

# Impact of School Start Time on Student Learning

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In the following report, Hanover Research presents an assessment of the literature regarding the most effective school start times for elementary, middle, and high school students. We review the actions of school start time change committees and pilot studies to provide profiles of schools that have implemented new start times.

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## EXECUTIVE SUMMARY AND KEY FINDINGS

### INTRODUCTION

Increasingly busy schedules over the past few decades have led to lifestyles in which America's youth get about an hour less sleep each night today than they did in 1980.<sup>1</sup> Extracurricular activities, heavy homework burdens, television and cell phone use, and a lack of family-instituted bedtimes have all contributed to a world where sleep schedules take a back burner after a child reaches school age. *New York Magazine* reports that "even kindergartners" sleep less than they used to, averaging a comparative deficit of a half hour each night.<sup>2</sup>

Despite the inclination to think students simply need to make sleep a bigger priority and go to bed earlier, research shows adolescents to have a delayed sleep-wake cycle due to endocrine rhythms that makes them naturally want to stay up later than younger children do.<sup>3</sup> Unfortunately for adolescents, middle and high schools often have the earliest start times within a district. Although pre-pubescent children are better suited to learn early in the morning than adolescents, there are other practical reasons for later elementary school start times such as concerns for the safety of young children walking to school or waiting for a bus.

In this report, Hanover explores literature concerning the academic impact of school start time among elementary, middle, and high school students. We particularly focus on the middle school and high school levels, as the main benefits and challenges of shifting start times appear to relate specifically to older age groups rather than elementary school students. The current body of research suggests that later start times for middle and high school students can improve academic performance as well as out-of-school behavior. This report presents the background and benefits of ideal school start times, obstacles for implementing new school start times, and guidelines and models for implementing changes.

### KEY FINDINGS

Based on the findings of this report, school districts could **increase student safety and boost adolescent academic success** by instituting later start times for middle and high school students. This could be done by one of two methods. The first method would be to simply **switch the time at which middle school students are picked up** by buses with the time **elementary school students** are picked up, from 6:00 a.m. to 6:30 a.m., updating school start times accordingly. However, as noted above, concern over transportation safety is one of the main reasons elementary schools have the latest start times, and since student safety

<sup>1</sup> Bronson, P. "Snooze or Lose." *New York Magazine*. October 7, 2007. <http://nymag.com/news/features/38951>

<sup>2</sup> Ibid.

<sup>3</sup> Hagenauer, M. H., Perryman, J. I., Lee, T. M., and Carskadon, M. A. "Adolescent Changes in the Homeostatic and Circadian Regulation of Sleep." *Developmental Neuroscience*, 31.4, pp. 276-284. 2009. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2820578/>

is the primary reason our partner has considered adjusting its transportation schedule, this option does not merit further consideration.

The second method would be to **shift all** bus pick-up and school **start times back**, even by the small increment of a **half an hour**. The impact on elementary school students' learning is not likely to be noticeable, while adolescent students may be more focused in their initial classes and may indeed benefit throughout the day if they are able to increase sleep time. However, financial impacts and community input should be considered before such changes are implemented.

The key findings of this report are discussed below:

- While research on start times for young students is sparse, it has shown **elementary school students do not benefit from a later start time**. Some experts suggest academic achievement of elementary school students would not be adversely impacted by an earlier start time, as young students are alert earlier in the day than adolescent students and start school at a later time than secondary students.
- Research has focused on **individual chronotype** dictating the times people learn best, as well as **biological changes experienced during adolescence**. As chronotypes are individual and therefore highly variable, research on biological changes are more widely and easily applied to the examination of ideal school start times for student achievement.
- While long seen as a cultural and psychosocial preference, later bedtimes among adolescents are now understood to be a biological response to puberty, the onset of which **results in a two-hour sleep-wake phase delay** without lessening total sleep requirements. Therefore, adolescents have a biological need to be able to sleep later in the morning.
- Studies have cited benefits ranging from **mood** and **alertness** to **fewer automobile accidents** and **less engagement in high-risk behavior** among middle and high school students who get more sleep.
- Researchers have shown that **even a modest delay in school start time** (30 minutes) produces improvements in measures of student mood, alertness, and health in adolescent students.
- Many middle and high schools hesitate to implement a later start time because of **obstacles such as financial constraints, after-school athletic activities, family schedules, and stakeholder opposition**.

- Because the costs and logistical challenges of implementing a later start time vary widely from district to district, experts recommend the following measures before deciding on whether and how to make a change:
  - **Survey students** to assess tiredness levels and interest in a later start time as well as **stakeholders** to gauge interest and support for the proposed change;
  - **Organize a task force or committee** dedicated to advocating for the shift and exploring the issue, its challenges, and potential benefits; and
  - **Conduct a pilot study** within a smaller group of students in order to experience real-time results without implementing the change at full scale.
  
- Even when schools and districts use various planning methods to more efficiently implement a later start time, our research reveals that not all committees formed to explore the benefits of a later start time decide to move forward with the shift.
  
- **One school cited in our report shortened the length of the school day by 30 minutes to avoid logistical issues** with afterschool commitments, childcare of younger siblings, and teachers' schedules. This indicates that **flexibility with scheduling** may be crucial for successfully bringing about change.

## SECTION I: BACKGROUND AND POTENTIAL BENEFITS

This section discusses strands of research related to elementary and secondary school start times. While the impact of shifting school start time on elementary school is discussed, middle and high school students are the main focus of the literature on the topic.

### TIME OF DAY

Some research on ideal times for student learning examines the time of day at which students report being most alert and receptive to new information. These time-of-day studies often categorize people as **morning-types** or **evening-types**, based on the **time of day they feel most alert and productive**.<sup>4</sup> Janet Kinoshian, writing about morning- and evening-type persons, notes that “Stanford University sleep expert Emmanuel Mignot theorizes that a mutation on chromosome 4—the clock gene—plays a big role in your preference for morning or evening life.”<sup>5</sup>

While there are some trends linking age and the time of day preferred, **age groups are mostly a mix of types, making it hard to match learning to a beneficial time of day for all**.<sup>6,7,8</sup> Studies that examined the sleeping preferences of students, taking into account if they were morning versus evening types, “suggest that self-reported eveningness, delayed sleep schedules, and early school start times seem to be associated with daytime sleepiness, dozing in class, attention difficulties, and poorer academic performance.”<sup>9</sup> Therefore, sleep and reported sleep preferences do seem to have an effect on students’ school achievement. However, it would be difficult to create different school schedules around students’ reported time preferences, such as Roger Callan’s hypothetical school system in which students choose among classes that start in the morning, late morning, or evening.<sup>10</sup>

Despite the overall decrease in sleep times among children and teens over the past few decades, studies show that not only do adolescents function optimally after approximately nine hours of sleep each night, but also that **delaying the time at which adolescents must**

<sup>4</sup> “Morning People and Night Owls Show Different Brain Function.” *ScienceDaily*. June 24, 2009.  
<http://www.sciencedaily.com/releases/2009/06/090623150621.htm>

<sup>5</sup> Kinoshian, J. “Are You a Lark or an Owl?” *Huffington Post*. February 11, 2010.  
[http://www.huffingtonpost.com/janet-kinoshian/larks-vs-owls-who-is-the\\_b\\_457811.html](http://www.huffingtonpost.com/janet-kinoshian/larks-vs-owls-who-is-the_b_457811.html)

<sup>6</sup> *Ibid.*

<sup>7</sup> Tenedero, H. S. “Children’s Time-of-day Preferences.” Manila Bulletin Publishing Corporation. Dec. 16, 2009.  
[http://www.mb.com.ph/articles/234269/children-s-timeofday-preferences#.UNxZyW\\_BF1F](http://www.mb.com.ph/articles/234269/children-s-timeofday-preferences#.UNxZyW_BF1F)

<sup>8</sup> Callan, R. J. “Giving Students the (Right) Time of Day.” *Educational Leadership*, 55.4: pp. 84-87. 1998.  
[http://www.ascd.org/publications/educational-leadership/dec97/vol55/num04/Giving-Students-the-\(Right\)-Time-of-Day.aspx](http://www.ascd.org/publications/educational-leadership/dec97/vol55/num04/Giving-Students-the-(Right)-Time-of-Day.aspx)

<sup>9</sup> Wolfson, A. R. and Carskadon, M. A. “Understanding Adolescents’ Sleep Patterns and School Performance: A Critical Appraisal.” *Sleep Medicine Reviews*, 7.6, 491-506. 2003: p. 499.  
<http://web.mit.edu/writing/2010/July/Wolfson&Carskadon2003.pdf>

<sup>10</sup> Callan, R. J. “Giving Students...Day.” *Educational Leadership*. Op. cit.

**wake up (and subsequently attend class) yields significant returns in alertness, mood, and physical health.**<sup>11</sup> The preference for a later bedtime among teens has long been considered a cultural and psychosocial change, rather than one which is due to “specific biological processes.”<sup>12</sup>

According to a July 2010 report in the *Archives of Pediatrics and Adolescent Medicine*, the **onset of puberty results in “adolescents [developing] as much as a two-hour sleep-wake phase delay (later sleep onset and wake times) relative to sleep-wake cycles in middle childhood** (emphasis added).<sup>13</sup> This delayed sleep cycle appears to be due to endocrine rhythms, which are even observed in adolescents receiving sufficient sleep. These changes in sleep cycles have been observed “in over 16 countries on 6 continents, in cultures ranging from pre-industrial to modern...confirm[ing] that the timing of sleep is delayed during adolescence.”<sup>14</sup>

Dr. Richard Schwab at the University of Pennsylvania states that the resulting “ideal” bedtime for teens of midnight or 1:00am makes waking up in time for school a significant challenge, and one that trades logistical convenience for student achievement.<sup>15</sup> He posits that the **status quo must be “reversed” in order to achieve optimal results for students** of all levels, from elementary school through secondary (emphasis added):<sup>16</sup>

Right now, high schools usually start earlier in the morning than elementary schools. But if school start times were based on sleep cycles, **elementary schools should start at 7:30 and high schools at 8:30 or 8:45**—right now it’s the reverse. School systems should be thinking about changing their start times. It would not be easy...but it would increase their students’ sleep time and likely improve their school performance.

In a meta-synthesis of studies examining children’s sleep patterns and school performance, Amy R. Wolfson and Mary A. Carskadon analyze studies that use academic measures of school performance, such as grades, rather than performance on study questionnaires. Wolfson and Carskadon’s review shows that, overall, students in middle and high-school who got more sleep reported better school achievement and fewer behavioral problems at school.<sup>17</sup>

<sup>11</sup> “Delayed School Start Time Associated With Improvements in Adolescent Behaviors.” *ScienceDaily*. July 8, 2010. <http://www.sciencedaily.com/releases/2010/07/100705190532.htm>

<sup>12</sup> Kirby, M., Maggi, S., and D’Angiulli, A. “School Start Times and the Sleep-Wake Cycle of Adolescents: A Review and Critical Evaluation of Available Evidence.” *Educational Researcher*, 40.2, pp. 56-61. 2011: p. 56. <http://isites.harvard.edu/fs/docs/icb.topic951144.files/schoolStartTimesAndSleepWakeCycleOfAdolescents-kirby2011.pdf>

<sup>13</sup> *ScienceDaily*. “Delayed School...Behaviors.” Op cit.

<sup>14</sup> Hagenauer, M. H., et al. “Adolescent Changes...of Sleep.” Op. cit.

<sup>15</sup> “Start School Later in the Morning, Say Sleepy Teens.” *American Thoracic Society*. May 20, 2007. <http://www-archive.thoracic.org/sections/publications/press-releases/conference/articles/2007/press-releases/start-school-later-in-the-morning,-say-sleepy-teens.html>

<sup>16</sup> *Ibid*.

<sup>17</sup> Wolfson, A. R. and Carskadon, M. A. “Understanding Adolescents’ Sleep...A Critical Appraisal.” *Sleep Medicine Reviews*. Op cit., p. 493.

A meta-analysis by Julia Dewald, et al., supports the conclusions of the aforementioned meta-synthesis and makes associations with key variables of age and gender. The meta-synthesis finds that sleep quality, duration, and sleepiness are “significantly but modestly related to school performance.”<sup>18</sup> Of the three sleep variables, “sleepiness showed the strongest relation to school performance” with students that report less sleepiness performing better in school.<sup>19</sup> Sleep quality showed the second strongest association and sleep duration the third strongest, with better sleep quality and more sleep both resulting in better school achievement.<sup>20</sup>

Notably, Dewald’s meta-analysis finds that the effects of these sleep variables have a stronger effect on cognitive functioning and school performance in younger adolescents than older adolescents. It may be that adolescents are most affected by sleep when they first start puberty. However, it is also worth noting that males develop later than females, so early adolescence is likely to continue through later grades among male students.<sup>21</sup>

### WIDE-RANGING BENEFITS

Taking a closer look at the impact of school start times on different age groups, we discuss research specific to secondary and elementary school students below. Research on the impact of sleep has been correlated to student achievement, safety, and behavior.

#### *HIGH SCHOOL*

Researchers have found **even a modest shift in school start time benefits the academic achievement, truancy rate, and behavior of older adolescent students.** In a study of high school students, Owens et al. found a delay of 30 minutes “was associated with a significant increase in self-reported sleep duration and a decrease in a number of ratings of daytime sleepiness.”<sup>22</sup> Students were also less likely to report depression, and had more motivation to participate in extracurricular activities.<sup>23</sup>

In “A’s from Zzzz’s? The Causal Effect of School Start Time on the Academic Achievement of Adolescents” researchers found **“the later first period begins, the higher the distribution of student grades.”**<sup>24</sup> Compared to adolescents with a start time of 7 a.m.,<sup>25</sup> students starting

<sup>18</sup> Dewald, J. F., Meijer, A. M., Ooart, F. J., Kerkhof, G. A., and Bögels, S. M. “The Influence of Sleep Quality, Sleep Duration and Sleepiness on School Performance in Children and Adolescents: A Meta-Analytic Review.” *Sleep Medicine Reviews*, 14, 179-189. 2010: p. 179.  
[http://www.bat.uoi.gr/files/animal\\_physiology/2011\\_list\\_projects/18.pdf](http://www.bat.uoi.gr/files/animal_physiology/2011_list_projects/18.pdf)

<sup>19</sup> *Ibid.*, pp. 179 & 183.

<sup>20</sup> *Ibid.*, p. 182.

<sup>21</sup> *Ibid.*, p. 187.

<sup>22</sup> Owens, J. A., Belon, K., and Moss, P. “Impact of Delaying School Start Time on Adolescent Sleep, Mood, and Behavior.” *Archives of Pediatric & Adolescent Medicine*, 164.7: pp. 608-614. 2010. p. 612.  
<http://archpedi.jamanetwork.com/article.aspx?articleid=383436>

<sup>23</sup> *Ibid.*

<sup>24</sup> Carrell, S. E., Teny, M., and West, J. E. “A’s from Zzzz’s? The Causal Effect of School Start Time on the Academic Achievement of Adolescents.” *American Economic Journal: Economic Policy*. 3:62-81. 2011. p. 74.  
[https://bearspace.baylor.edu/J\\_West/www/CarrellMaghakianWest.pdf](https://bearspace.baylor.edu/J_West/www/CarrellMaghakianWest.pdf)

<sup>25</sup> *Ibid.*, p. 67.



**50 minutes later** in the day showed “a significant positive effect on student achievement, which is roughly equivalent to raising teacher quality by one standard deviation.”<sup>26</sup>

Not only do studies show that students benefit academically from later start times, but some report that **teachers also prefer later start times for high school students**. In a test on the effects of a delayed start time, high schools in Minneapolis changed start times from 7:15 a.m. to 8:40 a.m. for a 4-year period.<sup>27</sup> After these changes were instituted, the majority of teachers supported a later start time, with 31.7 percent preferring class start at 8 a.m. and 22.8 percent preferring 8:30 a.m.<sup>28</sup> Additionally, 92% of *suburban* parents of high school students affected by the delayed start time supported later start times, while *urban* parents had more complaints about the delayed start.<sup>29</sup> Principals and other school administrators noted that **students were less likely to skip their first period classes**, and the **mood of students was improved overall**. Students, especially in grade 9, showed improved attendance rates, and all students in participating schools average an hour more of sleep per night in comparison to their peers, a distinction that held constant through the 4 years in which the study was conducted.<sup>30</sup> This would indicate that students are actually using the later start time for sleep, as opposed to using it simply to stay up later.

### *MIDDLE SCHOOL*

In a study of the effects of a later school start time, authors of an article in *Behavioral Sleep Medicine* focused on seventh- and eighth-grade students that started school at early and late times (7:15 a.m. and 8:37 a.m., respectively).<sup>31</sup> Researchers found that “**students at the earlier starting school were tardy four times more frequently, and eighth graders at the earlier starting school obtained significantly worse average grades** than the eighth graders (emphasis added)” that started school later.<sup>32</sup> Students who started later were able to sleep, on a nightly average, an hour more than their counterparts with early starts. This additional sleep helped the middle school students to avoid “irregular weekly sleep patterns, increased daytime sleepiness, and more sleep-wake behavior problems.”<sup>33</sup>

A recent article in the *Economics of Education Review* provides an additional source of findings of the positive academic effects of later school start times for middle school students. This study, focusing on middle school students in Wake County, North Carolina,

<sup>26</sup> Ibid., p. 62.

<sup>27</sup> Walstrom, Kyla. “Changing Times: Findings From the First Longitudinal Study of Later High School Start Times.” *NASSP Bulletin*, 86.833: 3-21. p. 3.  
<http://conservancy.umn.edu/bitstream/139295/1/2002%20NASSP%20Bulletin%2c%20Vol.%2086%20No.%20633.pdf>

<sup>28</sup> Ibid., p. 17.

<sup>29</sup> Ibid.

<sup>30</sup> Ibid., p. 18.

<sup>31</sup> Wolfson, A. R., Spaulding, N. L., Dandrow, C., and Baroni, E. M. “Middle School Start Times: The Importance of a Good Night’s Sleep for Young Adolescents.” *Behavioral Sleep Medicine*, 5.3, pp. 197-209. 2007. p. 197.  
<http://www.tandfonline.com/doi/abs/10.1080/15402000701263809>

<sup>32</sup> Ibid., p. 204.

<sup>33</sup> Ibid.

revealed that students who have later school start times score at a higher percentile on math and reading tests than do students who have earlier school start times.<sup>34</sup>

Finally, the *Journal of Clinical Sleep Medicine* published a study in 2011 that tested the effects of delaying school start times by one hour on the attention levels of adolescents. Results demonstrated that “in the first week, the experimental group slept an average of 55 minutes longer each night, for five nights.”<sup>35</sup> These same students **performed better when tested for attention** by the “Mathematics Continuous Performance Test” and the “d2 Test of Attention.”<sup>36</sup> The study concluded with a strong recommendation that “middle schools should consider delaying the school starting time by at least one hour.”<sup>37</sup>

### ELEMENTARY SCHOOL

Research on the benefits and challenges of shifting start times appears to **focus specifically on older students instead of elementary school students**. Most research that does focus on elementary school students addresses the amount of sleep younger students get rather than specific times correlated to an ideal sleep-wake cycle. Research shows that even a 30 minute increase in sleep for pre-adolescent students results in “significant improvement in their ability to regulate their emotions, including limiting restless-impulsive behavior in school.”<sup>38</sup> Such an increase was also noted to promote “a significant reduction in reported daytime sleepiness.”<sup>39</sup> Younger students who get less sleep overall or a poorer quality of sleep struggle to learn in school and perform on tests.<sup>40,41</sup> The National Sleep Foundation recommends 11 to 13 hours of sleep for preschoolers (ages 3-5) and 10 to 11 hours of sleep for school-aged children (ages 5-10).<sup>42</sup>

The same study that looked at middle school start times in Wake County, North Carolina, also investigated elementary school start times, noting that **a later school start time had no effect on elementary student test scores**. While these results could suggest that earlier school start times have no effect on pre-adolescent students, the author notes that

<sup>34</sup> Edwards, F. “Early to Rise? The Effect of Daily Start Times on Academic Performance.” *Economics of Education Review*, 31: pp. 970-983. 2012. p. 975. <http://www.sciencedirect.com/science/article/pii/S0272775712000830>

<sup>35</sup> Lufi, D., Tzischinsky, O., and Hadar, S. “Delaying school starting time by one hour; some effects on attention levels in adolescents.” U.S. National Library of Medicine, National Institutes of Health. April 15, 2011. <http://www.ncbi.nlm.nih.gov/pubmed/21509327>

<sup>36</sup> Ibid.

<sup>37</sup> Ibid.

<sup>38</sup> “More Sleep Linked to Improved Child Alertness, Behavior.” American Academy of Pediatrics. October 15, 2012. <http://www.healthychildren.org/English/news/Pages/More-Sleep-Linked-to-Improved-Child-Alertness-Behavior.aspx?nfstatus=401>

<sup>39</sup> Gruber, R., Cassoff, J., Frenette, S., Wiebe, S. and Carrier, J. “Impact of Sleep Extension and Restriction on Children’s Emotional Lability and Impulsivity.” *Pediatrics*, 130.5, pp. 1155-1161. 2012. <http://pediatrics.aappublications.org/content/130/5/e1155>

<sup>40</sup> “Less Sleep, More Struggles for Elementary and Middle School Students.” *ScienceDaily*. November 11, 2005. <http://www.sciencedaily.com/releases/2005/11/051111103748.htm>

<sup>41</sup> Sadeh, A., Gruber, R., and Raviv, A. “Sleep, Neurobehavioral Functioning, and Behavior Problems in School-Age Children.” *Child Development*, 73.2, pp. 405-407. 2002. <http://sleep.tau.ac.il/schslpnes.pdf>

<sup>42</sup> “How Much Sleep Do We Really Need?” National Sleep Foundation. <http://www.sleepfoundation.org/article/how-sleep-works/how-much-sleep-do-we-really-need>

“elementary schools start much later than middle schools,” with start times of 8:15 or 9:15 a.m.<sup>43</sup> However, Dr. David Sousa, author of *How the Brain Learns*, suggests that pre-adolescents (i.e., virtually all elementary-aged students) are more focused earlier in the morning than adolescent students. Specifically, he shows pre-adolescent students having the same degree of focus at 7 a.m. that adolescent students have at 8 a.m.<sup>44</sup> This suggests that **elementary schools may be able to start earlier in the day without negatively affecting student achievement.**

## GENERAL BENEFITS

The research presented above provides examples of findings that have consistently demonstrated that pushing back the start times of morning classes for adolescents results in “improved mood, attention and learning for students.”<sup>45</sup> Dr. John Cline, writing in *Psychology Today*, emphasizes the significance of these results, noting that “students actually use the [extra hour in the morning] for sleeping and are not spending another hour [at night] on the computer, watching TV, socializing or doing home work.”<sup>46</sup> Studies in Minnesota also have confirmed these findings.<sup>47</sup> In addition, students who began school at the later time showed “significantly better performance” in tests of their concentration levels and their ability to pay attention.<sup>48</sup>

Studies also indicate that that **later start times result in better driving and subsequently fewer accidents.** A recent study compared car accident statistics in two Virginia cities with school start times that were 75 to 80 minutes apart from one another to determine if there were any differences that could be attributable to insufficient sleep among teenagers. Motor vehicle accident rates in the first town, where 16- to 18-year-olds attended school at the traditional start time, occurred at a rate of 65.8 per 1,000 in 2008 and 71.2 per 1,000 in 2007. In comparison, accident rates within the community in which schools began later in the day stood at 46.6 per 1,000 in 2008 and 55.6 per 1,000 in 2007, demonstrating a difference that was statistically significant.<sup>49</sup> The study notes that traffic congestion was taken into account when comparing these figures and that this factor “did not account for the difference in crash rates.”<sup>50</sup> Findings in Fayette County, Kentucky, were similar: after the

<sup>43</sup> Edwards, F. “Early to Rise?...Performance.” *Economics of Education Review*. Op cit., p. 980.

<sup>44</sup> Sousa, D. “Impact of Circadian Rhythms on Schools and Classrooms.” October 17, 2011.

<http://howthebrainlearns.wordpress.com/2011/10/17/impact-of-circadian-rhythms-on-schools-and-classrooms/>

<sup>45</sup> Cline, J., PhD. “Sleepless in America: Latest Findings on Later School Start Times.” *Psychology Today*. May 9, 2011.

<http://www.psychologytoday.com/blog/sleepless-in-america/201105/latest-findings-later-school-start-times>

<sup>46</sup> Ibid.

<sup>47</sup> Heurich, A. “Summary of Research on School Start Time & Adolescent Sleep Trends.” October 18, 2005. p. 2.

<http://www.icsd.k12.ny.us/redistricting/startend/starttimesummary.pdf>

<sup>48</sup> Cline, J., PhD. “Sleepless in America... Times.” *Psychology Today*. Op. cit.

<sup>49</sup> Vorona, R.D. et al. “Dissimilar Teen Crash Rates in Two Neighboring Southeastern Virginia Cities with Different High School Start Times.” *Journal of Clinical Sleep Medicine*, 7.2. 2011: p. 149.

<http://www.sleepeducation.com/resources/lessons/teensdrowsydriving/teencrashrates.pdf>

<sup>50</sup> Cline, J., PhD. “Sleepless in America... Times.” *Psychology Today*. Op. cit.

start times in high schools were delayed to 8:30am, “the number of teenagers involved in car crashes dropped, even as they rose in the state.”<sup>51</sup>

Behavioral factors are also important to consider. According to a 2011 study conducted by staff at the Centers for Disease Control and Prevention, insufficient sleep among high school students is associated with a wide range of what are deemed “health-risk behaviors,” including:<sup>52</sup>

- Lack of exercise
- Poor diet
- Use of computers for three or more hours each day
- Physical fighting
- Cigarette, alcohol, and marijuana use
- Sexual activity
- Depression
- Suicidal tendencies

One of the authors of the study further explained that a “public health intervention is greatly needed” as a result of these findings. She went on to note that “the consideration of delayed school start times may hold promise as one effective step in a comprehensive approach to address this problem.”<sup>53</sup>

## INSTITUTIONAL RESPONSES

Alongside scientific findings proving the importance of sleep, especially in adolescence, education experts are focusing more on the effect of insufficient sleep on middle and high school students’ academic performance, behavior, and reported moods. This emphasis has led to the shift of many middle and high schools to later start times that allow students to sleep more, thus accommodating the sleep-wake phase delay and ensuring better rested students for first period. A 2010 article in the *Los Angeles Times* states that no one has kept track of how many schools have changed their start times, which is consistent with the research conducted for this report.<sup>54</sup> However, the article also noted that at the time of writing, “Since the discussion on school start times began more than a decade ago, not a single district that has made the change has decided to change back.”<sup>55</sup>

<sup>51</sup>Kalish, N. “The Early Bird Gets the Bad Grade.” *New York Times*. January 14, 2008.  
<http://www.nytimes.com/2008/01/14/opinion/14kalish.html>

<sup>52</sup>“Media Advisory: Insufficient sleep among high school students associated with a variety of health-risk factors.” Center for Disease Control and Prevention. September 26, 2011.  
[http://www.cdc.gov/media/releases/2011/a0926\\_insufficient\\_sleep.html](http://www.cdc.gov/media/releases/2011/a0926_insufficient_sleep.html)

<sup>53</sup>Ibid.

<sup>54</sup>Sohn, E. “Later School Start Times and Zzzs to A’s.” *Los Angeles Times*. August 23, 2010, p. 3.  
<http://articles.latimes.com/print/2010/aug/23/health/la-he-school-time-20100823>

<sup>55</sup>Ibid.

This shift, adopted by a growing number of schools over the last decade, suggests that not only does a later start time demonstrably improve adolescent students' ability to come to class prepared to learn, but that it also is **sustainable in the long term**.<sup>56</sup> Indeed, a 2011 report by the Brookings Institution notes that emerging evidence suggests that "mundane reforms," like altering start times, are less politically controversial than other, more unwieldy systemic policy changes. The study goes on to say that these simpler shifts have the potential to "**produce substantial achievement gains at relatively low cost**. (emphasis added)"<sup>57</sup>

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<sup>56</sup> Dooren, J.C. "Later Start to School Boosts Teens' Health." *The Wall Street Journal*. July 6, 2010.  
<http://online.wsj.com/article/SB10001424052748704535004575349182901006438.html>

<sup>57</sup> Jacob, B.A. and Rockoff, J.E. "Organizing Schools to Improve Student Achievement: Start Times, Grade Configurations, and Teacher Assignments." The Brookings Institution: The Hamilton Project. September 2011.  
[http://www.brookings.edu/~media/Files/rc/papers/2011/09\\_organize\\_jacob\\_rockoff/092011\\_organize\\_jacob\\_rockoff\\_paper.pdf](http://www.brookings.edu/~media/Files/rc/papers/2011/09_organize_jacob_rockoff/092011_organize_jacob_rockoff_paper.pdf)

## SECTION II: OBSTACLES TO IMPLEMENTATION

In an editorial for the *Archives of Pediatric and Adolescent Medicine* discussing the benefits that students can receive from later start times, Wahlstrom indicates that “accumulating evidence about the benefit of delayed start times is only one piece of the puzzle in actually implementing later school day starts for teens.”<sup>58</sup> She goes on to argue that **community and institutional support of a revised schedule is crucial** if students are going to be able to logistically shift their commutes, afterschool activities, childcare and other plans that revolve around the times they arrive at and leave school.

**Many districts acknowledge the benefits of later start times but ultimately decide that logistical or financial constraints prevent them from making the shift.** In 2009, for instance, students at Richard Montgomery High School requested that the county school board consider later start times, forcing the board to revisit an issue that had already been “studied twice by the school system within the last decade.”<sup>59</sup> While the board vice-president indicated that they would “keep an open mind” when reviewing the proposal, she also warned that the challenges that prevented implementation of such a plan a decade ago would likely remain, including parent opposition and “other complications,” such as transportation cost increases.<sup>60</sup> As of December 2012, Richard Montgomery High School’s warning bell signaling a five minute window before the start of first period still rings at 7:20am.<sup>61</sup> In a similar situation, the principal of Glenn Hills High School in Augusta, Georgia requested a shift in the school start time from 7:15 a.m. to 9:15 a.m., though the request “never made it to a school board meeting agenda for a vote.”<sup>62,63</sup>

In addition to barriers resulting from community opposition, the National Sleep Foundation (NSF) lists the eight most significant obstacles to delaying school start times as follows:<sup>64</sup>

- **Transportation:** altering what are often long-entrenched bus transportation schedules can have a real impact on districts’ abilities to deliver district-wide bus transportation efficiently and at the lowest possible cost.

<sup>58</sup> Wahlstrom, K. “School Start Time and Sleepy Teens.” *Archives of Pediatric and Adolescent Medicine*, 164:7, 2010, pp. 676-677. <http://teensneedsleep.files.wordpress.com/2011/05/editorial-school-start-time-and-sleepy-teens-archives-of-pediatrics-adolescent-medicine-july-2010.pdf>

<sup>59</sup> Brachfeld, M. J. “Students want school system to reconsider later start times.” *Gazette.Net*. August 19, 2009. [http://ww2.gazette.net/stories/08192009/olnew204340\\_32525.shtml](http://ww2.gazette.net/stories/08192009/olnew204340_32525.shtml)

<sup>60</sup> Ibid.

<sup>61</sup> “Regular Bell Schedule.” Richard Montgomery High School. <http://www.montgomeryschoolsmd.org/uploadedFiles/schools/rmhs/students/Regular%20bell%20schedule.pdf>

<sup>62</sup> McManus, Tracey. “Glenn Hills Principal Wants to Start School at Later Time.” *The Augusta Chronicle*. April 26, 2012. <http://chronicle.augusta.com/news/education/2012-04-26/glenn-hills-principal-wants-start-school-later-time>

<sup>63</sup> McManus, Tracey. “Glenn Hills High Principal Wayne Frazier Transferred to Alternative School.” July 26, 2012. <http://chronicle.augusta.com/news/education/2012-07-26/glenn-hills-high-principal-wayne-frazier-transferred-alternative-school>

<sup>64</sup> “Eight Major Obstacles to Delaying School Start Times.” National Sleep Foundation (NSF). 2011. <http://www.sleepfoundation.org/article/hot-topics/eight-major-obstacles-delaying-school-start-times>

- **After-School Activities:** Athletics in particular can be affected by later start times, impeding a school’s ability to coordinate logistically with coaches and other teams. The Brookings report notes that outdoor winter sports could be most affected given the early sunset during that season.<sup>65</sup>
- **Other Students and Programs:** An institutionalized shift in start times among older students could push elementary start times ahead, resulting in young students “waiting for the bus in the dark early mornings, or waiting at home alone after school.”<sup>66</sup> In addition, implementing earlier start times for elementary schools just to satisfy logistical needs is difficult to justify when the general body of research does not study “the effect of school start times on younger students.”<sup>67</sup>
- **Reduced Time to Access Public Resources:** Libraries, supply stores and other community businesses are available to students for less time during the week if the end of the school day is pushed back into the afternoon.
- **Teachers:** A later start and release time leaves teachers to face the same scheduling concerns that students would have under the same circumstances, like less time with their families.
- **Stress for Families:** Altering a student’s schedule has implications for caregivers who are responsible for aiding in transportation, providing meals after school, and assisting with homework.
- **Uneducated Community:** Resistance to change usually stems from a lack of education about the merits of a new plan, and communities may balk at the new change before learning more.
- **Resistance of Students:** Students may resist changes that have the potential to affect participation in extra-curricular activities and limit the amount of time they have to complete homework in the evenings.

Cost of implementation is also a major concern. While a shift in start times is considered a low-cost systemic change when, say, earlier high school start times are swapped with later elementary school start times, there is relatively little evidence discussing the effects of such a change on the younger students. As such, simply swapping times may not be recommendable. Moreover, it is clear that moving from a tiered/staggered start time system (where schools districts can maximize the repeated use of buses and other transportation equipment) to a unified start time for all grades would require increased spending to make up for the loss of overlap.<sup>68</sup>

A 2011 study of schools in Wake County, North Carolina concluded that the school would need to spend roughly \$150 per student per year to have all grades district-wide begin class at 9:15am.<sup>69</sup> The Brookings Institution report discussing this study points out that “if we [aggregate the costs] over the thirteen years a student is in a K-12 system, we arrive at an

<sup>65</sup> Jacob, B.A. and Rockoff, J.E. “Organizing Schools...Assignments.” The Brookings Institution. Op. cit., p. 10.

<sup>66</sup> National Sleep Foundation (NSF). “Eight Major Obstacles to Delaying School Start Times.” Op. cit.

<sup>67</sup> Ibid.

<sup>68</sup> Jacob, B.A. and Rockoff, J.E. “Organizing Schools...Assignments.” The Brookings Institution. Op. cit., p. 9.

<sup>69</sup> Ibid.

increase in transportation costs of \$1,950 over the student's school career."<sup>70</sup> However, the report notes that in those school systems that already use tiered transportation systems, swapping the order of school start times would have "little, if any, direct financial costs to school districts."<sup>71</sup>

If it is simply not possible to change older students to later start times, **experts in the field point out that other steps can be taken to mitigate the adverse effects** of the "misalignment between the typical adolescent circadian rhythm and early classes."<sup>72</sup> Kirby, Maggi and D'Angiulli's 2011 report suggests that "memory task performance" is best done by adolescents at the "nonpeak" time of the day. Therefore, when start times cannot be delayed for middle and high school students, "a restructuring of class schedules so that adolescents are practicing fluency-based skills—such as reading aloud or rehearsing music—in the morning may be more beneficial than trying to have them assimilate new knowledge early in the day."<sup>73</sup> The report notes that such claims have yet to be proven, but that a change like this would still be "most effective" if used in combination with a delayed start time. Used alone, the restructuring of classes only partially addresses issues related to sleep deprivation experienced "as a result of early start times."<sup>74</sup>

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<sup>70</sup> Ibid.

<sup>71</sup> Ibid.

<sup>72</sup> Kirby, M., Maggi, S., and D'Angiulli, A. "School Start...Evidence." *Educational Researcher*. Op. cit., p. 60.

<sup>73</sup> Ibid.

<sup>74</sup> Ibid.



## SECTION III: GUIDELINES AND MODELS TO IMPLEMENTING CHANGES

When trying to implement later starting times, the National Science Foundation recommends planning for the education of stakeholders early in the process, ensuring community engagement, maintaining clarity of goals, and remaining flexible.<sup>75</sup> Hanover Research’s exploration of the topic and current trends suggests that conducting **pilot studies** and **forming broad stakeholder committees** are two primary modes of initiating sustainable implementation. By forming “start time committees” and conducting surveys, schools can examine the potential costs of changing start times and explore the details of what such a change would entail. Pilot studies, too, allow schools to experience in real time how these changes would affect the school or district without having to implement a full-scale change all at once.

In the next few pages, we review examples of schools and districts that have used committees and pilot studies to evaluate stakeholder opinions and compose final recommendations for full-scale implementation. Some of these examples demonstrate instances in which research and preparation helped to successfully change school start times; others serve as examples in which stakeholders ultimately chose to keep the original schedule after reviewing the preliminary findings.

### START TIME COMMITTEE EXAMPLES

#### *RIVER FALLS, WISCONSIN*

Many schools and districts have organized study groups and committees to discuss the possibility of later school start times and explore the implications of such a change. Such a committee at the School District of River Falls in River Falls, Wisconsin, provided a PowerPoint presentation to stakeholders that reviewed the school district’s overall mission, research on later start times, and “school start time proposals for 2012-13.”<sup>76</sup>

The committee comprised 20 people—staff members, parents, students, community members and administrators—who met every two to four weeks during the fall of 2010 to research, gather information, compare different school districts, and explore options for schedules and alternatives to the current transportation schedule.<sup>77</sup> Specified constraints regarding the change of start times included transportation issues, the need to ensure the best interests of all students were served, and the necessity of preventing any increase to the school budget. The committee offered four different start time options and indicated

<sup>75</sup> “General Advocacy Tips for Changing School Start Times.” NSF.

<http://www.sleepfoundation.org/article/hot-topics/general-advocacy-tips-changing-school-start-times>

<sup>76</sup> Westerhaus, T., Cleveland, G., and Baumann, E. “A Presentation of School Start Time Proposals for 2012-13.” School District of River Falls. <http://www.rfsd.k12.wi.us/OurDistrict/sp/sst/Documents/Start%20Time%20Powerpoint.pdf>

<sup>77</sup> Ibid.

that a survey would be conducted in September and October 2011 to obtain community input.<sup>78</sup>

In a quick resolution, the school board voted in November 2011 to change high school and middle school days to 7:45 a.m. to 2:50 p.m. and elementary schools to 8:45 a.m. to 3:45 p.m.<sup>79</sup> The entire process appears to have taken slightly over one year, with implementation to occur in the following academic year.

### *NORTH ANDOVER, MASSACHUSETTS*

At North Andover Public Schools in North Andover, Massachusetts, a survey was taken by members of the community in the spring of 2010 to “determine initial preferences” for school start times.<sup>80</sup> In November 2010, an initial proposal to push back school start times for all grades (K-12) was adjusted a month later, seemingly in order to address concerns of the parents of elementary school students, 90.5 percent of whom stated in a survey that they were in favor of keeping the start time close to where it had always been.<sup>81</sup>

In response, the district board ultimately agreed to a 20-minute delay at the elementary level while start times for middle and high schools were pushed back by 35 minutes. While the district did not plan to implement later start times until the 2011-2012 academic year, meetings held by the School Committee began to address the issue and brainstorm implementation ideas in January 2010.<sup>82</sup> The following resources regarding the planned change are made available by the district on its website for the benefit of parents and other community stakeholders:<sup>83</sup>

- Frequently asked questions about school start times
- School Committee presentation on possible changes in start times
- Advisory Committee’s final report
- Elementary start time survey results
- Initial presentation in the spring of 2010
- Presentation on research regarding sleep and adolescent development
- Spring 2010 survey for the community
- Interim draft report completed during the winter and spring of 2010

<sup>78</sup> Hadley, S. and Trechter, D. “School District of River Falls- School Start Time Survey Report, 2011.” Survey Research Center Report, 2011.

<http://www.uwrf.edu/SurveyResearchCenter/upload/SDRF-School-Start-Time-Survey-Final-Report.pdf>

<sup>79</sup> “School District of River Falls: 11/21/11 Board Meeting Minutes.” Nov. 21, 2011.

[http://www.riverfallsjournal.com/event/article/id/100843/publisher\\_ID/19/](http://www.riverfallsjournal.com/event/article/id/100843/publisher_ID/19/)

<sup>80</sup> “Superintendent’s Advisory Committee on School Start Times.” North Andover Public Schools.

<http://www.northandoverpublicschools.com/starttimes.cfm>

<sup>81</sup> “Start Time Survey- NA Elementary Schools. Survey Results.” North Andover Public Schools.

[http://www.northandoverpublicschools.com/cms\\_files/resources/elemSurvey.pdf](http://www.northandoverpublicschools.com/cms_files/resources/elemSurvey.pdf)

<sup>82</sup> North Andover Public Schools. “Superintendent’s Advisory...Times.” Op. cit.

<sup>83</sup> Ibid.

*AMHERST, MASSACHUSETTS*

In the spring of 2011, Amherst Regional Public Schools in Amherst, Massachusetts issued a “Report of the Later Start Times Task Force.” The report outlined the district’s reasons for pushing back the start times of secondary schools, which include efforts to improve students’ “academic performance, attendance, mental health, and overall health.”<sup>84</sup> The survey of secondary students in the district revealed that 51 percent fall asleep in class “occasionally,” and “nearly 80 percent of secondary students, parents and teachers thought a later start time would ‘positively affect [student] achievement.’”<sup>85</sup> In response to these findings, the report comprehensively outlines five possible options, including:<sup>86</sup>

- No change
- Switch start times for secondary and elementary school
- Shift everything a half-hour later
- Put the middle school on the elementary schedule
- Put K-12 all on the elementary schedule

For each option, the committee notes the probable effects on sleep, transportation issues, sports schedules, and disruption to the schedules of elementary school students. Later on, the report raises concerns about the impacts of various possible options, focusing on the following facets:<sup>87</sup>

- **Financial** effects of higher transportation costs and more crossing guards to account for a possible earlier start time for elementary school students
- **Labor contract** effects, since changing the daily schedule is an “impact bargaining” item for the local union
- **Transportation** issues, since the current schedule allows for the same buses to be used for elementary and secondary school students
- Effect on the **athletic schedule**, and possible subsequent **community opposition**, since “later sports practices and home games would also conflict with town programs during all three seasons, as the high school and middle school share facilities with town sports programs.”
- **Elementary school effects**, since “different start times have no inherent value” for these students and would only disrupt their current schedule and family routines.

In October 2012, Amherst Regional Public Schools presented a report of three possible start time scenarios, with comments from the superintendent. The report detailed the impacts the scenarios would have on sports and transportation as well as possible costs of the

<sup>84</sup> “Report of the Later Start Times Task Force.” Amherst Regional Public Schools. April 15, 2011: p. 2.

<http://www.arps.org/files/LaterStartReport.pdf>

<sup>85</sup> Ibid.

<sup>86</sup> Ibid, p. 4.

<sup>87</sup> Ibid, pp. 6-8.

changes.<sup>88</sup> However, when put to a vote later that month, the proposal for a later start time was voted down. The committee cited various reasons for their lack of support for the proposal, including sports, finances, and family schedules.<sup>89</sup>

#### *DERRY TOWNSHIP, PENNSYLVANIA*

Pennsylvania's Derry Township District is another example of an unsuccessful attempt to change start times. In March 2011, the district formed a task force to examine research on adolescent sleep behavior in order to make a decision about how to proceed with start times for the township's schools.<sup>90</sup> Six months later, the group announced that the 7:38am high school start time would not be moved, instead recommending that the "district reinforce the importance of regular sleep habits and the detrimental effects on adolescent health and well-being cause by continuous late-night activities during the school year."<sup>91</sup>

The task force argued that a shift from the current schedule would be disruptive, require more money, complicate bus schedules, and affect the schedules of parents who rely on their older children to help babysit younger ones. In addition, a major issue was that a later start time would "take too much time away from school for teachers who are coaches and student athletes."<sup>92</sup> The committee chairman noted that "if Derry Township decided to start secondary [school] later, the district would only have control of athletic start times for approximately 50 percent of the games, since the home team sets start times. Students and coaches would need to be pulled from classes for larger amounts of time than now."<sup>93</sup>

#### **PILOT STUDY EXAMPLE – ST. GEORGE'S SCHOOL, RHODE ISLAND**

Pilot studies have the potential to bolster stakeholder support by providing concrete evidence of the benefits of any proposed changes. The results of a 2010 pilot study conducted in St. George's School, a private Rhode Island high school, support this reality: at the beginning of the study, "teachers, coaches and administrators all resisted the later start" of the school day (a shift from 8:00 a.m. to 8:30 a.m.).<sup>94</sup> However, demonstrated outcomes over the course of the pilot study proved sufficient to convince stakeholders to support and uphold the change. **After evaluating the effects of the delayed opening, nearly all stakeholders supported the 8:30 start time.**<sup>95</sup> Further, the percentage of students who reported getting at least eight hours of sleep each night skyrocketed from 16 to 55 percent;

<sup>88</sup> "Later Start Time Superintendent Recommendations." October 23, 2012.

<http://www.arps.org/files/Later%20Start%20Time%20Superintendent%20Recommendations.pdf>

<sup>89</sup> Grabbe, N. "Amherst Regional Schools Won't Change Start Time." *Gazettenet.com*. October 23, 2012.

<http://www.gazettenet.com/home/2479305-95/amherst-committee-later-schools>

<sup>90</sup> Malawskey, N. "Hershey study asks: Should the High School Day Start Later?" *PennLive.com, The Patriot News*.

March 20, 2011. [http://www.pennlive.com/midstate/index.ssf/2011/03/high\\_school\\_students\\_sleep.html](http://www.pennlive.com/midstate/index.ssf/2011/03/high_school_students_sleep.html)

<sup>91</sup> Shade, M. "Derry Township School Board panel favors retaining Hershey High School's start time." *The Patriot News*. September 25, 2011.

[http://www.pennlive.com/midstate/index.ssf/2011/09/hershey\\_high\\_school\\_panel\\_favo.html](http://www.pennlive.com/midstate/index.ssf/2011/09/hershey_high_school_panel_favo.html)

<sup>92</sup> *Ibid.*

<sup>93</sup> *Ibid.*

<sup>94</sup> Graber, C. "Later School Start Time Leads to Better Students." *Scientific American*. July 5, 2010.

<http://www.scientificamerican.com/podcast/episode.cfm?id=later-school-start-time-leads-to-be-10-07-05>

<sup>95</sup> *Ibid.*

class attendance improved; and reported feelings of unhappiness, depression, and irritability significantly declined.<sup>96</sup>

The pilot study also revealed that these **students were going to bed an average of eighteen minutes earlier than they had before the start time was moved**, “presumably because [being well-rested] felt so good.”<sup>97</sup> As one student put it, the 8:30am start time demonstrated the benefits of an extra half hour of sleep, motivating him to aim for an additional half hour on the other side of his sleep time. This study, which was the first to compare “the same students at the same school,” ultimately convinced students and faculty alike to vote for a permanent change to a later start time. It should also be noted that the school **did not extend the school day beyond its original end time: instead; classes were shortened by five or ten minutes to minimize complications resulting from pushing back the end of the school day.**<sup>98</sup>

**St. George’s School avoided complications with after-school activities and teachers’ evening commitments by delaying the start time by 30 minutes and shortening the school day.**

Recommendations from the Brookings report include a suggestion that “districts conduct pilot studies to determine the benefits of moving to a later start time and assess the feasibility of various ways to implement this change.”<sup>99</sup> The report notes that schools could approach the study from many different angles, either by splitting a schedule in districts with just one high school or choosing one high school in a group of several to start later. The report notes that “piloting of later start times should be done first in those areas with the highest expected net benefit...**schools that should pilot first are those with more disadvantaged students for whom the benefits will be greater.**”<sup>100</sup>

<sup>96</sup> Ibid.

<sup>97</sup> Burns, M. “Findings: No More Dozing Off in First Period.” Miller-McCune. August 1, 2010. <http://www.miller-mccune.com/health/no-more-dozing-off-in-first-period-19579/>

<sup>98</sup> Ibid.

<sup>99</sup> Jacob, B.A. and Rockoff, J.E. “Organizing Schools...Assignments.” The Brookings Institution. Op. cit., 11.

<sup>100</sup> Ibid.

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