Changing School Start Times: Research Findings

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Thirty Years' Worth of Data

Over 2,000 articles have examined

adolescent sleep, late start,

health & safety, and psycho-social issues

Outcomes for Stakeholders in the Change

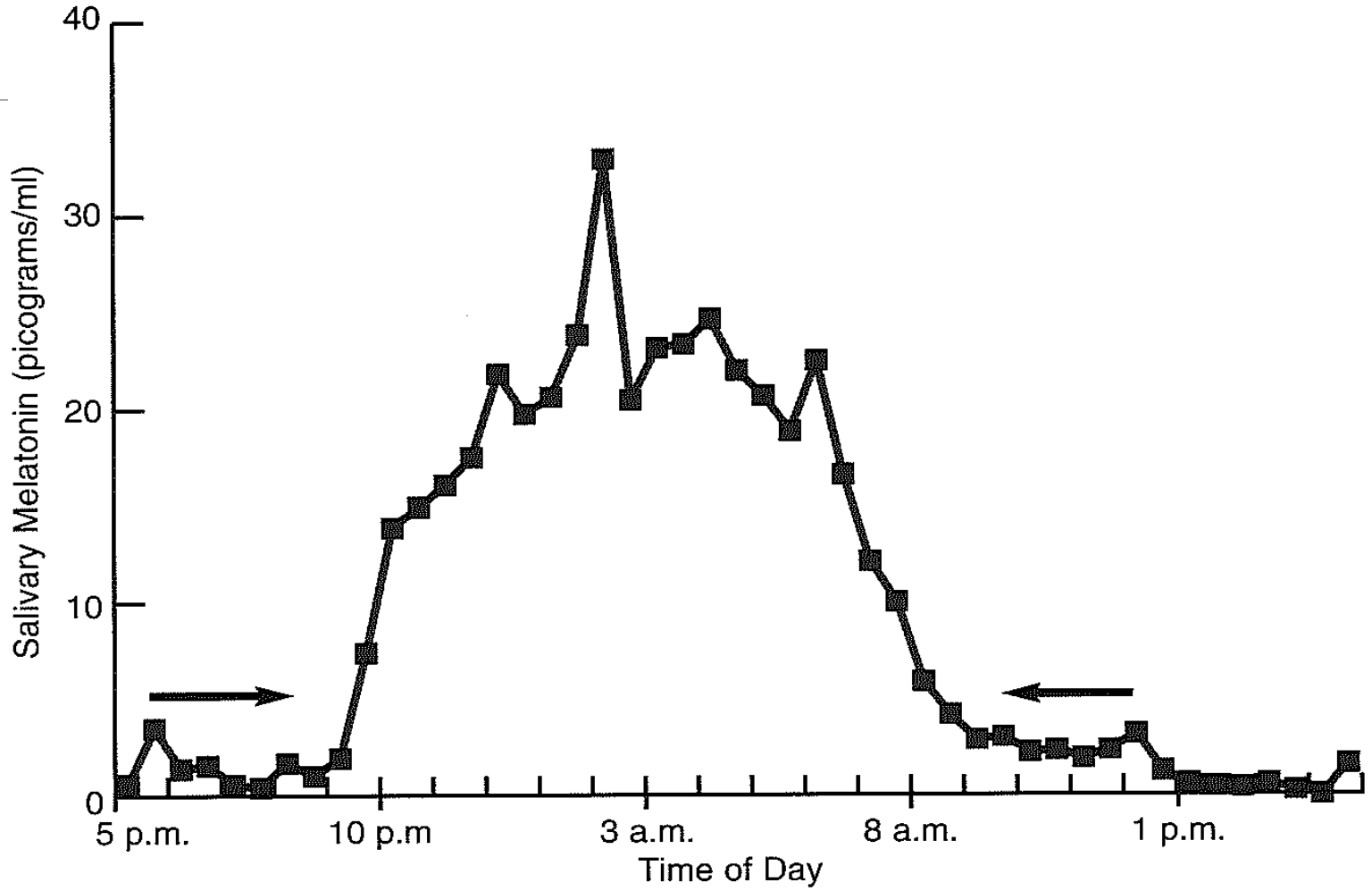
- Students
- Teachers
- Parents
- School administration
- Community

Basic Facts about Sleep

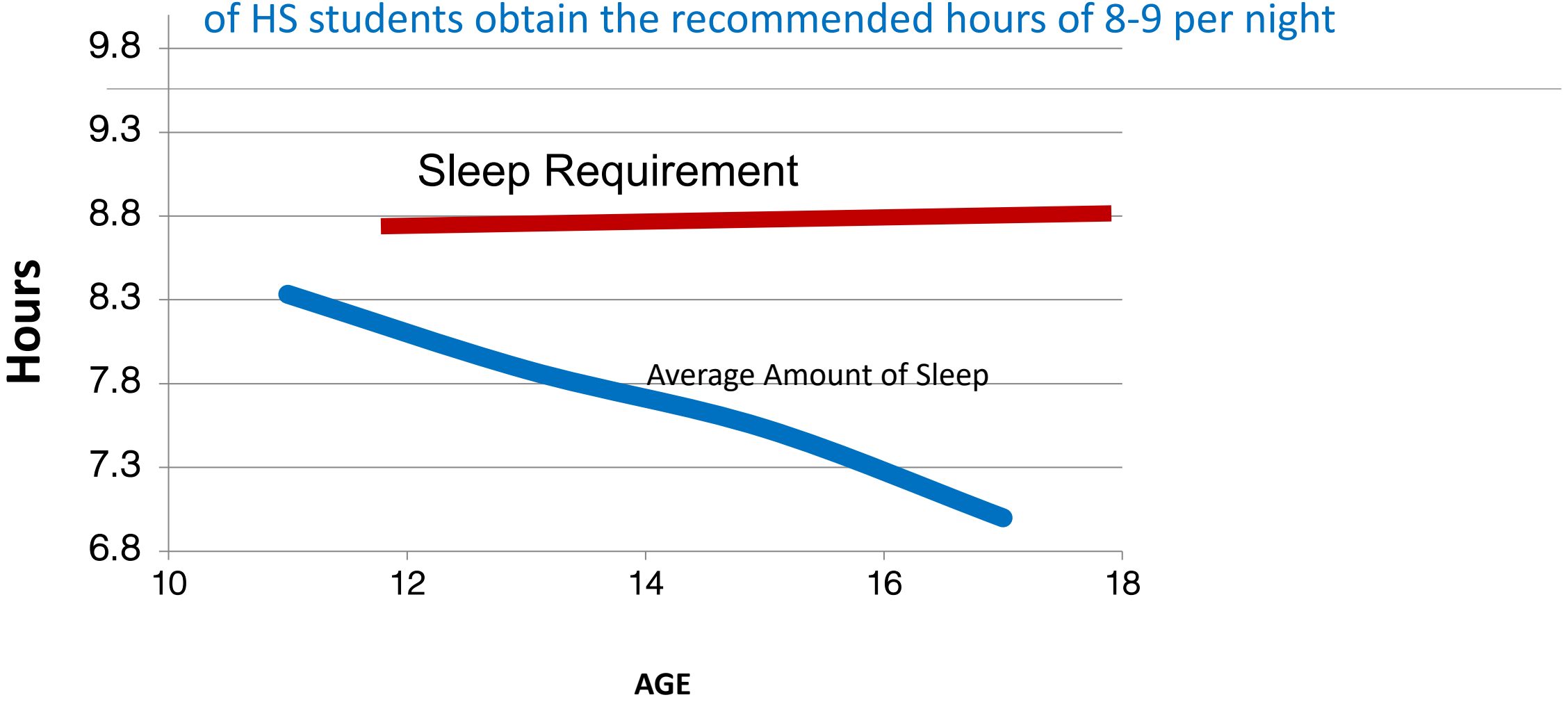
Why do humans need sleep? Essential processes…

- **Clearance of neurotoxins each night**
- **Synapses in the brain's nerve cells are repaired and connected**
- **Learning, memory, and abstraction are enabled**
- **You will die sooner from lack of sleep than from lack of food!**

Pattern of Melatonin Secretion in Adolescents to age 20 (as measured in saliva samples)—controlled by the circadian timing system

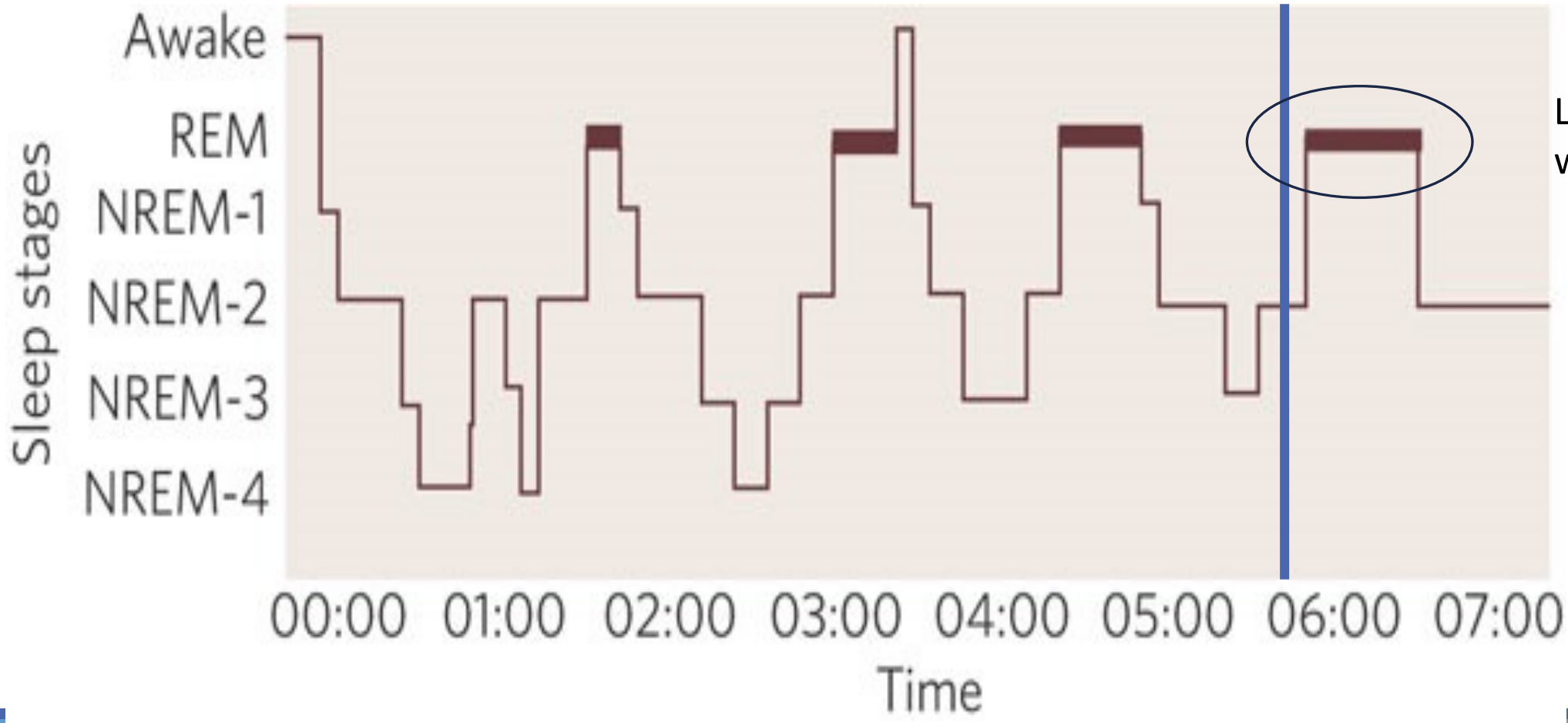


42% of MS students average less than 8 hours per night; Only 23% of HS students obtain the recommended hours of 8-9 per night



The Human Sleep Cycle

Across the night, NREM and REM sleep cycle every 90 minutes, while the ratio of NREM to REM sleep shifts. During the first half of the night, NREM stages 3 and 4 NREM (SWS) dominate, while stage 2 NREM and REM sleep prevail in the latter half of the night.



Lost REM sleep with early rising

Sleep, Memory, and Cognition

- Sleep after learning enables the brain to consolidate new information, with improved next day recall.

- One night of sleep deprivation markedly impairs brain function, imposing a deficit in the ability to commit new experiences to memory. (Walker, 2008)

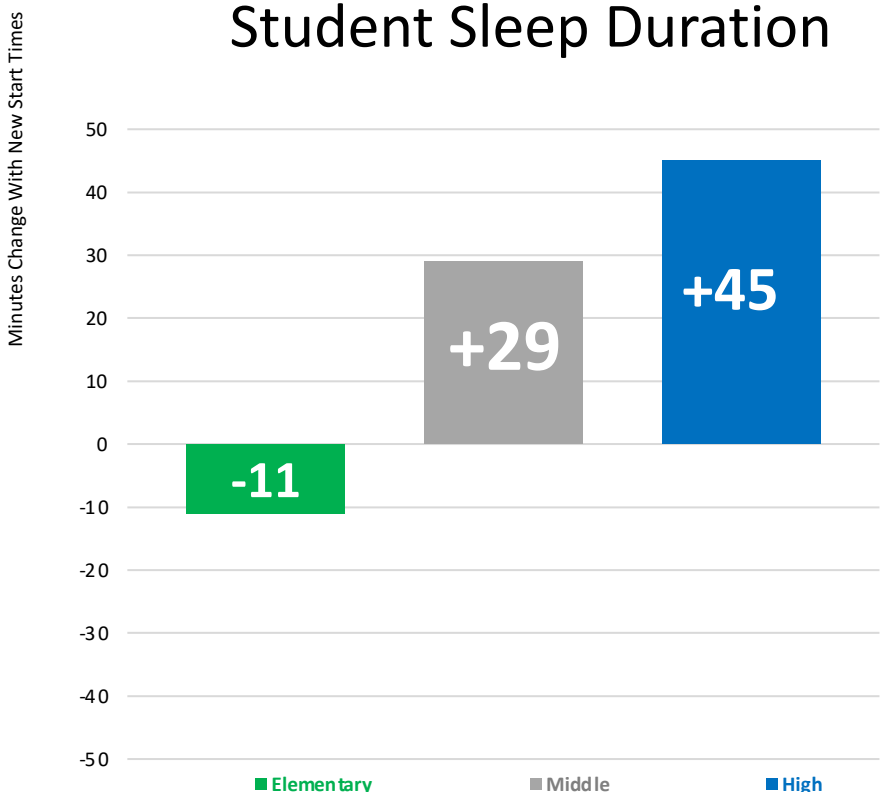
- REM (Rapid Eye Movement) sleep has multifaceted functions in brain development, learning, and memory consolidation.

(Li et al., 2017)

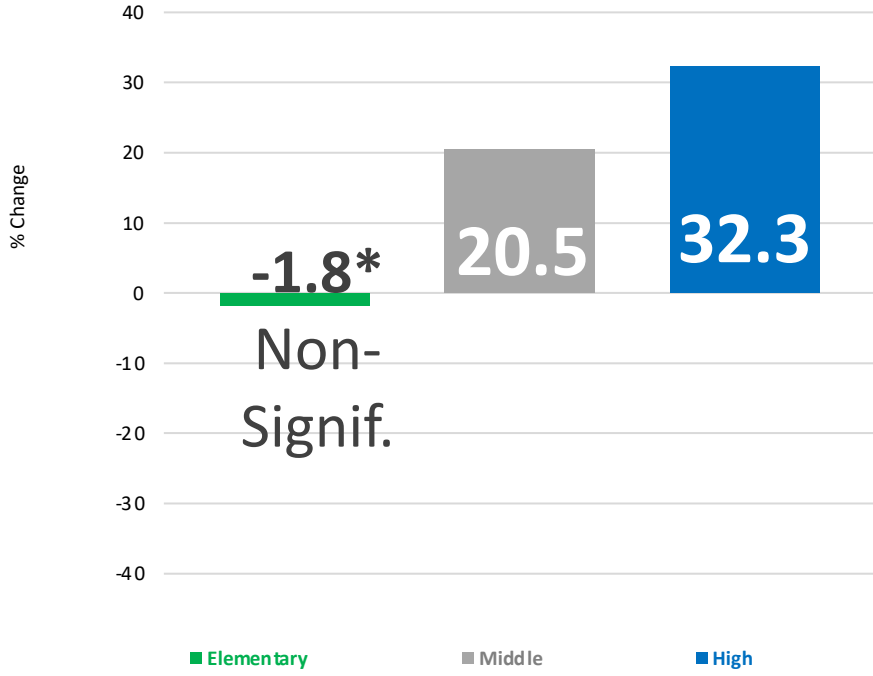
Changes in Sleep Duration with One Hour Change in Start Time

(N=55,000 students in Colorado—MS & HS 1+ hr. later, Elem 1 hr. earlier)

Minutes/Night Change in Student Sleep Duration



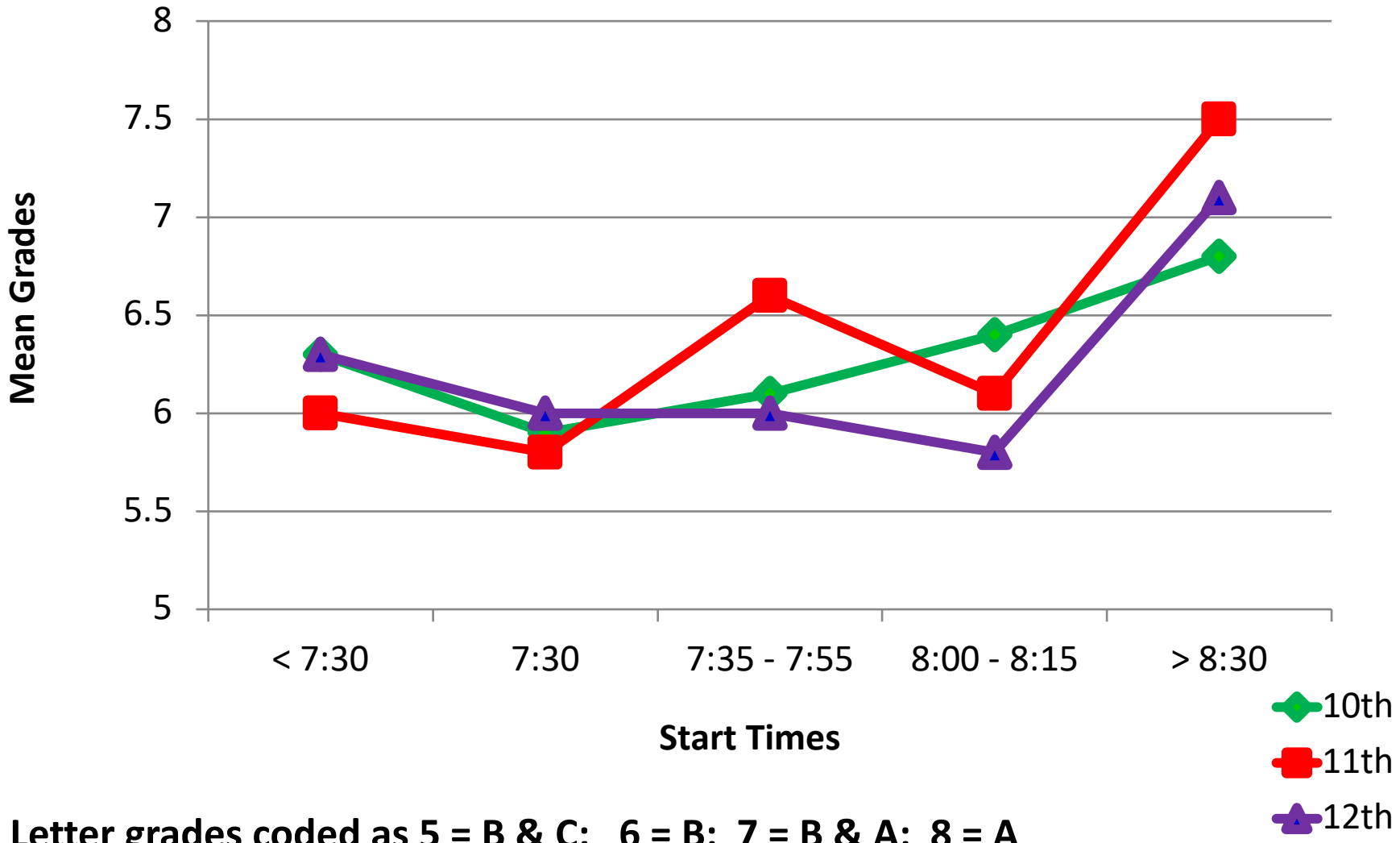
% Change in Students Obtaining Sufficient Sleep



Student Academic Performance

Earliest Evidence—Mean Overall GPA X Start Times
(n = 7,168 students)

Wahlstrom, 1998



Letter grades coded as 5 = B & C; 6 = B; 7 = B & A; 8 = A

Standardized Achievement Tests and Later Start Times

National ACT exam:

- No evidence that variation in start times affected scores for high school students. (Lenard et al., 2020)

State-level mathematics and reading achievement test scores:

- One hour later start leads to a 3 percentile point gain for the average middle school student. (Edwards, 2012)
- Math scores show greater positive impact with late start as compared with reading scores (Edwards, 2012)
- Lower performing students benefit more than others with a one-hour delay in school start times (Edwards, 2012)

Grades for First Period Classes

- Start times from 8:00-8:35 AM

  Statistically significant increases in one or more core courses of English, math, social studies, and science in five high schools

- Start time of 8:55 AM

  Significant increases in all 1st period core courses for all semesters at all grade levels 9-12 in Jackson Hole HS

  (Wahlstrom et al., 2014)

- Start time before 8:00 AM

  Achievement was significantly lower in first-period classes than in other periods; this negative effect was particularly significant for mathematics classes

  (Cortes et al., 2012)

Attendance, Tardies, & Graduation Rates as Student Engagement Outcomes

- Significant improvement in attendance and graduation rates for students in schools with delayed start times of 8:30 AM or later. (McKeever & Clark, 2017)

- Attendance rates improved and were maintained for 3 years for all ethnic groups (Asian, Hispanic, Native American, Black, and White) for students in grades 9 to 11 after the change in start time from 7:15 to 8:40. (Wahlstrom, 2002)

Economically Disadvantaged Students

The magnitude of the positive effects of later school start time on academic outcomes is larger for economically disadvantaged students:

- Higher course grades
- Higher achievement test scores
- Reduced tardies
- Improved attendance
- Reduced suspensions

(Bastian & Fuller, 2018; Groen & Pabilona, 2020; Edwards, 2012; Dunster et al., 2018)

Teachers and Late Start Outcomes

52% HS/MS teachers saw fewer students falling asleep in class

Allows secondary teachers time for better planning across subject areas

Fewer than 1 in 5 teachers indicate middle and high school students are ready for learning before 8 AM

Both elementary and secondary teachers note schedule changes affect their personal lives, but most say the benefits to students is worth it.

Findings for earlier start time for elementary schools

- Increase in student attentiveness
- Increase in elementary students eating breakfast
- Schools are able to structure core classes before lunch and during the best learning time
- A decreased need for morning childcare allows fewer transitions for students
- No negative effect on academic achievement
- Research shows that after the first year, majority of families and school staff prefer the earlier start

Academic Summary

- A later start time in secondary schools is equivalent to:
  - Being in a class with a third fewer students.
  - Having a teacher whose instructional performance is one standard deviation higher than peers on a teacher performance evaluation. (Shapiro, 2015)
- The effect of a later start time in high schools is very similar in size to the effect of reducing class size from 22 students to 15 students in grades K–3. (Groen & Pabilona, 2019)
- Deficient sleep and academic performance are clearly related: as sleep increases for most students, academic outcomes improve.

Health and Well-Being

Impact on health when students receive less than 8 hours of sleep

- Increased rates of depression, anxiety and fatigue
- Increased risk of suicide
- Increased rates of auto accidents
- Decreased athletic and motor skills
- Weight gain and/or elevated blood pressure
- Increased likelihood of risk-taking behavior (drugs, alcohol)
- Interference with brain development (memory formation)

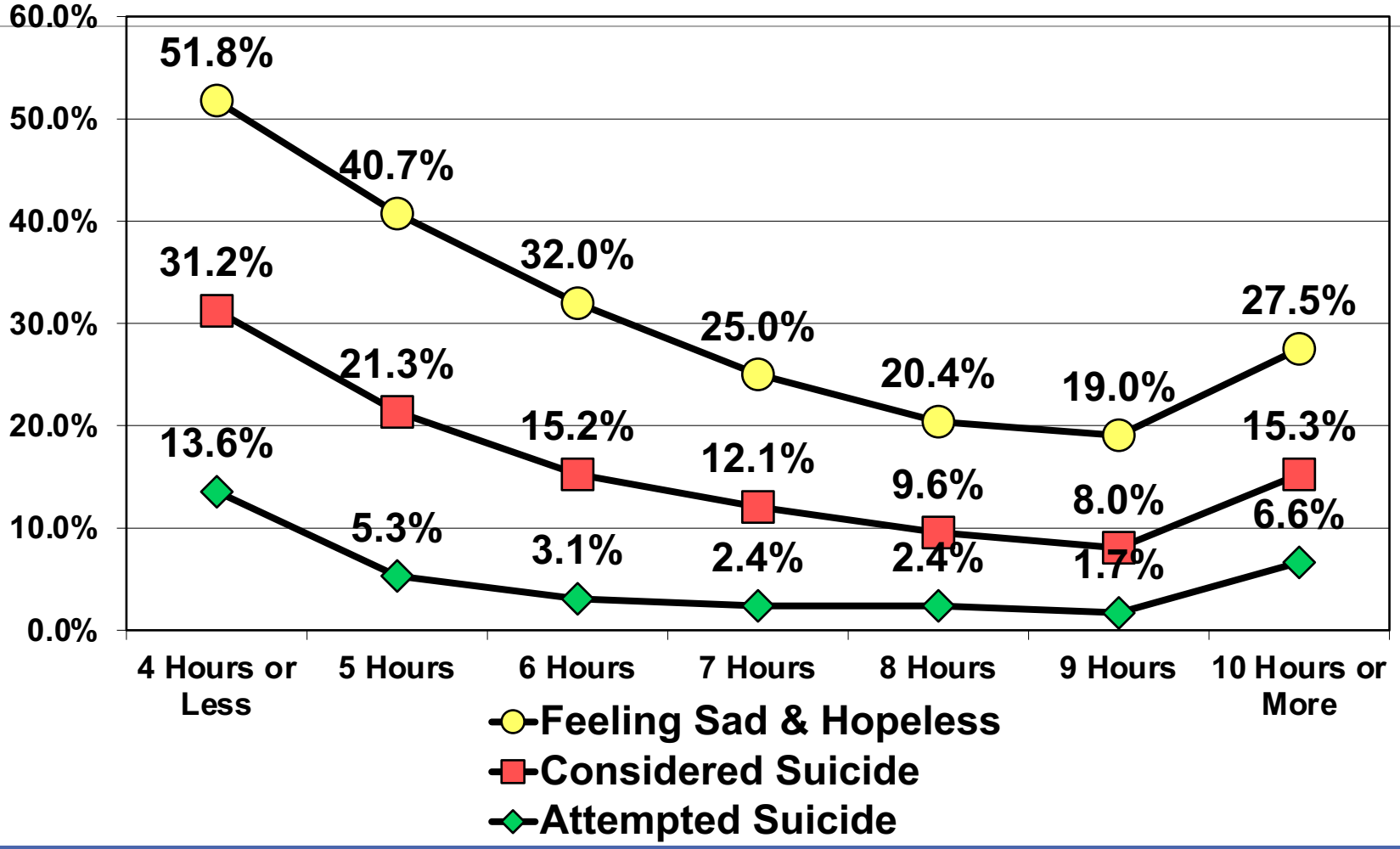
Odds associated with insufficient sleep for health-risk behaviors: CDC Youth Risk Behavior Survey

N= 12,154 students in grades 9-12, all 50 states

	<8 hrs sleep vs. > 8+ hrs sleep
Used 1+ cigarettes daily	24% / 15%
Used alcohol in past 30 days	50.3% / 36.7%
Used marijuana in past 30 days	23.3% / 15.6%
Currently sexually active	39.1% / 27.8%
Felt sad or hopeless (felt daily in past 2 wks and stopped usual activities)	31.1% / 21.6%

McKnight-Eily, L.R. et al., *Preventive Medicine*, 2011

Depression and Suicide by Average Number of Hours of Sleep on a School Night for 8th, 10th, and 12th Grade Students (Fairfax County Public Schools, 2009)



Car Crash Rates and Later Start Time

- Car crashes are the #1 cause of deaths in teenagers
- Later start times account for an average of 13% reduction in teen car crashes
- Sample of Pre-Post crash rates:
  - Mahtomedi 65% reduction
  - So. Washington Co. 6% reduction
  - Jackson Hole, WY 70% reduction

Phone & Apps Use and Sleep

Using technology within an hour of going to bed disrupts sleep onset due to brain being stimulated.

72% of adolescents and young adults use a smartphone within 30 minutes before bed.

38% of young adults sleep with cell phone ringer ON in the bedroom.

The more engaging the technology application, requiring mental alertness, the greater the likelihood with difficulty falling asleep and having nonrestorative sleep.

Translating research into local and policy decisions

Research Findings: Real Issues vs. Those Not Substantiated in Findings

REAL

Athletics—schedules and last class missed

- Younger children in AM darkness
- Child care schedules for younger kids before and after school
- Parents' work schedules
- Local traffic patterns

NOT SUBSTANTIATED

- Athletics—less participation, fewer games won
- After-school activities decline
- Transportation costs higher
- After-school employment negatively affected

Transportation Criteria for Decisions

Student ride time

Student safety at bus stops

After school activities and sports

Cost—especially with multi-tiered busing

Efficiency—alternate models of mixed age busing

District parent feedback

Economic Impact of Improved Academic Performance

- The estimated costs of adjusting school start time are less than the estimated costs of reducing class size. (Jacob and Rockoff, 2011; Schanzenbach, 2006).

- Delays to school start times could add $83 billion to the U.S. economy over the next decade. (Hafner, Stepanek, & Troxel, 2017).

- A one standard deviation rise in test scores is estimated to increase future earnings of students by 8%, an approximately $10,000 average increase in future earnings per student. The benefit is even larger for students at the bottom of the grade distribution. (Shapiro, 2015)

Administration, Parents, and Community

- Principals describe…
  - Less agitation in hallway passing times
  - Fewer lunchroom incidents
  - Quieter “tone” to the entire building
- 92% of parents say their child is “easier to live with”
- Parents need adequate advance time to adjust schedules
- Community traffic patterns often affected

How Late is “Late Enough?”

- Districts making a modest move to a later start (e.g., from 7:25 to 7:55; from 7:35 to 8:05) experienced only modest benefits, but have experienced the same amount of community disruption as did the districts that made the change to start at 8:30 or later.

- The starting time of 8:30 AM or later shows the most positive results.

Findings after 30 Years of Research on School Start Times

- Not all students will benefit equally
- The goal is to provide “the greatest good for the greatest number of students”
- Anticipation often worse than reality (impact on athletics, teacher retention, after-school programs, childcare issues)
- Initial challenges were reduced over time

Lessons Learned

- Educating the general public about brain development during adolescence is essential: It's about their health, safety *and* learning
- Engaging the community in solutions is a must: Identify and involve key stakeholders
- Allowing adequate time for families to become informed and make sufficient plans prior to implementation is critical
- Each community faces different, unique conditions… Finding and applying solutions from other districts is key

Suggested Next Steps

Parents becoming better informed about the importance of sleep and how to support good “sleep hygiene” at home.

Teens learning about role of sleep and the impact of sleep deficits affecting them.

Administrators and teachers discuss how the sleep needs of students intersect with school activities and actions.

Final Thoughts

We all need frequent reminders that the sleep phase shift in teens is based in human development and not simply due to rebellious adolescent behavior.

When making educational decisions,
it is important to keep the focus on the child
and not on the system.

Thank You!

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