleep and suicide.

• “Unlike other suicide risk factors, sleep complaints may be particularly amenable to treatment.” (pg 1)

*Bernert & Joiner, Sleep disturbances and suicide risk: A review of the literature (2007)*
Too Much Research to Review Today!
The Perfect Storm

Caffeine, Vaping, & Other Drugs

bioregulatory pressure

psychosocial pressure

sleep pressure rise slowed circadian phase delay

bedtime autonomy academic pressure screen time social networking

early to rise

late to bed

short and ill-timed sleep

CONSEQUENCES
Accidents, Depression/Anxiety, Suicide risk, learning challenges, health concerns......

Crowley, Wolfson et al., 2018
Adolescent Sleeplessness Epidemic

Individual vs. Structural Interventions

**Individual/small group Focus**
- Sleep Hygiene Strategies
- Sleep Disorders/Challenges
- Prevention

**Structural societal Change**
- **School/Class Start Times**
- Institutions (e.g., work load, extracurricular/athletic demands; driving regulations; employment schedules)
- Environment (e.g., ban use of electric lighting!)
- Library hours
- Context –Living/sleep environment (e.g., College dorms)
- Social norms/attitudes (e.g., celebrating sleep deprivation)

- Addressing individual level has minimal impact if structural roots not addressed.
- Social Justice: Structural approach allows youth from disadvantaged home environments, etc. to reap greater benefits of delaying school.
From Adolescent Sleep & CR Science to Later School Start Times for Adolescent Health

1993: Carskadon et al landmark study: association between more mature pubertal development and later circadian preference

“[T]he starting time of school puts limits on the time available for sleep. This is a nonnegotiable limit established largely without concern for sleep.”
Professional medical and public health organizations have reviewed all of the available sleep research on adolescent health. They have recommended a start time for all middle/high schools.

American Academy of Child & Adolescent Psychiatry
American Academy of Pediatrics
American Academy of Sleep Medicine
American Medical Association
American Psychological Association
American Sleep Association
American Thoracic Society
Centers for Disease Control
Massachusetts Medical Society
National Association of School Nurses
National Institutes of Health
National Parent Teacher Association
National Sleep Foundation
Sleep Research Society
Society of Behavioral Medicine
Society of Pediatric Nurses

No organization has found that starting middle or high schools before 8:30am is safe or healthy for our children.

Facts About School Start Times
- The American Academy of Pediatrics recommends that middle and high schools start at 8:30 a.m. or later.
- Today, many middle and high schools begin much earlier, often around 7 a.m.
- Bus pick-ups starting between 5:15 and 6:30 a.m. require students to wake up hours before what is healthy, safe, and developmentally-appropriate for their still-growing brains and bodies.
- With such schedules, teenagers have to be in bed and asleep at 8 or 9 p.m. in order to get the amount of sleep they need. This just isn’t possible — for both biological and logistical reasons.

Learn more about why it's time to Start School Later
... and what you can do to help.
SST Outcome Research
Benefits of Later School Start Times

• Review of 38 studies (Wheaton et al, ’16); Meta-analysis of 20 studies (Bowers & Moyer, ’17); other studies:
  • Increased TST by 30-60 min, later WTs, consistent BTs, fewer sleep problems, less social jetlag, decreased sleepiness
  
  • Reduced tardiness (as much as 4X)
  • Increased attendance
  • Reduced drop-out rates
  • Improved standardized test scores, particularly Math & Reading
  • Improved GPAs
  • Increased/stable engagement sports, extracurricular activities
  • Improved time allocation

• Improved mood
• Improved mental health
• Decreased delinquent type behavior
• Decreased health center visits
• Improved family well-being (decreased family conflict)
• Decreased sleep-driver accidents
• Decreased substance abuse

• Economic benefits far exceed costs in real dollars by ratio of 6:1 as early as 2 years out

Wolfson et al., 2007; Edwards, 2012; Wheaton et al., 2016; Jacob & Rockoff, 2011; Bowers & Moyer, 2017; Hafner et al., 2017; Wahlstrom, 2001, 2014; Owens et al., ‘10, ‘17; Berger et al 2018; Sleep Health special issue, ‘17, Semenza et al., 2019, Groen et al., 2019, Dunster et al., 2018, etc.
Not New: Middle School Start Times and Sleep

Method:
- N = 205 7th & 8th graders
  - Early (7:15 am) vs. late (8:37 am) start public schools
  - 18% low income families

Key Results:
- School L sleeping 51 min. longer on school nights due to rising 71 min. later.
- 36% School L reported obtained 9+ hours sleep on school nights vs. 18% School E.

- School L reported significantly less daytime sleepiness.
- School E tardy 4 X more often than School L.
- 8th graders at School E lower grades than School L.

- Findings replicated fall and spring!

Wolfson et al., ‘07
Distribution of School-night Total Sleep: Early versus Late Starting Middle Schools

School-night Total Sleep Times

- < 5 hr
- 5 - 6 hr
- 6 - 7 hr
- 7 - 8 hr
- 8 - 9 hr
- > 9 hr

Wolfson et al., 2007
Later SSTs associated with later wake times. Teens starting school at 8:30 AM or later only group with average time in bed, allowing 8 hours sleep.


Nahmod et al. (2017), Sleep Health
Sleepless No More in Seattle Public Schools
(54,000 students, one of largest U.S. districts)

• 2015: Start School Later & local chapter, Start School Later Seattle
• 2017-'18: implemented delayed school start times
• 2018-'19: further funded changes -- SSTs between 7:55 – 8:55am!
• Modeled way citizen advocates, school leaders, health care providers collaborate!
  • Launched by district teacher with collaboration from school nurses, local teachers union, sleep researchers & clinicians
    • Set goal later start times for adolescents to benefit student health, wellbeing, performance
    • Broad spectrum of school, community stakeholders
    • Developed consensus about ways to achieve goal
    • Seattle change successful because district listened to parent feedback on initial proposal, making final plan more more popular and feasible

https://www.facebook.com/worldeconomicforum/videos/1941250946179397/UzpfSTc3NDY4NDE0Nzg6MTAxA3OTk1NTkwNjE0Nzk/
Dunster et al. (2018), Science Advances

- Pre/post- delay High School SST, 7:50 to 8:45am.
- Activity monitors for 2 weeks at each time (N = 178).
- 34 min increase in daily median school day sleep duration (6.8 to 7.4 hr).
- Later light exposure in am, but not pm & less social jetlag.
- 4.5% increase in median grades.
- Improvement in attendance, decreased tardies.
Snooze or lose: High school start times and academic achievement

Jeffrey A. Groen\textsuperscript{a}, Sabrina Wulff Pabilonia\textsuperscript{b,c}

\textsuperscript{a}U.S. Bureau of Labor Statistics, 2 Massachusetts Ave. NE, Rm. 4945, Washington, DC 20212, United States
\textsuperscript{b}U.S. Bureau of Labor Statistics, 2 Massachusetts Ave. NE, Rm. 2180, Washington, DC 20212, United States

Sample

• Nationally-representative sample, N = 1,200
• Interviews & Time Diaries

Key Findings

• Most important determinants of SST Census region
  o Earliest: Northeast, Suburban, Larger, earlier sunrise

• Testing:
  • Negative association between SST & test scores, \textit{with magnitude of effect greater for economically disadvantaged students}
    o 1-hour delay in HS start time increases reading test scores for females, less for males

• Time Allocation:
  • Students spend less time on leisure activities with later SST.
    o For males, decrease largely from spending less time on TV, computer games.
Delaying School Start Times: Social Justice Solution!

• Public health sees health & well-being as **public good**, meaning government should create/support policies that address root causes of poor health (Hale & Troxel, 2018).

• Strong evidence of racial/ethnic, socioeconomic disparities in adolescent sleep.
• As example, we demonstrated timing, regularity of middle schoolers’ school/weekend-night sleep associated with demographic (education, income), behavioral (tech use, bedtime routines, etc.), and neighborhood (outside environment including crowding) aspects of SES (Marco, Wolfson et al, 2011).

• Students from economically disadvantaged backgrounds experience greatest drawbacks from early SSTs.
• Early SSTs reduce performance among disadvantaged students by amount equivalent to having a highly ineffective teacher (Hamilton Report, 2011).

• Later middle SSTs associated with 2 percentile point gain in Math/Reading test scores, with larger gains at lower end of socioeconomic spectrum (Edwards, 2012).

• Delayed SSTs associated with increases in attendance & better graduation rates (McKeever & Clark, 2017).

• Therefore, later SSTs important & cost effective strategy to minimize achievement & health gaps for socioeconomically disadvantaged students.
Summary: Adolescents’ Sleep after Delayed School Start Times

• Additional 30 to 60 min sleep per night!
• Later Wake times, while Bedtimes remain the same!
• More morning sleep = increased REM sleep (memory, learning, consolidation)!
• Decreased social jetlag!
• Decreased daytime sleepiness!

Wolfson et al., ’07, Wahlstrom ‘14, ’16, Sleep Health Special Issue, ‘17
MULTI-PRONGED APPROACH

http://www.startschoollater.net/

Diverse players
(Community advocates, educators, health professionals, sleep health researchers, policymakers)

National
- Legislation (e.g., ZZZs to As Act)
- Position Statements (e.g., AAP, CDC, APA, DOE, Educ Comm. Of the States)
- Litigation (?)
- Grassroots Activism
- Education

State
- Legislation
- Position Statements (e.g., state medical societies)
- Litigation (?)
- Grassroots Activism
- Education

Local
- Legislation
- Position Statements (e.g., local board of health)
- Grassroots Activism
- Education
Sleep on set
8.5 to 9.5 hr
sleep need

Morn Routine Time!

Bedtime Routine Time!

25 - 47 min HS commute in Phil depending on mode of transportation

Imagine 45+ min. commute? 20% NYC teens commute 45+ min.

Don't forget Times 8:30am or later...

Questions?
Thank You!