



## A BRIEF LOOK AT EARLY SCHOOL START TIMES

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**WAKE COUNTY**  
PUBLIC SCHOOL SYSTEM

DATA, RESEARCH & ACCOUNTABILITY



## SUMMARY

This literature review is intended to provide an overview of the current research literature on the effects of early secondary school start times on student outcomes and to help inform decisions regarding options for future Wake County Public School System (WCPSS) start times. Even though research shows that getting sufficient sleep is critical for all students, sleep deprivation is prevalent among American adolescents. Early school start times are one of the primary hurdles secondary students face to getting enough sleep. As states and districts across the country deliberate adjusting school start times, current research suggests that pushing back secondary school start times (i.e., starting later) is an effective counter measure to combat sleep deprivation and to positively impact students' sleep patterns, physical and mental health, safety, and academic outcomes.



## LITERATURE REVIEW

### SLEEP AND SCHOOL START TIME RECOMMENDATIONS

Even though research shows that sufficient sleep is critical for all students, sleep deprivation is prevalent among American adolescents (AAP, 2014; Boergers, 2015; Guglielmo et al., 2018; Heissel & Norris, 2018). Research suggests that adolescents require at least 8 to 10 hours of sleep a night (AAP, 2014; Bowers & Moyer, 2017; Guglielmo et al., 2018; Hirshkowitz et al., 2015; Minges & Redeker, 2016); however, national data show that approximately 60% of middle school students and 87% of high school students do not meet these sleep requirements (Bastian & Fuller, 2018; National Sleep Foundation, 2006). The American Academy of Pediatrics (AAP) identifies adolescents' insufficient sleep as an important public health issue that significantly impacts the health, safety, and academic performance of middle and high school students (AAP, 2014).

Early school start times are one of the primary hurdles secondary students face to getting enough sleep. In 2014, the AAP issued a policy statement recommending that adolescents sleep until at least 8:00 a.m. and that middle and high schools start no earlier than 8:30 a.m. (AAP, 2014). This recommendation, however, runs counter to the reality for secondary schools in the U.S. such that <21% of middle schools and <18% of high schools start at 8:30 a.m. or later (Meltzer et al., 2021; NCES, 2018; Wheaton et al., 2015). To arrive at school on time, the average high school student needs to wake up by 6:30 a.m., and to gain the recommended amount of sleep, they would need to be in bed by 9:00 p.m. (Boergers, 2015). This bedtime is unrealistic, and nearly impossible, given their biological sleep rhythms.

## BIOLOGICAL UNDERPINNINGS

One of the primary reasons for adolescents' insufficient sleep is biological changes in their circadian sleep rhythms (AAP, 2014; Carrell et al., 2011; Dewald et al., 2010; Edwards, 2012; Figlio, 2017; Foley, 2021; Heissel & Norris, 2018). Around the onset of puberty, most adolescents experience "phase delay"—later sleep onset and wake times which shift their bodies' internal clocks back by up to two hours (AAP, 2014; Boergers, 2015; Bowers & Moyer, 2017; Carskadon, 2011; Foley, 2021; Minges & Redeker, 2016). Compared to when they were younger or to when they become adults, adolescents' nocturnal melatonin production (which aids in falling asleep) is delayed by several hours (AAP, 2014; Bastian & Fuller, 2018; Carskadon, 2011; Edwards, 2012; Figlio, 2017). This natural shift in circadian rhythms makes it more difficult to fall asleep before 11:00 p.m. and wake up before 8:00 a.m. (AAP, 2014; Bastian & Fuller, 2018; Bowers & Moyer, 2017; Carrell et al., 2011; Foley, 2021; Wheaton et al., 2016). In other words, adolescents are biologically programmed to fall asleep later in the evening (Boergers, 2015). Even though they fall asleep later in the evening, they still require 8 to 10 hours of sleep every night. These hormonal changes therefore make it difficult for them to compensate for early school start times by going to bed earlier (Bowers & Moyer, 2017; Edwards, 2012).

The shift in adolescents' circadian rhythms may also interact with other lifestyle and academic factors that reinforce later bedtimes. For example, modern technology such as cell phones, tablets, social media, and video games make it easier and more appealing to stay up late (AAP, 2014; Boergers, 2015; Carskadon, 2011; Wheaton et al., 2015, 2016). Additionally, extracurricular

activities, after-school jobs, and homework may also contribute to adolescents' tendency to stay up late (AAP, 2014; Boergers, 2015; Minges & Redeker, 2016; Wheaton et al., 2016). Given these biological and sociocultural factors, most adolescents stay up late on weeknights and sleep in on weekends to catch up on their sleep. This sleep schedule has been shown to worsen circadian disruption and morning sleepiness at school (AAP, 2014). To support adolescents getting the optimal amount of sleep each night, it is important that they learn about the importance of sleep for their health and academic success. Parents are also encouraged to set regular bedtimes for their adolescents and limit evening electronic usage (Boergers, 2015).

## EFFECTS ON STUDENT OUTCOMES

### Insufficient Sleep

Due to biological and sociocultural factors contributing to adolescents' delayed sleep patterns, research has shown that the average American adolescent is chronically sleep deprived (AAP, 2014; Guglielmo et al., 2018; Meltzer et al., 2021; Wheaton et al., 2016). For example, in a National Sleep Foundation poll, 28% of middle and high school students reported falling asleep in school at least once a week (National Sleep Foundation, 2006). Insufficient sleep is associated with a wide range of negative outcomes for adolescents including impairments on mood, affect regulation, executive function, and behavior (AAP, 2014; Boergers, 2015; Bowers & Moyer, 2017; Carskadon, 2011; Edwards, 2012; Guglielmo et al., 2018; Minges & Redeker, 2016; Wheaton et al., 2015, 2016). Adolescents who do not get sufficient sleep are also more irritable and are at greater risk



for depression and anxiety than their peers (Boergers, 2015; Bowers & Moyer, 2017).

Insufficient sleep is also associated with cognitive problems that can influence academic performance such as alertness, attention, learning, memory, motivation, and decision-making (Dewald et al., 2010). To learn during the school day, students need to be mentally alert (Bowers & Moyer, 2017). Research has shown that adolescents who are chronically sleep deprived perform more poorly in their morning classes and in overall performance, have higher rates of absenteeism and tardiness, and have a decreased ability to learn and retain new material, actively participate in class, and perform decision-making tasks (Bowers & Moyer, 2017; Minges & Redeker, 2016). In their meta-analysis, Dewald and colleagues (2010) found that elementary and secondary students with higher sleep quality, longer sleep duration, and lower sleepiness performed better in school (i.e., increased standardized test scores and higher GPA). Even students who perform well in school are affected by partial sleep deprivation, and some of these cognitive deficits do not completely abate even after students get two full nights of sleep (Lo et al., 2016). Furthermore, experimental studies in which adolescents were randomly assigned to sleep either a sufficient or insufficient number of hours showed that insufficient sleep undermines memory for classroom material (Cousins et al., 2019).

### School Start Times

Given the association between sleep and student outcomes, momentum is building behind later start times for secondary schools. As states and districts across the country deliberate over adjusting school start times, current research suggests that

pushing back secondary school start times is an effective counter measure to combat sleep deprivation and to positively impact students' sleep patterns (e.g., increased duration and sleep quality), physical and mental health (e.g., lower rates of depressive symptoms), safety (e.g., lower rates of car crashes), and academic outcomes (e.g., lower dropout rates, fewer absences and tardies, higher concentration in class, and higher grades in core academic subjects and standardized test scores; AAP, 2014; Bastian & Fuller, 2018; Boergers, 2015; Meltzer et al., 2021; Minges & Redeker, 2016; Wahlstrom et al., 2014; Wheaton et al., 2016).

In terms of positive impacts on students' sleep patterns and physical and mental health, students attending high schools with later start times report getting more sleep and feeling more rested than their peers attending schools with earlier start times (Bastian & Fuller, 2018; Wahlstrom et al., 2014). In their meta-analysis, Bowers and Moyer (2017) examined the effects of elementary and secondary school start time on students' sleep patterns. Results indicated that later school start times (15- to 130-minute delay) were associated with more sleep, less daytime sleepiness, and less tardiness. Similarly, Boergers and colleagues (2014) found that when delaying an independent boarding school's start time from 8:00 a.m. to 8:25 a.m., even this 25-minute delay was associated with a decrease in students' depressive moods, caffeine use, daytime napping, class tardiness, and falling asleep in class.

Given that early school start times make it difficult for secondary students to get a sufficient amount of weeknight sleep, students may be less engaged with and successful in school (Bastian & Fuller, 2018).



The growing literature demonstrates a positive impact on students' school engagement and performance when secondary school start times are delayed. In a case study using data from WCPSS, Edwards (2012) used data from 1999 to 2006 to investigate the effects of delaying middle school start times by one hour. Results suggested that the delay increased students' standardized test scores in math by two percentile points and in reading by one and a half percentile points. Additionally, these students had fewer absences, watched less television, and spent more time on homework each week. In another study using data from WCPSS, Lenard and colleagues (2020) used a quasi-natural experimental design to examine the effects of moving five high schools' start times earlier by 40 minutes (8:05 a.m. to 7:25 a.m.). While there was no impact on students' ACT test scores, there was an increase in students' absenteeism, tardiness, and dropout rates. In a different study, Air Force Academy freshmen randomly assigned to early-morning classes (starting before 8:00 a.m.) performed significantly lower on standardized course examinations than did their peers assigned to classes starting later in the day (Carrell et al., 2011). In a research review, Wheaton and colleagues (2016) found that during the school week, students at schools with later start times got up later in the morning and had longer sleep duration than those at earlier-starting schools. This increase in sleep duration was shown even with relatively short delays in start times (e.g., 30 minutes). Students with later start times also reported less daytime sleepiness and falling asleep in class, had less frequent tardiness and absences, and showed an increase in academic performance. However, in contrast to studies finding a positive association between delayed school

start times and students' academic performance, a case study from Minneapolis which delayed high school start times by an hour and a half (7:15 a.m. to 8:40 a.m.) showed no impact on ACT scores or student attendance (Hinrichs, 2011).

One concern for delaying secondary school start times in an effort to increase students' weeknight sleep duration is that students will simply stay awake even later. In their systematic research review, Minges and Redeker (2016) reported that for middle and high schools that delayed their start times by 25 to 60 minutes, students gained an additional 25 to 77 minutes of sleep per weeknight and showed significant improvement in daytime sleepiness. To gain this additional sleep, students were delaying their wake-up times and not their bedtimes. This provides evidence countering the concern that students would not use the opportunity of delayed school start to gain more sleep on school nights. Moreover, even though the reviewed studies showed no significant difference in self-reported grades, they did reveal significant declines in tardiness, falling asleep during class, arriving late to class because of oversleeping, and being too tired to do homework (Minges & Redeker, 2016).

To accommodate later secondary school start times, one option school districts have taken is to shift elementary schools to an earlier start time schedule. Therefore, a second concern for delaying secondary school start times is potential negative effects on elementary-aged students as a result of their schools' earlier start times. To ensure that they followed AAP's recommendation of starting secondary schools at or after 8:30 a.m., a diverse, suburban school district staggered their



school bus schedule so that elementary schools started an hour earlier (8:00 a.m.), middle schools delayed their start times by 40 to 60 minutes (8:50 a.m.), and high schools delayed their start times by 70 minutes (8:20 a.m.; Meltzer et al., 2021). Results revealed no significant differences in elementary school students' sleep duration, sleep quality, or daytime sleepiness. Middle school students slept an additional 29 minutes per weeknight and high school students gained about 45 more minutes of sleep per weeknight. This study demonstrates that delaying secondary school start times can effectively reduce adolescents' sleep deprivation with no significant negative effects of earlier elementary school start times.

### Equity Considerations

Emerging sleep research suggests that economically disadvantaged and racial/ethnic minority adolescents may be particularly vulnerable to the effects of insufficient sleep (Bastian & Fuller, 2018; El-Sheikh et al., 2010; Guglielmo et al., 2018; Meltzer et al., 2021). For example, in their review of studies that investigated racial/ethnic differences in sleep outcomes, Guglielmo and colleagues (2018) found that compared to White adolescents, racial/ethnic minority adolescents had shorter sleep duration and lower sleep quality.

In terms of studies that have explored the impact of school start times on student outcomes, few have focused attention on whether later school start times are especially beneficial for these student subgroups. To address this research gap, Bastian and Fuller (2018) used data from 410 public high schools across all school districts in North Carolina to address the following research questions: 1) Do later high school

start times predict students' engagement with school and their achievement in school? 2) Do later high school start times have larger impacts on the engagement and achievement outcomes of disadvantaged student subgroups? Results revealed that for all students, there was no association between school start times and student absences, average course grades, or test scores. Students attending high schools with later start times (i.e., 8:30 a.m. or later), however, had slightly higher grades in their first period classes and were less likely to be suspended. Results also showed that economically disadvantaged and racial/ethnic minority students attending high schools with later start times were less likely to be suspended, have higher course grades (overall and in first period classes), and higher Algebra 1 scores than students attending schools with earlier start times. In comparison, economically advantaged students attending schools with later start times were less likely to be suspended but were more likely to have increased absences. The GPAs of White students attending schools with later start times were also slightly lower.

Most recently, Meltzer and colleagues (2021) examined whether the impact of shifting elementary school start times 60 minutes earlier (8:00 a.m.), middle school start times 40 to 60 minutes later (8:50 a.m.), and high school start times 70 minutes later (8:20 a.m.) was consistent across different racial/ethnic and economic groups of students. Results revealed that the benefits of later start times (e.g., sleep duration, sleep quality, and daytime sleepiness) were similar across student subgroups. Similarly, in a large-scale population study of students ages 8 to 15, Heissel and Norris (2018) used the variation in sunrise times caused by Florida's time



zone boundary to explore the effect of sunlight exposure before school on academic achievement. Results showed that later start times relative to sunrise increased standardized math and reading scores. However, no significant differences were found based on race/ethnicity and socioeconomic status which suggests that delaying school start times affects all students similarly. Altogether, results from these studies indicate that future research should continue to explore potential sleep disparities and the mechanisms by which economically disadvantaged and racial/ethnic minority students may or may not be differentially impacted by a change in school start times.

## CONSIDERATIONS FOR CHANGING SCHOOL START TIMES

Even though mounting research supports that later school start times are beneficial to secondary school students, many school districts continue to debate whether they should make this organizational change. Along with the benefits of delaying secondary school start times come several challenges for careful consideration. First, a common concern is that with a delayed dismissal, secondary students may not have enough time to engage in all their after-school extracurricular activities (e.g., sports, clubs, and employment; AAP, 2014; Boergers, 2015; Figlio, 2017; Foley, 2021; Minges & Redeker, 2016; Wheaton et al., 2015, 2016). As a result, time devoted to participating in these activities may be cut short. Relatedly, scheduling conflicts may arise for athletic and academic competitions among schools with contrasting dismissal times. Moreover, a safety concern arises: With delayed school start times, students

participating in after-school activities may arrive home after dark. Second, there are transportation logistical issues and expenses associated with changing bus schedules and altering bus routes. Later start times could also mean more busses on the road later in the morning thereby potentially creating more traffic and increasing travel delays (Boergers, 2015; Foley, 2021; Minges & Redeker, 2016; Wheaton et al., 2015, 2016). Third, starting elementary schools earlier could have implications for parents' employment schedules and after-school childcare arrangements (AAP, 2014; Boergers, 2015; Figlio, 2017; Foley, 2021; Minges & Redeker, 2016). Some families rely on their older children to care for their younger siblings after school which would prove to be more difficult should secondary schools swap start times with elementary schools. Finally, depending on transportation arrangements, parents may be uncomfortable with their elementary school-aged children (as opposed to their adolescents) traveling to school in the morning in the dark which is also a safety concern (AAP, 2014; Figlio, 2017).

While these concerns are valid, they are also considered to be resolvable with flexibility and thoughtful planning. Advocates for delayed start times have proposed several potential solutions which include enlisting the help of community volunteers to provide supervision at bus stops, having older students take public transportation, adjusting class schedules to minimize late dismissal times, scheduling free periods/study halls at the end of the school day to allow participation in after-school extracurricular activities, exempting student athletes from physical education requirements, and installing lights on athletic





fields (AAP, 2014; Minges & Redeker, 2016). It is also noted that involving and gaining the support of key stakeholders (e.g., students, parents, teachers, coaches, school administrators, transportation directors, and school boards) is crucial to ensuring a successful transition to delaying secondary school start times. Districts debating whether to delay secondary school start times should consider collecting baseline data (e.g., student sleep characteristics, tardiness due to oversleeping, and falling asleep during class) to help inform the decision-making process as well as to inform key stakeholders of the extent of students' insufficient sleep and its impact.



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Meghan Scrimgeour, Ph.D.

Data, Research, and Accountability Department  
Wake County Public School System  
Cary, North Carolina