

SCHOOL HEALTH POLICY

# Setting Adolescents Up for Success: Promoting a Policy to Delay High School Start Times

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## ABSTRACT

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**BACKGROUND:** A unique biological shift in sleep cycles occurs during adolescence causing later sleep and wake times. This shift is not matched by a concurrent modification in school start times, resulting in sleep curtailment for a large majority of adolescents. Chronic inadequate sleep is associated with poor academic performance including executive function impairments, mood, and behavioral issues, as well as adverse health outcomes such as an increased risk of obesity, hypertension, and cardiovascular disease. In order to address sleep deficits and the potential negative outcomes associated with chronic sleep deprivation, the American Academy of Pediatrics (AAP) and US Centers for Disease Control and Prevention (CDC) support delaying school start times for middle and high school students.

**METHODS:** We summarize current evidence, explicate the need for policy change, and urge school districts to put adolescent students' health as top priority and implement school start times consistent with their developmental needs.

**RESULTS:** Whereas substantial evidence illustrating adverse consequences of inadequate sleep on psychological and physical health, and recommendations exist to adapt daytime school schedules to match sleep needs have been released, actual implementation of these recommendations have been limited.

**CONCLUSIONS:** This is a call to action for the implementation of AAP/CDC recommendations across the state and nation.

**Keywords:** adolescence; sleep; school start times; sleep deprivation; development; school health policy.

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Sleep is essential to human growth and development across all functional domains.<sup>1</sup> Sleep needs and patterns shift across the lifespan, with the most notable shift occurring in adolescence.<sup>1</sup> By mid-puberty, delays in the circadian nocturnal melatonin secretion increase the time required to fall asleep.<sup>2</sup> The melatonin secretion also turns off later in the morning, making it more difficult to wake up early.<sup>3</sup> Unfortunately, the current school schedule does not facilitate later wake times. The “mismatch” results in an estimated 2-hour sleep restriction and circadian rhythm disruption.<sup>2</sup> One could argue that less disruptive interventions may be just as effective for preventing sleep deprivation

(eg, reducing all night lighting, avoiding caffeine, stimulants, exercise, eating, screen time before bed, napping). However, even with the implementation of sleep hygiene interventions, sleep hygiene does not address the physiological shift in melatonin secretion. As such, the synchronization of the school schedule with adolescent sleep patterns is a key to reducing sleep deprivation and associated outcomes in teens. Reducing adolescent sleep deprivation via delayed school start times may have profound effects on cognitive function, feeding behaviors, physical activity, and overall health.<sup>1</sup> We emphasize the potential impact of longer sleep duration/later start times

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for adolescents on cognitive function, and more specifically executive function, in addition to overall health outcomes.

## SLEEP AND SCHOOL ACHIEVEMENT

The American Academy of Pediatrics (AAP) recommends 8.5 to 9.5 hours of sleep per night for adolescents.<sup>2</sup> However, a large proportion of adolescents reports getting less than 8 hours of sleep.<sup>1</sup> Estimates suggest that 26% of adolescents get less than 6.5 hours on school nights leading to consequences across several functional domains.<sup>2,4</sup> Sleep duration is inversely associated with absenteeism, academic achievement, and school readiness across middle school, high school, and college level adolescents.<sup>5-8</sup> Up to 28% of adolescents report falling asleep in school and 1 in 5 fall asleep doing homework at least once per week.<sup>4</sup> Sleep deficits impact cognitive function including decision-making, attention span, working memory, and impulse control.<sup>9-11</sup> Sleep-related cognitive deficits can also lead to increased emotional and behavioral difficulties.<sup>12,13</sup> Additionally, deficits in working memory increase the likelihood of risky behaviors (sex, drug and alcohol use, safety violations, and increased violence).<sup>13</sup> The negative impact of sleep deprivation on cognitive function, emotional well-being, and in turn both academic and social outcomes, highlights the importance of targeting adolescent sleep via delayed school start times.

## SLEEP AND ADOLESCENT METABOLIC HEALTH

Although not directly related to educational performance, in addition to inducing adverse psychosocial outcomes as a consequence of sleep deprivation, adolescents' physiologic health is also impacted, specifically through increased obesity and associated metabolic disease risk.

A number of biological mechanisms have been proposed to link sleep duration and obesity.<sup>14</sup> Figure 1 illustrates these obesogenic pathways. Sleep restriction has been linked to decreased serum leptin and increased ghrelin, which are both associated with increased hunger, appetite, desire to eat, and actual food intake.<sup>14-16</sup> It has also been suggested that, short sleep duration may increase obesity risk via eating

patterns that cumulatively increase energy intake.<sup>17-19</sup> It is hypothesized that increased energy intake is not compensated by commiserate energy expenditure with research indicating that decreased physical activity follows sleep deprivation.<sup>20</sup> Adolescents with shorter sleep duration had a 58% higher risk for overweight or obesity, and children with shortest sleep duration had an even higher risk (92%) when compared with children having longer sleep duration. For each hour increase in sleep, the risk of overweight/obesity was reduced on average by 9%.<sup>21</sup> In addition to the cognitive impairments associated with sleep deprivation, obesity has also been linked to cognitive impairments in the areas of executive function and working memory.<sup>22</sup> As both sleep and obesity share overlapping cognitive deficits, and sleep has been associated with increased risk for obesity, improving sleep quantity may help in a 2-fold manner by both reducing weight and ensuring that brain function and structure are protected even in the presence of excess weight.

## AAP POLICY RECOMMENDATIONS

Originally, school schedules were implemented to coincide with school budgets, transportation logistics, parental work schedules, athletic programs, and staff commutes as opposed to adolescent needs.<sup>11</sup> In 2014, the AAP published a policy statement recommending that middle and high schools delay start times to 8:30 AM or later.<sup>2</sup> Following this statement, several school districts in the United States (US) explored to option of delaying school start times to improve physiologic and psychological health of students; however, only a small proportion have actually implemented the recommended later schedules.<sup>11,23</sup> According to the AAP, 85% of high schools in the US start before 8:30 AM with half of these schools starting before 8:00 AM. The median middle school start time is 8 AM, and more than 20% of middle schools starting at 7:45 AM or earlier.<sup>2</sup> As melatonin secretion begins later at night and turns off later in the morning during adolescence, a majority of teens are starting school when they are still under biologically mediated sleep reinforcers.<sup>3</sup> As empirical data emphasizes the benefits of adequate sleep duration and sleep patterns during adolescence, more middle and high schools should

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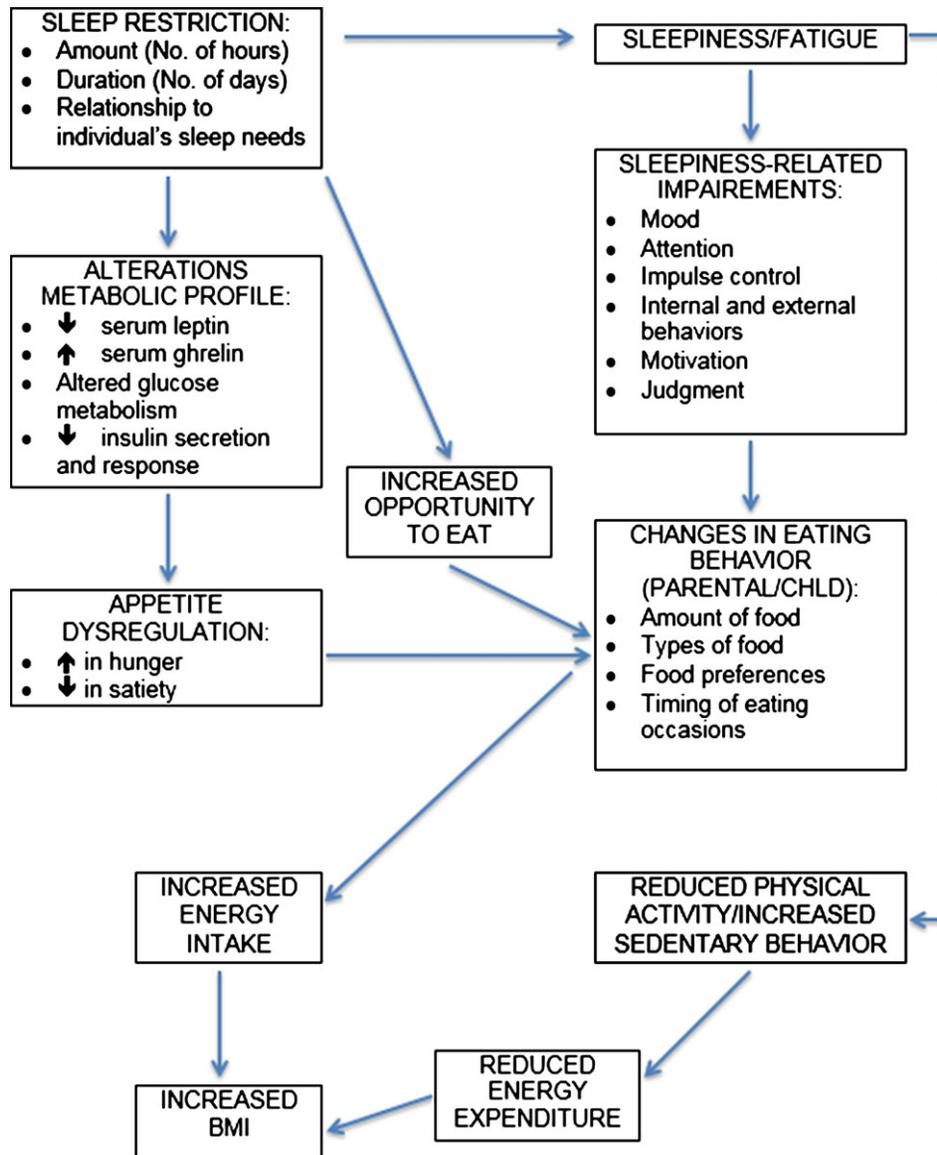
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Figure 1. Potential Mechanistic Pathways That May Increase Risk of Obesity With Sleep Restriction (adapted from Taheri<sup>14</sup>).



adopt later schedules to improve the overall health and well-being of their students.<sup>2,11</sup>

### EXPERIENTIAL EVIDENCE TO DATE

In 2 seminal US studies, adolescents experienced positive outcomes related to sleep, mood, caffeine intake, and healthcare use.<sup>11,24</sup> In the initial study conducted by Owens et al<sup>24</sup> school start time was delayed from 8:00 AM to 8:30 AM in an independent private high school serving adolescents from 9th to 12th grade. After implementing delayed school start times, self-reported mean school night sleep duration increased by 45 minutes, and average bedtime advanced by 18 minutes.<sup>24</sup> The percentage of students

getting less than 7 hours of sleep decreased by 79.4%, and those reporting at least 8 hours of sleep increased from 16.4% to 54.7%. Using a validated measure of sleep quality, students reported significantly more satisfaction with sleep and improved motivation to complete daily tasks. Daytime sleepiness, fatigue, and ability to function throughout the day were all significantly improved (Table 1). Health center visits for fatigue-related complaints, depressed mood, and class attendance also improved suggesting that the impact of a 30-minute shift in school start time may have far-reaching impacts on adolescent well-being beyond those directly related to sleep duration.<sup>24</sup> It is possible that with the later start times and associated increased sleep, students were better prepared to

**Table 1. Percentage of Students Reporting Daytime Sleepiness-Related Behaviors in the Past Week at Surveys 1 and 2 (N = 201; adapted from Owens et al<sup>24</sup>)**

Reported Behavior	% Change From Baseline <sup>†</sup>
Daytime sleepiness (at least more than a little)	-29.1*
Struggled to stay awake, fell asleep, or both during class	-24.6*
At least somewhat bothered by feeling too tired to do homework	-23.8*
Fell asleep during morning class (at least once)	-20.9*
Arrived late (at least once)	-14.1*
Takes naps at least sometimes	-16.1*
Required assistance to wake up in the morning	-7.6*

\*Significantly different at  $\leq .001$ .

<sup>†</sup>Percentage change reflects difference in percentage of students endorsing behavior from preintervention to postintervention.

attend class, pay attention to academic tasks, and perform academically which in turn may have led to improvements in mood and somatic complaints.

In the second study conducted by Boergers et al,<sup>25</sup> school start time at a similarly structured independent high school was delayed from 8:00 to 8:25. Delayed start times resulted in significant increases in sleep duration on school nights by an average of 29 minutes with the percentage of students receiving 8 or more hours of sleep on school nights increasing from 18% to 44%. Significant reductions in daytime sleepiness, depressed mood, and caffeine intake were also reported. Of note, when the 8:00 AM school start time was reinstated, sleep duration reverted to baseline levels.<sup>25</sup> It is notable that gains in sleep time were documented both through an early bedtime and a later wake time, as opposed to just a later wake time.

### INITIATING HEALTH BENEFITS

Changes in weight status and other metabolic parameters have not been experimentally evaluated in regards to delayed school start times. However, the Owens et al,<sup>24</sup> study did include an assessment of the types and numbers of foods consumed during breakfast for adolescents prior to and after the changed schedule. After delaying school start times, school food services reported a significant increase in the amount of hot breakfast foods consumed from December to February (35 vs 83 servings per month). Because both December and February are winter months, the authors suggest that the change in school start times may have been associated with an increase in breakfast consumption for the adolescents. Longitudinal research with outcomes specifically related to obesity and metabolic shifts is needed to assess the impact of delaying school start times on adolescents' dietary habits, weight and metabolic health. However, this requires schools to adopt later start times to demonstrate potential benefits.

The National Sleep Foundation has identified potential barriers to implementing delayed school start times for adolescents including transportation, after school activities, impact on younger students and community programs, reduced time to access public resources, teacher impact, increased family stress, community objection, and student resistance.<sup>2,4</sup> We present specific barriers and possible solutions in Table 2.

### ALABAMA RESPONDS

Two school districts (PC and DC) in Alabama have responded to the US Centers for Disease Control and Prevention and AAP endorsements for delayed school start times for adolescents. Beginning in the 2014-2015 school year, PC public schools delayed start times from 7:45 AM until 9:00 AM for students in grades 8-12 and advanced start times for students in grades 6-7 from 8:30 AM to 7:45 AM. Elementary school students start at 8:00 AM. To ensure a smooth transition to the new schedule, PC identified and addressed barriers ahead of implementation including the need to reroute buses and provide extended childcare coverage for parents and teachers in both the morning and afternoons. Preliminary evaluations based on individual school data indicate that tardiness and late check-ins for high school students have decreased. Additionally, the new schedule did not increase costs to the district. A second district in Alabama (DC) also pushed back middle and high school start times from 7:45 AM until 8:30 AM and advanced elementary school start times from 8:30 AM to 7:45 AM. Initial report from the district superintendent indicated that the new schedule saved the district money on transportation and decreased tardiness. Taken together, the preliminary evidence in conjunction with published studies supports efforts to adopt new policy among other regional and national districts to implement similar schedules.<sup>24,25</sup>

### IMPLICATIONS FOR SCHOOL HEALTH

Given the existing research about the prevalence of adolescent sleep deprivation and the risks it poses to adolescent health and well-being, current recommendations support school start time delays as an important public health measure.<sup>2,4</sup> Advocacy should be aimed at providing evidence-based research to educate school administrators and school boards about the benefits of instituting a delay in school start times as a means of counteracting adolescent sleep restriction.<sup>2</sup> The AAP urges middle and high schools to aim for school start times that are consistent with adolescents' sleep patterns and that would allow students to receive 8.5 to 9.5 hours of sleep a night.<sup>2,4</sup> Vital to the design and implementation

**Table 2. National Sleep Foundation's Barriers and Solutions to Later School Start Times**

Barrier	Solution 1	Solution 2	Concerns
Transportation	Flip school elementary and high school start times	Shift to public transportation for high school routes	Traffic congestion for both students and teachers at later times
Extracurriculars	Reschedule practice and games for later in the day	Install extra lighting for later extracurriculars	Students who have after school jobs or those who have non-school-directed activities
Impact on other students/programs	Advance morning childcare schedules	Assign parents on rotating schedule as neighborhood bus stop supervisors	May require additional planning for special education students and career centers
Reduced time to access public resources	No solutions offered though it is hypothesized that students with better sleep may be more efficient workers and thus this will not be as much of a concern		
Teachers	Alter "planning time" to early morning so that teacher schedules do not change	Implement early morning childcare at schools as needed	Teachers with students whose schedules may no longer match their own
Family stress	Involve families in schedule planning ahead of implementation of new school start times	Implement hotlines, message boards, and meetings to increase communication and problem-solving	Most families schedules are finely tuned and thus a disruption can be overwhelming. Community involvement is key
Uneducated community	Campaign in local community to increase awareness of changes and reasons behind the change	Educate community about negative outcomes related to sleep deprivation, not just for students but for everyone	Lack of knowledge in the community may decrease community buy-in
Student resistance	Educate students about benefits of new start time. Can be done in relevant classes	Include students in early discussions to gain support	Students can be resistant to change even if beneficial

of systemic policy changes supporting delayed school start time is public education, including the students, parents, school personnel, and the general public about chronic sleep deprivation and the associated health outcomes, including depressed mood, deficits in learning, attention and memory problems, poor impulse control, poor academic performance, and an increased risk of obesity, hypertension, and long-term cardiovascular morbidity.<sup>2</sup> While the National Sleep Foundation and the AAP have made these recommendations for policy change, there is a lack of implementation. States and local school districts should evaluate current school schedules, community needs, resources and financial concerns, in order to develop an implementation plan to align local schools with recommended practices. As Table 2 shows, this implementation should be a joint effort between local school districts and key community stakeholders whereby the involved parties identify, discuss, and find solutions to barriers that may impede the implementation of delayed school start times for middle and high schools. Whereas general solutions and implementation strategies may be offered as in Table 2, individual district implementation plans will vary as a function of the communities they serve. To facilitate widespread adoption of delayed school start times, implementation plans should be documented and disseminated in school association and education-focused forums so that strategies can be shared with other school districts and/or policymakers on a national scale.

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