

Delaying School Start Times to Improve Population Health

Erika R. Cheng, PhD, MPA^{1,2}; Aaron E. Carroll, MD, MS^{2,3}

¹Children's Health Services Research, Indiana University School of Medicine, Indianapolis

²Center for Pediatric and Adolescent Comparative Effectiveness Research, Indiana University
School of Medicine, Indianapolis

³Associate Editor, *JAMA Pediatrics*

If there is one thing that parents, clinicians, and educators can agree on, it's the importance of sleep for our nation's youth. Too many are not getting enough.

Sleep is a basic human need, and one that is critical for optimal physical and mental health.¹ Mounting evidence suggests that this is particularly true during adolescence, a period marked by substantial neurodevelopmental changes in key regions of the brain that affect cognition, learning, and emotion regulation.² Research on adolescents underscores the vital role of sleep in nearly all aspects of their daily lives, linking sleep deprivation with poor memory consolidation, less sustained attention, decreased academic performance, physical and mental health problems, and more risk-taking behavior.^{2,3} As such, the National Heart, Lung and Blood Institute, the American Academy of Sleep Medicine, and the American Academy of Pediatrics recommend that adolescents sleep from 8 to 10 hours per day for optimal health.⁴

Despite this, studies also consistently indicate that our nation's youth do not get enough sleep. Meta-analytic estimates reveal that children aged 12 to 18 years sleep less than recommended guidelines—on

This is the author's manuscript of the work published in final edited form as:

Cheng, E. R., & Carroll, A. E. (2020). Delaying School Start Times to Improve Population Health. *JAMA Pediatrics*, 174(7), 641–643. <https://doi.org/10.1001/jamapediatrics.2020.0351>

average, less than 7 hours on school nights and less than 8 hours on weekends.⁵ This is particularly alarming because studies show that adolescents who do not sleep enough are at higher risk for poor school performance, mental health problems, and even car crashes.^{6,7}

These facts suggest that actions must be taken to help youth sleep more, but what can we do? First, we should acknowledge that both biological and social factors are a problem. From a biological perspective, adolescents experience natural circadian and physiological brain changes that shift their sleep preference to go to bed and wake up later than adults or younger children. Typical bedtimes for 12th graders are after 11 pm on weekdays⁸; adolescents aged 12 to 14 tend to fall asleep roughly 20 minutes later than children aged 9 to 11 years, and those aged 15 to 18 years, 24 minutes later.⁵

Unfortunately, the biological changes that make it easier for adolescents to stay awake later do not affect the amount of sleep they need. Sleep deprivation arises when biology collides with social factors such as homework, extracurricular activities, after-school jobs, the use of technology, and early school start times that often force adolescents to wake up well before 8 am.

The second thing we need to do to address adolescent sleep duration is identify which of these factors are amenable to policy change. We cannot change internal sleep cycles. We can, however, change when adolescents need to get up for school. This factor is the focus of a study in this issue of *JAMA Pediatrics*.⁹

More than 40% of high schools in the United States start before 8 am, and more than 20% of middle schools start at 7:45 am or earlier.¹⁰ It is not surprising that studies consistently implicate early school start times as a major contributing factor to curtailed sleep during the weekday, sleep deprivation, and daytime sleepiness, a relationship that seems to worsen with age from early to late adolescence.¹¹

Delaying school start times to allow adolescents to sleep until 8 am would align with their natural sleep cycle drivers and might increase the amount of sleep they get. Advocates of this change point to cross-sectional and observational research linking later school start times with longer sleep duration and

improved outcomes. Skeptics worry that delayed school start times will lead to students staying awake later on school nights, getting no more sleep overall, and catching up on weekends to account for this “sleep debt.”

Unfortunately, this debate has lacked robust research to inform us as to which side is correct. Although randomized clinical trials would provide the most irrefutable evidence for a causal link between school start times and these outcomes, they are not always practical, especially at the school level. In fact, we know of only 1 randomized study on the topic.¹² That study used wrist actigraphy to measure sleep duration in a cohort of 26 eighth-grade students who were randomized to delay their school start time by 1 hour (from 7:30 at 8:30 am) during the course of 1 week. When compared with a control group of 21 students, the students with the delayed start time slept longer and performed better on tests of attention level and impulsivity. This study provides compelling evidence of the causal relationship between school start times and curtailed sleep, but it was not conducted in the United States, which limits its generalizability to local school policy. Moreover, it was small, and the short follow-up period left unanswered questions about the long-term effects of the delay on student outcomes.

Enter this new study, in which Widome and colleagues⁹ examine sleep durations during the course of 2 years among 455 students attending 5 suburban and rural Minneapolis-area high schools, 2 of which adopted a preplanned delay in their start times by 50 to 65 minutes at baseline. The authors found that students attending schools with later start times slept approximately 40 minutes longer than students attending schools that did not adopt the policy, an increase that persisted during the 2-year study period. Notably, students attending schools with delayed start times did not fall asleep later or sleep more than their peers on the weekends, refuting the notion that later school start times will simply cause them to stay up later or contribute to a sleep debt.

The results of the study by Widome et al⁹ address the limitations of previous reports in important ways. First, the authors leverage a natural experiment to study the association of delayed school start times with student sleep duration. Their use of a natural experiment enabled effects to be studied in the entire school population with minimal bias and represents a strong study design where a randomized design would not have been practical. They also followed up participants longitudinally for 2 years, a significant contribution to the cross-sectional studies that dominate this research base. Finally, unlike previous studies that rely mostly on self-reported sleep durations, Widome et al⁹ used wrist actigraphy, which allowed them to measure sleep duration, timing, and quality objectively and with maximum validity.

It is important to note that this study included relatively affluent students and schools and that there were socioeconomic and racial differences in student characteristics between schools that did and did not adopt the later start times. For instance, 89.3% of students in the delayed start schools reported having at least 1 college-educated parent compared with 74.3% in the comparison schools. It is possible that unmeasured characteristics associated with parent education influenced the school district's decision to delay schools' start times and had an effect on student sleep duration. The study also did not examine effects beyond sleep duration, so future research should test whether sleep-related interventions such as delayed school start times protect teens from negative physiological, psychological, and behavioral outcomes.

Furthermore, changing this policy is not without cost. Many local school systems use the same buses for elementary, middle, and high school. Pushing back times for older kids could mean needing more buses or moving elementary school times earlier. After-school activities are also a concern, particularly for families that might rely on supplementary income brought in from adolescents who work after school.

These costs must be balanced against the benefits of increased productivity, academics, and improved health that are associated with sleep among teenagers. One published study, for example, argued that delaying school start times to 8:30 am might contribute more than \$80 billion to the economy within a decade, predominantly through decreased car fatalities and increased lifetime earnings.¹³ The costs of this change were not nominal and included infrastructure upgrades and transportation fees. Still, the educational and economic benefits far outweighed the costs in the long run.

Clearly, delayed school start time is only 1 policy affecting children's sleep, and, as mentioned, the reasons for teens' lack of sleep are complex and interrelated. However, given the importance of sleep to most aspects of health and functioning, it seems prudent to arm children with the tools they need to maximize their health, safety, and productivity. The study by Widome et al⁹ provides strong evidence that delaying early school start times would help adolescents get the sleep they need to thrive.

We ask our adolescents to perform well in school, build positive relationships, learn to drive, and avoid risk-taking behaviors; to do so, they need emotion regulation and executive functioning skills that depend on regions of the brain that are vulnerable to sleep deprivation. We often blame adolescents for their not getting enough sleep, but much of that is not their fault—it is ours. We set the school start times, mostly to fit our work schedules. Pushing back school start times might be inconvenient, but it is a mutable, cost-effective, population-level strategy that would improve the lives of many, if not most, adolescents in the United States.

Corresponding Author: Erika R. Cheng, PhD, MPA, Children's Health Services Research, Indiana University School of Medicine, 410 W 10th St, Ste 2000, Indianapolis, IN 46202 (echeng@iu.edu).

Conflict of Interest Disclosures: None reported.

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