

## School Day Start Times

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The school day start time refers to the time of day students begin their classes each day.<sup>1</sup> Issues surrounding school day start times are related to but separate from issues associated with the time of year students begin classes or the structure of the yearly school calendar. Advocates of starting the school day later than 8:00 a.m. often reference studies on the physiology of adolescence, noting that teenagers may find it difficult to fall asleep early enough to receive the eight or nine hours of sleep per night they require. A limited number of formal studies explore the link between later start times and academic achievement. Later start times may help increase attendance and improve academic performance for middle and high school students.

The decision to alter daily start times is complex and subject to the unique circumstances, needs, and goals of school districts. Local school boards have the authority to set their district start and end times; however, they must maintain 200 calendar days each year and 6.5 hour school days. (See “Laws and Policies Concerning School Calendars.”) Logistical concerns include the impact a later dismissal time would have on bus schedules and after-school activities.

This legislative brief reviews the logistical challenges of later start times and examines current school day start times in Tennessee, focusing on districts that have switched to a later start time or are considering such a change. The brief summarizes information on adolescent sleep research that is usually cited by advocates of a later start time, analyzes the physical and academic benefits that a later start time may give to middle and high school students, and reviews case studies of schools that have changed their start times.

### Logistical Considerations

Most secondary schools, nationally and in Tennessee, begin the school day earlier than elementary schools. The two most commonly cited reasons for secondary schools’ earlier start times are bus schedules and the coordination of before- and after-school activities.

**Bus Schedules:** More densely populated districts tend to “tier” their buses, using the same set of buses to transport several different populations of students on a staggered schedule. Altering the daily start time of one or all of the schools may affect bus routes, may prevent tiered bus schedules, and may require districts to purchase additional buses. For an urban district like Metropolitan Nashville Public Schools, a universal start time change across all grade levels would require the purchase of additional buses and would likely have a large financial impact on the district.<sup>2</sup> Some districts may be able to transition to a later start time without incurring additional expenditures by changing the start times of all grade levels by the same amount of time, allowing them to use the same bus routes and tier system but operating half an hour or an hour later. An example is the school district in Wilton County, Connecticut, which pushed back the start time of its middle and high schools, but kept existing bus routes

### Laws and Policies Concerning School Calendars

#### State of Tennessee

*TCA 49-6-3004:* Outlines the required 200 days, which include 180 days for classroom instruction, 10 days for vacation with pay, five days for in-service education, one day for teacher-parent conferences, and four other days as designated by the local board of education.

#### Tennessee State Board of Education

*Chapter 0520-01-03.02 (1)(a):* The minimum length of the school day for students shall be 6 ½ hours.

by switching the start time for middle and high school with the start time for elementary school.<sup>3</sup>

A change to a later start time may prompt administrators to reexamine bus schedules and identify and take advantage of efficiencies. For example, Anderson County Schools (Tennessee), which adopted a later start time in 2010, found that slight adjustments to the bus routes allowed the district to continue operating a two-tiered bus schedule, thereby avoiding the purchase of new buses.<sup>4</sup>

#### **Before-school and After-school Activities:**

Community members often raise concerns about the effects of a later dismissal time on after-school activities. Some districts found that many concerns typically diminished after the community had time to adjust to the daily start time change. Case studies of districts that have successfully switched to a later start time indicate such concerns can also be reduced or eliminated if the district is timely in its responses to community concerns.<sup>5</sup>

Scheduling for athletic events may be easier if other area schools agree to later game times. One study noted that some of the conflicts associated with later daily start times and dismissals may be reduced if the change is implemented not only at the district level but regionally as well.<sup>6</sup> In Mahtomedi Minnesota Public Schools, game times changed from 3:00 p.m. or 3:30 p.m. to as late as 4:15 p.m.. Districts initially resisted the change, but by the third year teachers and students had accepted the change.<sup>7</sup>

Other accommodations include reorganizing course schedules of student athletes to ensure that early dismissals for practices and games do not require them to miss core subject classes.<sup>8</sup>

Some districts are able to start their school day later while also saving money in transportation costs and accommodating concerns about after-school activities. Moore County Schools in North Carolina pushed back its high school start time by 45 minutes to 9:00 a.m. and saved an estimated \$400,000 during the 2011–12 school year by adjusting schedules and consolidating transportation routes. The district adopted a two-tiered bus schedule and used the same buses at different

times to transport elementary and high school students.<sup>9</sup> Principals expressed concern, however, with the 4:00 p.m. dismissal time and its effect on athletics and after-school activities. District officials responded by shifting back the start time for the high schools to 8:30 a.m. or 8:45 a.m. for the 2012–13 school year in order to allow for a more agreeable dismissal time.

#### **Start Times in Tennessee**

An informal poll of Tennessee superintendents conducted by OREA found schools in urban and suburban districts typically start between 7:00 and 7:30 a.m. Schools in rural districts begin at 7:45 a.m. or later. High schools usually open first, followed by the middle and elementary schools. Two districts changed the start time for some of their schools for the 2012–13 school year, one district starting earlier and the other starting later.<sup>10</sup> Milan Special School District in Gibson County added five minutes of instruction time to the middle school's day by changing from a 7:55 a.m. to 7:50 a.m. start time.<sup>11</sup> Cleveland City's middle and high schools changed from a 7:25 a.m. start time to 7:50 a.m.<sup>12</sup>

The following section reviews the experiences of other districts that have either changed or considered changing their daily start time, including Anderson County Schools, Metropolitan Nashville Public Schools, Hamilton County Schools, and Knox County Schools.

**Anderson County Schools.** Anderson County Schools adopted a later start time for all schools in 2010. The start time for high school changed from 8:00 a.m. to between 8:50 a.m. and 9:00 a.m.; the start time for elementary and middle schools changed from 7:30 a.m. to between 8:00 a.m. and 8:15 a.m. Student safety issues and adolescent sleep needs led school board members to adopt later start times. Prior to the start time change, some elementary students were picked up as early as 5:45 a.m. and dropped off at school up to an hour before classes started. School board members cited concerns about the safety of these students waiting in the dark at rural bus stops as a reason to reconsider start times.<sup>13</sup>

Before making any schedule changes, the district surveyed parents, students, principals, and faculty on adopting a later school day start time. Responses

indicated that 45 minutes later was an acceptable change;<sup>14</sup> 78 percent of principals expressed support for starting 30 minutes later. A majority of principals believed that both teachers and parents would adjust to the change.<sup>15</sup> Respondents raised two significant concerns about the start time change: logistical problems for students who had to arrive at school early due to their parents' work schedules and fears of less time for after-school activities and athletics.<sup>16</sup> The district responded to these concerns by adjusting after-school care to accommodate more time in the mornings and encouraging tutoring sessions before school for students who arrive early. These efforts by the school board and district to gather feedback from parents and the community in advance of any schedule changes resulted in a positive response to the eventual changes from students, parents, and faculty, according to one district official. The district reports no negative impact on athletics or after-school activities. Although slight adjustments had to be made to accommodate bus routes for some schools, the change did not have a significant financial impact on the district.<sup>17</sup>

**Hamilton County Schools.** The Regional Health Council (RHC) of the Chattanooga-Hamilton County Health Department is planning to study school day start times in Hamilton County.<sup>18</sup> Researchers may focus on three of the district's Innovation Zone schools to determine if a later daily start time may help raise achievement. The RHC intends to solicit community stakeholder input on how best to address the transportation and scheduling concerns that typically arise in conjunction with proposals for a later start time.<sup>19</sup>

A report published in 2008 by the Chattanooga Crime Task Force Committee recommended a later school schedule of 8:30 a.m. to 3:30 p.m. for all middle and high schools in Hamilton County.<sup>20</sup> As the basis for their recommendation, the task force report cited a lack of adequate sleep among teenagers, which often results in sleepiness and "unwelcome behaviors" such as depression and a lack of desire to learn. This recommendation, among others, was also designed to address the rising number of truant students in the district. The report referenced statistics that show teens are more likely to engage in risky behavior and commit crimes between the hours of 3:00 p.m. and 6:00 p.m.<sup>21</sup>

The report also addressed related issues, such as possible increases in transportation costs, though emphasizing that academic success should be the primary focus of the schools as opposed to cost saving measures related to logistics. The report also addressed possible scheduling conflicts with after-school athletic programs.<sup>22</sup>

**Knox County Schools.** With a few exceptions, middle and high schools in Knox County Schools (KCS) have operated on an 8:30 a.m. to 3:30 p.m. daily schedule since the 1970s. During the 2008–09 budget discussions, the district estimated that it could save approximately \$750,000 in transportation costs by reconfiguring the start times for the middle and high schools to an earlier staggered schedule. Input from the community, however, showed little support for the proposed schedule changes; opponents to the schedule change cited both logistical concerns as well as research on adolescent sleep needs. Today, KCS operates a two-tier bus schedule to accommodate the uniform middle and high school schedules as well as to ensure that elementary students are not on buses with older students.<sup>23</sup>

**Metropolitan Nashville Public Schools.** Although changes to school day start times have been discussed in Metropolitan Nashville Public Schools (MNPS), logistical concerns preclude implementing changes. Most high schools in MNPS begin classes around 7:05 a.m., elementary schools around 8:00 a.m., and middle schools around 8:55 a.m.<sup>24</sup> Like Anderson County, MNPS employs a tiered bus route system. An MNPS official indicates tiered bus schedules are "more cost efficient since the cost of additional buses and drivers to have a universal start time would be a major expense, plus it is an ongoing effort to hire enough drivers and substitute drivers to cover the more than 600 buses we have."<sup>25</sup> According to MNPS, logistical concerns such as after-school childcare for younger students whose families depend on older siblings; time restraints for after-school athletics, activities, and jobs; and children walking home or waiting at bus stops in the dark due to time changes throughout the year are the main obstacles to modifying daily schedules.<sup>26</sup>

## Effects of Early Morning Start Times on Adolescents

**Physical and Behavioral Effects.** A 2011 Centers for Disease Control and Prevention (CDC) study estimated that “70 percent of U.S. teens are sleep-deprived, with nearly 40 percent getting six or fewer hours of sleep per night.”<sup>27</sup> Research indicates that adolescents require the same amount of sleep as they did when they were younger, approximately nine to nine and one-quarter hours per night.<sup>28</sup> Poor sleep habits, as well as daily schedules that are overextended, filled with homework obligations, numerous extracurricular commitments, and/or employment, may contribute to adolescents’ difficulty to obtain nine hours of sleep per night.<sup>29</sup> Extensive research exists about the physical and behavioral effects that too little sleep can have on adolescents. Children who do not get enough sleep are at risk for “impaired academic performance, an increased risk of obesity, injuries and accidents, suicide ideation, and drug and alcohol use.”<sup>30</sup> Behaviors associated with sleep deprivation include “information-processing and memory deficits; increased irritability, anxiety, and depression; hypersexuality; decreased creativity and ability to handle complex tasks.”<sup>31</sup> Researchers have also established a link between insufficient sleep and a high body mass index.<sup>32, 33</sup>

Studies indicate that adolescents’ sleep patterns differ from those of younger children and adults. The circadian rhythm, which drives “sleep-wake cycles,” is not cued by environmental factors or societal routines and is difficult to alter.<sup>34</sup> Melatonin, the body’s “sleep inducing hormone,” does not begin production in teens until around 11 p.m., continues until about 7 a.m., and stops around 8 a.m.<sup>35</sup> According to a 2005 survey more than half of public high schools reported a start time earlier than 8:00 a.m. – which means adolescents’ bodies may still be producing sleep-inducing melatonin in their first class of the day. One researcher notes that a 7:00 a.m. wake time for a teen can be compared to a 4:00 a.m. wake time for an adult.<sup>36</sup> The CDC found that delaying school start times is a demonstrated strategy to promote sufficient sleep among adolescents.<sup>37</sup>

Researchers have also found that the teen strategy of “sleeping in” on the weekends may make it more difficult to transition back to a weekday schedule.<sup>38</sup>

Other research shows that teens are at greater risk to be overweight or obese if there is a significant contrast between weekend and weekday sleep schedules.<sup>39</sup>

## Case Studies: The Impact of Later Start Times on Academic Achievement, Attendance, and Behavior

**Minnesota.** Although research exists about the physical effects of sleep deprivation on adolescents, few formal studies exist on the link between later start times and academic achievement. The most extensive study to date, performed by the University of Minnesota, included 17 Minneapolis area school districts between 1995 and 2000 and found significant improvements in attendance rates. The study also reported that students with later daily start times slept one additional hour per night compared to students with earlier daily start times. Students reported an improvement in their emotional and behavioral well-being, with some school principals noting fewer disciplinary referrals to their offices.<sup>40</sup> (See Exhibit 1.) For more information on the University of Minnesota study, see Appendix A.

### Exhibit 1: Results reported by Minnesota schools after implementing a later daily start time

- Attendance in grades 9–11 improved significantly
- Continual enrollment increased
- Students slept one additional hour per night
- Students reported less depressive feelings
- Fewer students reporting peer relationship problems or issues with their parents
- Participation in after-school activities and athletics remained the same
- Principals noted fewer disciplinary referrals to their offices
- Parents reported positive behavior changes in their children with fewer confrontations about getting to school on time
- Urban parents reported more issues with the schedule change interfering with work schedules and transportation issues

Source: Kyla Wahlstrom, “Changing Times: Findings from the First Longitudinal Study of Later High School Start Times,” NASSP Bulletin 86, No. 633, pp. 3-21, December 2002.

Advocates for later school start times typically refer to this study's results, and many educators who recommend a later start time cite the study as justification for making the change. Many schools that switch to a later start time have since reported their own anecdotal results of success, including increased attendance for first hour classes, improved academic achievement, and reports by faculty and parents of positive behavior changes among students.

The University of Minnesota researchers, however, hesitate to judge the success of a later daily schedule by academic achievement scores alone due to the large number of variables that can affect student achievement. They urge school administrators to look at other positive gains that may be achieved by an altered schedule, "such as student physical and emotional well-being, benefits associated with teaching and learning, and improved family relationships."<sup>41</sup>

**North Carolina.** A study published in *Education Next* analyzed the effects of changing the daily start time in middle schools in Wake County, North Carolina, the sixteenth largest public school district in the U.S. The schools operate on a three-tier schedule, with different schools starting at 7:30, 8:15, and 9:15 a.m. The variation of start times among middle schools within the district allowed researchers to compare cross sections of students. Researchers found that delaying start times by one hour, from roughly 7:30 a.m. to 8:30 a.m., increased standardized test scores by at least two percentile points in math and one and one-half percentile points in reading. Improvement in test scores was greater for students in the bottom third of test takers. The study suggested that starting school later in the morning affords students more time to eat breakfast, which may also contribute to the rise in test scores observed by researchers. Students with the later start time spent less time on average watching television, more time on homework per week, and had 25 percent fewer absences than typical students, according to the study. The researchers estimated that the cost to switch from a three-tier bus model to a single-tier model and move each student to a 9:15 a.m. start time would be \$150 per student in additional transportation costs per year. The Wake County school system considered the study's results, but opted to continue with the current school schedule, citing cost savings realized

through operation of the three-tier bus system. System officials estimated the district saved approximately \$100 million in transportation costs between 1993 and 2003 by operating a three-tier bus system.<sup>42</sup>

**Chicago.** A study of Chicago Public Schools, where schools typically begin classes by 8:00 a.m., found that students performed worse in their first-period class compared to the rest of their daily courses and had six more days of absences in their first-period class compared to their other courses.<sup>43</sup> Researchers suggest that a combination of factors, including early morning grogginess as well as late arrivals and absences that are factored into course grades, contribute to the lower course grade and poor performance on end-of-year standardized tests.<sup>44</sup> The Brookings Institution notes that "[t]his study highlights the fact that start times might influence adolescent performance not simply because they are less alert early in the mornings, but also because they may be more likely to miss early morning classes."<sup>45</sup>

**United States Air Force Academy.** A study of United States Air Force Academy cadets reported similar results to those found in Chicago. Researchers randomly assigned cadets to different schedules and studied the impact on student achievement. Cadets whose first course of the day began at 8 a.m. performed significantly worse in all their courses compared to students who were not assigned a first-period course.<sup>46</sup>

**Massachusetts.** A 2004 study in Massachusetts found a correlation between total hours slept each night and academic achievement. The study examined two middle schools, one with a 7:15 a.m. start time and the other with an 8:37 a.m. start time. The students with the early start time were tardy more often and had significantly worse grades overall compared to their counterparts.<sup>47</sup>

**Kentucky.** Fayette County, Kentucky, changed the start time of its high schools from 7:30 a.m. to 8:30 a.m. in 1999. The district has five high schools and enrolls approximately 32,000. Students reported "meaningful increases in sleep time, an increase in the percentage of students who got an adequate amount of sleep, and a decrease in catch-up sleep on the weekends" following the schedule change. More sleep may have also been a factor in reducing the county's teen car crash rates,



according to a study of the district's schedule change. Researchers noted that Fayette County's teen crash rates were "considerably higher than the rest of the state" prior to the change, but dropped by 16.5 percent in the two years following the introduction of the later start time. The statewide teen crash rate increased 7.8 percent over the same period of time.<sup>48</sup>

## Conclusion

Research on adolescent sleep patterns indicates adolescents' bodies are programmed to go to sleep later than younger children and adults, even though they still require the same number of sleep hours (nine hours) as elementary school children. School districts across the country, including some in Tennessee, have adopted a later start time to accommodate the sleep patterns of secondary school students. Districts that have made this change cite research linking a later start time with improved student behavior, attendance, and academic performance. Researchers have had difficulty establishing a definitive link between academic performance and school start times, and there are logistical considerations associated with changing start times (e.g., altering bus schedules, impacts on extracurricular activities).

Changing school day start times is a significant undertaking for any school district, regardless of its size or geographic location. District officials must take into account the diverse viewpoints of parents, students, faculty, and the community, and recognize that successful implementation of such a change typically involves a compromise on the start time among many affected groups. Costs associated with shifting to a later start time depend upon various factors, including:

- Switching from tiered bus routes to a larger fleet of buses may be too costly for some districts.
- A reexamination of existing policies, bus routes, and class schedules may reveal potential efficiencies that could be realized with a later daily start time.
- Extending faculty hours or hiring additional personnel may be necessary to accommodate working parents with children enrolled in before-school or after-school programs.

Various case studies from across the country show that some districts, such as suburban Edina, Minnesota, were able to make schedule adjustments with little fiscal impact. Moore County, North Carolina was able to save money by restructuring bus routes and eliminating buses. Other districts, however, such as the large district of Wake County, North Carolina, could not justify the additional bus system costs necessary to implement later start times. Tennessee's largest school districts, such as Metropolitan Nashville Public Schools and Hamilton County Schools, must contend with numerous logistical considerations when making any school schedule changes. Smaller districts, such as Anderson County Schools, may be able to adopt a later daily start time with little fiscal impact.

## Endnotes

- <sup>1</sup> See the Comptroller's Offices of Research and Education Accountability (OREA) website for a related report: *School Calendar Choices in Tennessee: A Look at Year Round/Nontraditional Schools*, <http://www.comptroller.tn.gov/OREA>.
- <sup>2</sup> Olivia H. Brown, Director of Communications, Metropolitan Nashville Public Schools, e-mail, June 28, 2012.
- <sup>3</sup> National Sleep Foundation, "Changing School Start Times: Wilton, Connecticut," Adolescent Sleep Initiative, 2005, <http://www.sleepin Fairfax.org/> (accessed Sept. 7, 2012).
- <sup>4</sup> Leisa Fair, Deputy Director for School and Student Affairs, Anderson County Schools, telephone interview, July 11, 2012.
- <sup>5</sup> Terra Ziporyn Snider, "Push Back High School Start Times," *Education Week*, May 15, 2012, <http://www.edweek.org/> (accessed June 13, 2012).
- <sup>6</sup> Brian A. Jacob and Jonah E. Rockoff, *Organizing Schools to Improve Student Achievement: Start Times: Grade Configurations, and Teacher Assignments*, Brookings Institution, Discussion Paper 2011-08, Sept. 2011, p. 10, <http://www.brookings.edu/> (accessed June 18, 2012).
- <sup>7</sup> Mark Larson, Superintendent, Mahtomedi Public Schools, Minnesota, e-mail, July 10, 2012.
- <sup>8</sup> Jacob and Rockoff, p.10.
- <sup>9</sup> Moore County Schools, "Many School Start, Dismissal Times for 2012–2013 to Change," <http://www.ncmcs.org/> (accessed Nov. 19, 2012).
- <sup>10</sup> The Comptroller's Offices of Research and Education Accountability received 51 responses from school superintendents or other school administrators. This informal e-mail poll asked the recipients if their district had changed or had considered changing its daily start time in the past several years.
- <sup>11</sup> Jill Gallemore, Human Resource and Transportation Supervisor, Milan Special School District, e-mail, June 26, 2012.
- <sup>12</sup> Cleveland City Schools, "Minutes, Regular Board Meeting, June 4, 2012," <http://emeetings.tsba.net/> (accessed July 3, 2012).
- <sup>13</sup> Leisa Fair, telephone interview, July 11, 2012.
- <sup>14</sup> Leisa Fair, telephone interview, July 11, 2012.
- <sup>15</sup> Anderson County Schools, "Principals Survey on start time," March 11, 2010, pp. 2 and 4, <http://images.pcmac.org/> (accessed Nov. 19, 2012).
- <sup>16</sup> Anderson County Schools, p. 6.
- <sup>17</sup> Leisa Fair, telephone interview, July 11, 2012.
- <sup>18</sup> As of the 2012–13 school year, most Hamilton County middle and high schools start around 7:15 a.m.; elementary schools start between 8:00 a.m. and 8:15 a.m.
- <sup>19</sup> Dr. Roger Thompson, Professor, University of Tennessee at Chattanooga, Criminal Justice Department, e-mail, September 11, 2012.
- <sup>20</sup> City of Chattanooga Office of Multicultural Affairs, *Crime Task Force Report*, 2008, p. 15, <http://www.chattanooga.gov/> (accessed June 28, 2012).
- <sup>21</sup> City of Chattanooga Office of Multicultural Affairs, *Crime Task Force Report*, 2008, pp. 14 and 15; U.S. Department of Justice, Office of Juvenile Justice and Delinquency Prevention, "Juvenile Violent Crime Time-of-Day Profiles," <http://www.ojjdp.gov/> (accessed July 3, 2012); National Sleep Foundation, "Background: Later School Start Times," <http://www.sleepfoundation.org/> (accessed June 15, 2012).
- <sup>22</sup> City of Chattanooga Office of Multicultural Affairs, *Crime Task Force Report*, 2008 p. 13.
- <sup>23</sup> Elizabeth Alves, Chief Accountability Officer, Knox County Schools, e-mail, Jan. 11, 2013.
- <sup>24</sup> Metropolitan Nashville Public Schools, "2012–13 Metropolitan Nashville Public Schools," <http://www.mnps.org/> (accessed March 19, 2013).
- <sup>25</sup> Olivia H. Brown, Director of Communications, Metro Nashville Public Schools, e-mail, June 28, 2012.
- <sup>26</sup> Olivia H. Brown, Director of Communications, Metro Nashville Public Schools, e-mail, June 28, 2012.
- <sup>27</sup> Snider, "Push Back High School Start Times."
- <sup>28</sup> National Sleep Foundation; Mary A. Carskadon, editor, *Adolescent Sleep Patterns: Biological, Social, and Psychological Influences*, United Kingdom, Cambridge University Press, 2002, p.173; Edward B. O'Malley and Mary B. O'Malley, "School Start Time and Its Impact on Learning and Behavior," Chapter 7 of *Sleep and Psychiatric Disorders in Children and Adolescents (Sleep Disorders)*, Anna Ivanenko, ed., Informa Healthcare, 2008, p. 79.
- <sup>29</sup> National Sleep Foundation.
- <sup>30</sup> Lisa Anne Matricciani, Tim S. Olds, Sarah Blunden, Gabrielle Rigney, and Marie T. Williams, "Never Enough Sleep: A Brief History of Sleep Recommendations for Children," *Pediatrics*, Vol. 129, No. 3 Feb. 2012, p. 549.
- <sup>31</sup> Carskadon, p.173.
- <sup>32</sup> According to the National Institutes of Health, body mass index is a measure of body fat based on height and weight that applies to adult men and women. For more information, see <http://nhlbisupport.com/bmi/>.
- <sup>33</sup> Till Roenneberg, Karla V. Allebrandt, Martha Merrow, and Celine Vetter, "Social Jetlag and Obesity," *Current Biology*, Vol. 22, No. 10, May 22, 2012, p. 939, <http://www.cell.com/> (accessed June 18, 2012).

- <sup>34</sup> O'Malley and O'Malley, p. 79; Scott E. Carrell, Teny Maghakian, and James E. West, "A's from Zzzz's? The Causal Effect of School Start Time on the Academic Achievement of Adolescents," *American Economic Journal: Economic Policy*, Vol. 3, Aug. 2011, p. 64; Carskadon, p. 173.
- <sup>35</sup> Carrell, Maghakian, and West, p. 64.
- <sup>36</sup> Jacob and Rockoff, pp 7 and 8.
- <sup>37</sup> Snider, "Push Back High School Start Times."
- <sup>38</sup> Roenneberg, Allebrandt, Mellow, and Vetter, p. 939; Sarah D. Sparks, "Sleep Timing a Weighty Problem for Students," *Education Week*, May 2012, <http://blogs.edweek.org/> (accessed Sept. 7, 2012).
- <sup>39</sup> Sparks, "Sleep Timing a Weighty Problem for Students;" Roenneberg, Allebrandt, Mellow, and Vetter, p. 939.
- <sup>40</sup> Kyla Wahlstrom, "Changing Times: Findings from the First Longitudinal Study of Later High School Start Times," *NASSP Bulletin*, Vol. 86, No. 633, Dec. 2002, pp. 8, 12, 14, and 17.
- <sup>41</sup> Wahlstrom, "Changing Times," p. 18.
- <sup>42</sup> Finley Edwards, "Do Schools Begin Too Early?" *Education Next*, Vol. 12, No. 3, Summer 2012, pp. 54-57, <http://educationnext.org/> (accessed March 20, 2013); Jacob and Rockoff, p. 9.
- <sup>43</sup> Jesse Bricker, Kalena Cortes, and Chris Rohlfs, "The Role of Specific Subjects in Education Production Functions: Evidence from Morning Classes in Chicago Public High Schools," Finance and Economics Discussion Series, Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board, Washington, D.C., Oct. 3, 2009, p. 2, <http://www.federalreserve.gov/> (accessed March 20, 2013); Jacob and Rockoff, p. 9.
- <sup>44</sup> Jacob and Rockoff, p. 9; Bricker, Cortes, and Rohlfs, p. 3.
- <sup>45</sup> Jacob and Rockoff, p. 9.
- <sup>46</sup> Carrell, Maghakian, and West, p. 63.
- <sup>47</sup> National Sleep Foundation, "Backgrounder: Later School Start Times," <http://www.sleepfoundation.org/> (accessed June 15, 2012).
- <sup>48</sup> Sleep in Fairfax, "Changing School Start Times"; Fred Danner and Barbara Phillips, "Adolescent Sleep, School Start Times, and Teen Motor Vehicle Crashes," *Journal of Clinical Sleep Medicine*, Vol. 4, No. 6, 2008, p. 535.



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## Appendix: University of Minnesota Study

Many advocates for later school start times base their arguments on the results of a study conducted by the Center for Applied Research and Educational Improvement (CAREI) at the University of Minnesota. Between 1996 and 2000, CAREI studied the adolescent sleep patterns in 17 districts in the greater Minneapolis area. In 1996–97, suburban Edina pushed back its high school start time from 7:25 a.m. to 8:30 a.m. The following year the Minneapolis school district changed its daily start time from 7:15 a.m. to 8:40 a.m. Other districts across the country often point to these two districts as models for changing school start times. The table below profiles the two districts in Minnesota.

### Profiles: Two Minnesota Districts

	Edina, Minnesota	Minneapolis, Minnesota
<b>Original High School Start Time</b>	7:25 a.m.	7:15 a.m.
<b>New High School Start Time</b>	8:30 a.m.	8:40 a.m.
<b>K-12 Student Population (2012-13)</b>	8,300	32,263
<b>Teachers &amp; Support Staff</b>	598 (2010-11)	6,227 (2012-13)
<b>Total Number of Schools in District</b>	9	70

Sources: Edina Public Schools, “About Us,” <http://www.edina.k12.mn.us/> (accessed March 18, 2013).  
Minneapolis Public Schools, “2012-2013 Fact Sheet,” <http://www.mpls.k12.mn.us/> (accessed March 18, 2013).

Overall, both districts reported positive results with the schedule changes. Attendance for students in grades 9–11 improved significantly. Researchers noted that students at risk to drop out due to insufficient credit from excessive tardies or absences may benefit from a change in daily start times. Student surveys conducted across the 17 school districts found that students, regardless of daily start time, reported an average bedtime of 11:00 p.m. Those students in the Minneapolis district, however, slept approximately one hour more each night than students who started their school day earlier. Students also reported an improvement in their emotional and behavioral well-being. In schools with a start time of 8:30 a.m. or later, students reported fewer depressive feelings than did students who started school between 7:15 a.m. and 7:30 a.m.

While the study found a slight improvement in grades district-wide, the results were not significant enough to correlate directly to the change in the daily start time; the researchers asked the districts to recognize other areas of improvement such as physical and emotional health improvements reported by students after the implementation of a later daily start time. Students reported that they felt more focused during the day and had more time to work on homework during school hours. A majority of suburban Edina teachers responded positively to the change, citing more time for class preparation and collaboration with other teachers in the mornings. Less than half of Minneapolis teachers reported positive feelings toward the change, most citing the impact that the later dismissal time had on their personal lives, especially in regard to rush hour traffic and less down time at home in the evenings. See also Exhibit 1: Results reported by Minnesota Schools after implementing a later daily start time.

CAREI credits much of the Minnesota schools’ success in implementation to ensuring that all stakeholders – parents, faculty, and students – were involved in the discussions. Neither Edina nor Minneapolis reported increased transportation costs in making the schedule changes. Both districts continued to use the same routes and buses, but picked up students at a later time.

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