



# INFORMATION CAPSULE

## Research Services

Vol. 0908  
October 2009

Christie Blazer, Supervisor

## DELAYED HIGH SCHOOL STARTING TIMES

### At a Glance

*Educators around the nation are considering pushing high school starting times back until later in the morning, based on evidence suggesting that amount of sleep and circadian rhythms play a part in adolescents' academic performance. While research confirms that adolescents don't get enough sleep and that insufficient sleep can negatively impact students' performance, studies have not yet determined if delaying the start of the high school day is the answer to this problem. In general, research suggests that students attending high schools with delayed starting times sleep longer than students attending schools with earlier starting times and that when schools start later, they tend to have lower levels of tardiness and, in some cases, absenteeism. However, no definitive conclusions can be drawn regarding the impact of delayed starting times on students' academic performance.*

*After-school jobs appear to be unaffected by delayed schedules, although later release times have been reported to cause some conflicts between after-school activities and last period classes. While teacher and student perceptions of delayed high school starting times are mixed, parent opposition to schedule changes is one of the biggest obstacles districts face. Considering the lack of empirical evidence supporting improved academic achievement as a result of setting back school starting times and the potential for collateral harm the change might cause to other facets of school, personal, and family life, school districts should thoroughly deliberate before instituting such a change in policy. Although the research to date has not empirically demonstrated reliable improvements in academic achievement, the multitude of personal and social benefits derived from starting school later may by themselves be sufficient justification. Therefore, starting times at a limited number of senior high schools willing to experiment and pilot test the policy accompanied by a thorough follow-up evaluation regarding the efficacy of the policy change might be a prudent course of action.*

*In addition to a review of the relevant research, this Information Capsule includes a discussion of key issues districts must resolve before delaying high school starting times; guidelines for districts to follow when they delay high school starting times; and a summary of alternative ways schools can improve students' academic performance when delayed starting times are not an option.*

There are over 15,000 school systems in the United States and the vast majority of high schools start before 8:00 a.m. Historically, high schools were assigned the earliest starting times because they had the most extensive after-school programs and because parents didn't want younger children standing at bus stops in the dark. Educators around the nation, however, have begun to question whether the traditional early starting times used by most high schools are conducive to higher levels of academic performance. There is mounting evidence that amount of sleep and circadian rhythms play a part in adolescents' ability to learn (Hui, 2009; Truempy, 2008; National Sleep Foundation, 2006; Strauss, 2006; Tonn, 2006; University of Minnesota, 1998a).

Research Services

Office of Assessment, Research, and Data Analysis  
1500 Biscayne Boulevard, Suite 225, Miami, Florida 33132  
(305) 995-7503 Fax (305) 995-7521

There are no statistics that track the exact number of schools delaying their starting times (Hagan, 2008; Strauss, 2006), but the National Sleep Foundation (2009a) reported that individual schools or districts in 19 states have pushed back their starting times and more than 100 school districts in an additional 17 states are considering later starting times.

### **Adolescent Sleep Habits**

There is a general consensus among researchers that American adolescents are not getting enough sleep (Truempy, 2008; Yan & Slagle, 2006; Acebo & Carskadon, 2002). High school students need a minimum of nine hours of sleep per night until age 17, but a poll conducted by the National Sleep Foundation (2006) found that on average, adolescents reported getting 7.6 hours of sleep on school nights. The amount of sleep varied by grade level, with adolescents tending to get less sleep as they got older (from an average of 8.4 hours in sixth grade to an average of 6.9 hours in twelfth grade). The poll found that at least once a week, 28 percent of high school students reported falling asleep in school, 22 percent reported falling asleep doing homework, and 14 percent stated they arrived late or missed school because they overslept.

### **Circadian Rhythms**

Everyone has an internal biological clock that influences body temperature, appetite, hormonal changes, and sleep cycles. The biological and psychological processes that follow the cycle of this 24-hour internal clock are called circadian rhythms. Before adolescence, circadian rhythms direct most children to naturally fall asleep around 8:00 or 9:00 p.m. But puberty changes the internal clock, delaying the time adolescents start to feel sleepy, often until 11:00 p.m. or later. Researchers have discovered that the brain secretes a hormone called melatonin that is responsible for sleepiness. Teenagers generally do not secrete melatonin until later in the evening (about 10:30 or 11:00 p.m.) and it is secreted until approximately 8:00 a.m. Adolescents' 11:00 p.m. to 8:00 a.m. sleep-wake cycle is therefore extremely resistant to change and forced awakening does not reset the physiological process taking place within the brain (Truempy, 2008; Mayo Clinic, 2007; Strauss, 2006; University of Minnesota, 2002; Downs, 2001; Graham, 2000; Wahlstrom, 2000).

Some researchers once theorized that social factors and extensive after-school commitments, such as extracurricular activities, sports, and homework, were to blame for adolescents' later bedtimes. It is now understood that circadian rhythms are generated internally and develop without any social or environmental cues. Studies have revealed that the sleep-wake cycles for adolescents in countries all around the world are nearly identical to those found among adolescents in the United States (National Sleep Foundation, 2009b; Delisio, 2003; Banks & Atkinson, 2002; Wahlstrom, 2002; Downs, 2001; Graham, 2000; University of Minnesota, 1998a).

Proponents of delayed high school starting times contend that current schedules fail to take adolescents' circadian rhythms into account (Hagan, 2008; Strauss, 2006; Yan & Slagle, 2006; Keller, 2001). The National Sleep Foundation (2009a) stated that high schools starting before 8:00 a.m. "stand in stark contrast with adolescents' sleep patterns and needs." Research has shown that over 50 percent of students report being most alert after 3:00 p.m., suggesting that most students attend school when they are least alert and are released from school when they are reaching their peak levels of alertness (Tonn, 2006; New York State United Teachers, 1998; Allen & Mirabile, 1989). Dr. Mark Mahowald, medical director of the Minnesota Regional Sleep Disorders Center stated: "We're sending [high school students] to school during the last one-third of their sleep cycles. It's comparable to adults getting up at 3 a.m. or 4 a.m." (Delisio, 2003).

### **Effects of Insufficient Sleep**

Insufficient sleep impacts people in a number of ways. Negative effects of sleep deprivation include (National Sleep Foundation, 2008a; Dean, 2006; Yan & Slagle, 2006; Mitru et al., 2002; Downs, 2001; Graham, 2000; Carskadon, 1999):

- daytime sleepiness and fatigue;
- deficits in information processing;

- memory lapses;
- difficulty handling complex tasks;
- decreased creativity;
- reduced productivity;
- difficulty concentrating;
- lack of initiative;
- impaired decision making skills;
- decreased ability to engage in abstract thinking;
- slower reaction time;
- behavioral problems, such as increased irritability, anxiety, and depression;
- aggressive or inappropriate behavior; and
- increased likelihood of stimulant use.

The National Sleep Foundation's (2006) *Sleep in America* poll found that adolescents who exhibited symptoms of depression on a frequent basis were more likely to have sleep problems. Adolescents who scored high on the poll's depressive mood scale were more likely to report that they took longer to fall asleep on school nights, got an insufficient amount of sleep, and had problems related to sleepiness. In fact, 73 percent of adolescents who reported feeling depressed also reported not getting enough sleep at night and feeling excessively sleepy during the day.

Several studies have correlated insufficient sleep with significant decreases in adolescents' overall academic performance.

- Wolfson and Carskadon (1998) surveyed 3,120 Rhode Island high school students at four public high schools in three different school districts using the *School Sleep Habits Survey*. They found that students who reported getting poor grades (Cs, Ds, and Fs) stated that they got 25 minutes less sleep a night than students who reported getting As and Bs. In addition, students who stated that they got less sleep also reported more sleep/wake behavior problems, such as arriving late to class because of oversleeping and feeling tired nearly every day. Although an assumption of cause and effect is not warranted as a result of this study, a self-reported relationship appears to exist.
- Acebo and Carskadon (2002) analyzed data from Rhode Island administrations of the *School Sleep Habits Survey*, controlling for gender; ethnicity; self-assessment of health; and use of caffeine, tobacco, alcohol, or drugs. They found that students who reported less total sleep time also reported more sleep/wake behavior problems, such as difficulty waking up in the morning, oversleeping, and difficulty falling asleep at night. The researchers concluded that many factors, such as health, learning disabilities, and substance abuse, contributed to differences in adolescents' daytime functioning, but even after controlling for these factors, the amount of sleep students received was still an important predictor of self-reported daytime functioning.
- Kelly, Kelly, and Clanton (2001) administered surveys to 148 college students regarding their sleep habits and academic performance. Participants self-reported their average nightly sleep length and their overall college grade point average (GPA). Students were classified as short sleepers (six or fewer hours per night), average sleepers (seven to eight hours per night), or long sleepers (nine or more hours per night). Long sleepers reported a significantly higher GPA than short sleepers (3.24 versus 2.74). Average sleepers' GPA (3.01) was not significantly different than long or short sleepers' GPA. The researchers suggested that short sleepers' lower GPA may have been the result of a decreased ability to focus on education-related activities; however, they noted that their results would have had greater validity if they had obtained school-reported GPAs, instead of relying solely on self-reported GPAs.
- Epstein and associates (1995) studied the sleep habits, school starting times, and academic performance of approximately 6,500 Israeli students attending 40 elementary, middle, and senior high schools. They reported significant correlations between total reported sleep time and students' tardiness, ability to concentrate in school, and tendency to fall asleep during class.

## Research on Optimal Time of Day

Research supports the idea that the majority of people have a certain time of day when they are most alert and able to perform at their best. Students' academic performance may be enhanced when they are provided with learning opportunities during this time period; however, identifying the best time of day to teach is difficult, as studies indicate there is no one time of day that is best for everyone in a particular age group (Banks & Atkinson, 2002; Mitru et al., 2002; University of Minnesota, 1998b; Ammons et al., 1995).

The following two studies suggest that some skills may be more influenced by students' optimal time of day than others.

- McElroy and Mosteller (2006) administered the *Horne & Ostberg Morningness-Eveningness Questionnaire* (a measure of morning or evening preference) to over 250 students attending Appalachian State University. Only students falling under the classification of "definitely morning" and "definitely evening" types were included in the study. The researchers found that in courses that were very difficult, students' preferred time of day had a strong influence on their grades. In other words, students who preferred the morning received higher grades when they took difficult courses in the morning; conversely, those who preferred the evening received higher grades when they took difficult courses later in the day. Students' preferred time of day did not influence their performance in less difficult courses. Results also suggested that students with a strong evening preference were most affected by the time of day at which they took their classes.
- Goldstein and associates (2007) administered a morning-evening preference scale to 259 young adolescents, ranging from 11 to 14 years old. Only students who obtained extreme morning and evening scores participated in the study. Students were randomly assigned to either a morning session or an afternoon session and administered the WISC-III IQ test. The researchers found that on measures of fluid intelligence (abstract reasoning), students tested at their optimal times of day significantly outperformed those tested at their non-optimal times. However, scores on crystallized intelligence measures (accumulated knowledge and experience) did not change across the day. Using an estimate of the full-scale IQ score and collapsing across the fluid and crystallized measures, the researchers found approximately a six-point difference in full-scale IQ equivalents as a function of the match between an individual's optimal time of day and the time of testing.

## Research on Later High School Starting Times

Studies have provided strong evidence that American high school students do not get enough sleep and that their biological clocks, not environmental factors, are responsible for their tendency to go to sleep later and wake up later in the day. Studies have also demonstrated that adolescents suffer a variety of negative consequences when they don't get enough sleep. It seems logical to assume then that delayed high school starting times would contribute to higher levels of daytime functioning. Unfortunately, only a few studies have been conducted to specifically answer this question. Consequently, the impact of delaying the start of the school day is not yet well understood.

Before reviewing the research on later high school starting times, it is important to note some limitations of the studies conducted to date. These limitations include (Yan & Slagle, 2006; Taras & Potts-Datema, 2005; Wolfson & Carskadon, 2003):

- Most researchers conducted correlational studies. Their findings demonstrate the existence of a relationship between later high school starting times and the outcome measures studied, but not a cause and effect relationship (for example, they confirm there is a relationship between later high school starting times and higher grades, but not that later starting times actually caused higher grades).
- Studies did not randomly assign students to schools or districts. Without random assignment, it cannot be definitively concluded that groups of students were truly comparable or that observed differences in outcomes were not the result of extraneous factors or pre-existing differences.

- In many studies, data collection was based on unvalidated, self-reported information. Future studies should use more objective sources of measurement, such as standardized test batteries and sleep laboratory recordings.
- The majority of studies did not take into account other factors, such as income level, parental involvement, and employment hours, that may have confounded the results.
- All of the studies were based on specific geographic areas and school systems. Large-scale, multi-site studies are needed before any generalizations can be made.

Minneapolis was the largest district in the United States to alter its starting times based at least in part on sleep research. During the 1997-98 school year, the Center for Applied Research and Educational Improvement (CAREI) at the University of Minnesota was asked by the Minneapolis School Board to examine the impact of later high school starting times on its students, staff, families, and community members. Many of the findings reviewed below are based on multiple studies conducted by CAREI. Therefore, a brief description of the delayed high school starting time initiatives in Minneapolis Public Schools and nearby Edina Public Schools is provided below.

Beginning in the 1997-98 school year, Minneapolis Public Schools pushed high school starting times back one hour and 25 minutes (from 7:15 a.m. to 8:40 a.m.). Middle school starting times were delayed two hours (to 9:40 a.m.). Elementary schools, which had all started at 9:40 a.m. prior to the switch, started at one of three times (7:45, 8:40, or 9:40 a.m.). Three tiers of starting times were needed so each school bus could make three round trips, since the district bused 90 percent of its students. Edina Public Schools, a district in a southwestern suburb of Minneapolis, had already made the decision to start its high school day 70 minutes later one year earlier. It should be noted that Minneapolis' high schools were in an urban, low income setting with a large immigrant population and where half of the students failed to complete high school. In contrast, suburban Edina had high income levels, enrollment was stable, and most students graduated high school and went on to attend college (Graham, 2000; Lawton, 1999; Wahlstrom, 1999).

Research conducted on the impact of later high school starting times is summarized below. Studies are presented according to the following outcome measures: sleep habits; academic performance; attendance and tardiness; depressive feelings and behaviors; after-school activities; traffic accidents; and parent, teacher, student, and employer perceptions.

### **Sleep Habits**

Studies consistently indicate that students attending high schools with later starting times are more likely to use the extra time in the morning to sleep longer, rather than extend their bedtimes on school nights. Students attending high schools with delayed starting times also report less daytime sleepiness.

- Carskadon and associates (1998) studied ninth grade students attending one Rhode Island junior high school that started at 8:25 a.m. The students were followed as they advanced to tenth grade and attended a high school that started at 7:20 a.m. (65 minutes earlier). Sleep time estimates were based on actigraphy, or sensors worn by students that measured their gross motor activity. According to the actigraph recordings, students woke up earlier in the morning following their enrollment in the school with the earlier starting time, but went to sleep at about the same time (around 10:40 p.m.). The earlier starting time was associated with significantly more sleep deprivation and daytime sleepiness.

When given the opportunity as part of the experiment to try to fall asleep shortly after they arrived at school in the morning, tenth grade students fell asleep on average in 5.1 minutes, a speed that the researchers labeled as pathologically sleepy. The research team concluded that the early high school starting time was associated with significant sleep deprivation and that "imposition of early school starting times may require unrealistic - if not unattainable - bedtimes to provide adequate time for sleeping." [The reader should view these findings with a certain degree of caution, as they are based on a small number of students (32 in ninth grade and 26 in tenth grade)].

- The University of Minnesota's (1998b) *School Start Time Study* focused on data obtained from three Minnesota school districts that responded to the *School Sleep Habits Survey*. The study compared grades 10-12 students in one district who attended high schools with delayed starting times (between 8:00 and 8:30 a.m.) to students in two districts with earlier high school starting times (between 7:30 and 8:00 a.m.). The student populations in the three districts were similar in terms of socioeconomic status and ethnic diversity. The researchers found that students in the district with the later starting time reported that they did not go to bed much later than students in the other two districts but woke up approximately one hour later. Students in the later starting district also reported significantly less daytime sleepiness.
- Wahlstrom and colleagues (1998) analyzed data from the *School Sleep Habits Survey*, administered to a stratified random sample of approximately 500 students attending three Minneapolis late starting high schools. Survey data were also obtained from a stratified random sample of high school students enrolled in a demographically similar urban high school that started 70 minutes earlier. The Minneapolis high school students reported sleeping approximately one extra hour each night compared to their peers who began school earlier. Students whose school day started later reported significantly less daytime sleepiness. For example, students in the late starting schools reported that they were less likely to arrive late to class because of oversleeping, fall asleep in class, and feel sleepy while taking a test, reading, or studying.
- Middle school and high school starting times were pushed back one hour in a countywide school district in Kansas (from 8:00 to 9:00 a.m. at middle schools and from 7:30 to 8:30 a.m. at high schools). Surveys administered to approximately 10,000 students both before and after the change in school starting times revealed that when school started one hour later, students averaged from 12 minutes (grade 9) to 30 minutes (grade 12) more self-reported nightly sleep. The percentage of students who slept at least eight hours per night increased significantly, from 36 percent to 50 percent, and the percent of students who slept at least nine hours increased from 6 percent to 11 percent. Students also reported less daytime sleepiness (Danner & Phillips, 2008).
- In Wilton, Connecticut, 259 students were administered the *School Sleep Habits Survey* following implementation of a 40-minute delay in their high school's starting time (from 7:35 to 8:15 a.m.). Survey responses indicated that students' bedtimes did not change and that they got approximately 35 minutes more sleep each night after the time change was implemented. The number of students who reported that "daytime sleepiness was not a problem" doubled (National Sleep Foundation, 2005b).
- After Fayette County Public Schools in Lexington, Kentucky delayed middle school and high school starting times by one hour, students in every grade level (from grades 6 to 12) reported that they averaged up to 50 extra minutes of sleep each night. The percent of high school students getting at least eight hours of sleep per night increased from 21 percent to 51 percent (National Sleep Foundation, 2005a).
- Kowalski and Allen (1995) studied 119 high school seniors attending a late starting school (9:30 a.m.) and 97 high school juniors and seniors attending an early starting school (7:20 a.m.). All students completed a sleep-wake questionnaire. Results indicated that total sleep time during the school week was significantly longer for the late starting group (7.5 hours versus 6.9 hours). The researchers noted, however, that even the late starting group did not get a sufficient amount of sleep. They concluded that starting high school at 9:30 a.m. did not reduce the effects of sleep lag (similar to jet lag, when the body's clock is out of sync with the natural sleep and wake times) as much as they had anticipated.
- Baroni and associates' (2004) study of seventh and eighth grade students attending two New England middle schools found that students whose school started later reported sleeping one hour longer on school nights than students attending the school with the earlier starting time. The researchers concluded that although students at both schools were not getting enough sleep, the negative effects of sleep deprivation were far more pronounced in students attending the earlier starting school.

## **Academic Performance**

Some studies suggest that school starting times may be associated with students' levels of academic performance, although more research is needed before any definitive conclusions can be drawn.

- The University of Minnesota's (1998b) *School Start Time Study* focused on data obtained from three Minnesota school districts that responded to the *School Sleep Habits Survey*. The study compared grades 10-12 students in one district who attended high schools with delayed starting times (between 8:00 and 8:30 a.m.) to students in two districts with earlier high school starting times (between 7:30 and 8:00 a.m.). The student populations in the three districts were similar in terms of socioeconomic status and ethnic diversity. The researchers found that students in the district with the later starting time reported significantly higher grades than students in the other two districts. As noted by the researchers, however, these results should be interpreted with caution because the study did not control for students' prior levels of academic achievement. In addition, students in the district with delayed starting times reported spending more time studying than students in the other two districts. Therefore, their higher grades may have been the result of more studying, not the later bell schedule.
- Wahlstrom (2002) analyzed the school grades of students in seven Minneapolis high schools over the course of five years. Data were available for two years when high schools began at 7:15 a.m. and for three years when they began at 8:40 a.m. The researchers found that after starting times were delayed, students' grades improved slightly, but not significantly. Wahlstrom warned that these conclusions should be viewed with caution, as grades are influenced by subjective factors, such as curricular changes, teacher and administrator turnover, and changes in how students' performance is assessed over time.
- In contrast to other findings, Trockel and associates' (2000) study of college students' grades and sleep habits found that later wake-up times were actually associated with lower average grades. The researchers surveyed 200 randomly selected college freshmen regarding their sleep, exercise, and eating habits; mood states; perceived stress; time management; social support; spiritual or religious habits; and number of hours worked per week. They also obtained GPAs from the university registrar. Of all the variables considered, sleep habits, particularly wake-up times, accounted for the largest amount of variance in GPA. For each hour of delay in reported average weekday rise time, the predicted GPA decreased by 0.13 on a grading scale of 0.0 to 4.0.

## **Attendance and Tardiness**

Most studies suggest that delayed high school starting times reduce tardiness. In some cases, later starting times may also lead to increased attendance.

- Wahlstrom and colleagues (2001) examined five years of attendance data (1995-96 to 1999-2000) from the Minneapolis Public Schools: two years of data from when high schools began at 7:15 a.m. and three years of data from when they began at 8:40 a.m. Students were divided into two groups: those who had been continuously enrolled in the same high school for two or more years and those who had been enrolled in different high schools over a two-year period. For continuously enrolled students in grades 9-11, the researchers found no significant difference in attendance rates between the years with the early start and the years with the later start. However, the attendance rate of students in grades 9-11 who had not been continuously enrolled in the same high school increased significantly after school starting times were delayed. These students' combined attendance rate increased from an average of 73.7 percent with the early start to 77.5 percent with the later start. The researchers theorized that continuously enrolled students' attendance rates may not have increased significantly because they were already at high levels (93-94 percent) before the change in school starting times. It should be noted that grade 12 attendance rates were not deemed to be an accurate outcome measure because many of these students had already completed some of their required classes and therefore attended school for only part of the day.

- The University of Minnesota's (1998b) *School Start Time Study* of three Minnesota school districts found that students attending schools with later high school starting times were significantly less likely to report arriving late to class because of oversleeping, compared to students attending schools with earlier starting times. The researchers noted a slight, but not significant, improvement in attendance rates during the first year of the later starting time.
- In 1999, Fayette County Public Schools in Lexington, Kentucky pushed the high school starting time back one hour (from 7:30 to 8:30 a.m.). Middle school starting times were also delayed by one hour (from 8:00 to 9:00 a.m.). District officials reported that the middle school attendance rate, which was already high, remained fairly stable. For high school students, however, dramatic decreases in absenteeism and tardiness were noted (Lawton, 1999).
- The Public Schools of North Carolina (1999) identified one school in the state that had implemented a delayed high school starting time. District officials reported that the number of students arriving late to school dropped significantly after the later starting time was implemented.
- Baroni and associates' (2004) study of seventh and eighth grade students attending two New England middle schools found that students whose school started earlier were tardy four times more often than students whose school started later.
- In the fall of 2003, Wilton Public Schools in Wilton, Connecticut reversed the upper elementary starting time (8:15 a.m.) with the middle and high school starting times (7:35 a.m.), giving older students an extra 40 minutes of time for sleep in the morning. In contrast to most studies previously cited, the National Sleep Foundation (2005b) reported that Wilton Public Schools did not see any change in tardiness or attendance rates.

### **Depressive Feelings and Behaviors**

Students attending schools that start later report significantly fewer depressive feelings and behaviors. The reader should note that although these results indicate there is a relationship between delayed school starting times and depression, it has not been demonstrated conclusively that later starting times actually cause students to have fewer feelings and behaviors associated with depression.

- Wahlstrom and colleagues (1998) analyzed data from the *School Sleep Habits Survey*, administered to a stratified random sample of approximately 500 students attending three Minneapolis high schools. Survey data were also obtained from a stratified random sample of high school students from a demographically similar urban high school that started 70 minutes earlier. Students attending the late starting Minneapolis high schools reported significantly fewer feelings and behaviors often associated with depression (such as unhappiness, sadness, hopelessness, and worrying) than students attending the earlier starting comparison school.
- Wahlstrom (2002) conducted a longitudinal study of later high school starting times in the seven Minneapolis high schools that shifted their starting times from 7:15 to 8:40 a.m. She found that students reported significantly fewer depressive feelings after their schools' starting time was delayed.
- The University of Minnesota's (1998b) *School Start Time Study*, based on data obtained from three Minnesota school districts that pushed back their starting times, found that students who reported more sleepiness also reported significantly more depressive feelings and behaviors.

### **Participation in After-School Activities**

Studies suggest that levels of participation in after-school activities remain at similar levels after high schools switch to later starting times (and consequently, later release times). However, many students and teachers report conflicts between later release times and after-school activities.



- The University of Minnesota's (1998b) *School Start Time Study* focused on data obtained from three Minnesota school districts that responded to the *School Sleep Habits Survey*. The researchers concluded that the later high school dismissal times did not restrict student participation in after-school extracurricular activities or organized sports.
- Wahlstrom and colleagues (1998) studied three Minneapolis high schools that delayed their starting and release times. They found that later bell schedules did not restrict student participation in organized sports. In fact, Minneapolis students spent more time participating in organized sports than students attending a comparable urban school district with earlier starting times. However, survey data collected from teachers at the three Minneapolis schools indicated that they believed later dismissal times conflicted with students' participation in athletic activities. Interviews conducted with 18 high school athletic coaches revealed that 72 percent stated that the change had been difficult. Problems reported by the coaches included students leaving class early for competitions; shortened practices; lack of facilities to accommodate teams' practices and competitions; less student participation in athletics; and a shortage of buses to take athletic teams to practices and games. The researchers concluded that the impact of later dismissal times on student athletes is a critical issue that must be resolved.
- Kubow and associates (1999) studied the impact of later starting times on students attending Minneapolis and Edina high schools. While Edina students were generally positive about the change, many Minneapolis students reported that the later dismissal time limited their participation in after-school activities. Lack of athletic field lights, for example, required some sports practices to be held in the early morning, negating the potential sleep gains. Students from both districts reported complications related to the last period of the day, when they had to be excused from class in order to participate in extracurricular activities.
- Wahlstrom and Freeman's (1997) study of the impact of later starting times in Minneapolis and Edina district high schools found that after-school athletic practices, extracurricular activities, and extended day programs were shortened in both districts. However, actual participation rates in after-school sports and extracurricular activities remained at similar levels following the delay in dismissal times. Most coaches and activity leaders were generally supportive of the change, reporting that students were less tired and more alert at the end of the day.
- Wahlstrom (2000) collected data from the Minneapolis and Edina school districts and found that students reported working the same amount of hours at their after-school jobs as they had worked prior to the delay in high school starting and dismissal times.
- In Wilton, Connecticut, district officials reported a continued rise in athletic program participation after the high school starting time was delayed 40 minutes. The only difficulties noted were for students who participated in multiple sports and when students had to be released from class early for away games (National Sleep Foundation, 2005b).

### **Traffic Accidents**

Earlier school starting times have been associated with more reports of students driving while drowsy. Two studies suggest that later high school starting times may help to reduce the number of adolescent traffic accidents.

- Middle school and high school starting times were pushed back one hour in a countywide school district in Kansas (from 8:00 to 9:00 a.m. at middle schools and from 7:30 to 8:30 a.m. at high schools). Average crash rates for the county's teen drivers in the two years after the delay in starting time decreased 16.5 percent, compared to the two years prior to the change. Teen crash rates for the rest of the state, where school schedules had not been adjusted, increased 7.8 percent over the same time period (Danner & Phillips, 2008).

- Fayette County Public Schools in Lexington, Kentucky flipped elementary and high school starting times (delaying the beginning of the high school day by one hour). The National Sleep Foundation (2005a) reported that while the rate of traffic accidents statewide increased 8 percent over the two years after the schedule change, Fayette County's accident rate decreased by over 15 percent.

### **Perceptions of Parents, Teachers, Students, and Employers**

In general, stakeholders have mixed perceptions of delayed high school starting times. Parent opposition to schedule changes is often one of the biggest obstacles districts face when delaying high school starting times. Many parents are concerned about changes they will be required to make to their established work, childcare, and transportation schedules. Teachers and students often report difficulties related to the scheduling of after-school sports, extracurricular activities, and employment. The majority of employers, however, indicate that delayed release times have little or no impact on students' employment opportunities.

#### Parent Perceptions

- Wrobel (1999) concluded that the schedule change at Minneapolis high schools had a profound effect on some families. Income level had a significant impact on families' ability to adjust to the change. Lower income families expressed concern about the effect of the later dismissal time on their children's after-school jobs. Some parents expected their children to work, either to supplement the basic family income or to cover unmet personal expenses and leisure activities. In order to maintain their own jobs, some lower income parents whose work schedule did not match their children's new school schedule had to leave their children unsupervised for parts of the day. Older siblings who had previously provided after-school care for younger siblings were now unavailable. Many of these parents mentioned that affordable, reliable daycare options did not exist in their community.

The concerns in the lower income communities about leaving young children unsupervised did not surface in the more affluent communities. The more affluent families were often better able to accommodate changes in routine by simply altering their work schedules to match their children's new school schedules. The result was that families in more affluent communities reported that school schedules should be based on the best interests of the children, while less fortunate families were more concerned with transportation, child care, and employment issues.

Parents' involvement in the district's decision to delay starting times affected how they responded to the change. Those who described the policy process as open and sensitive to their needs reported being better able to make changes to their schedules. Families that reported less involvement in the process were often vocal in their distrust of the reasons given for the schedule change.

- Wahlstrom's (2002) study of Minneapolis and Edina school districts found that 92 percent of Edina parents responding to a written survey stated that they supported the change to a later school starting time. Negative comments focused on the later time their children arrived home after participating in after-school activities or sports. The reactions of Minneapolis parents, interviewed in focus groups, were more mixed. Many parents offered negative comments related to changes they were required to make in their employment and transportation schedules.

#### Teacher Perceptions

- Wahlstrom and Freeman (1997) studied the impact of later starting times in Minneapolis and Edina district high schools. Surveys were completed by 335 teachers. The researchers found that Edina teachers were more positive about the change than Minneapolis teachers. The majority of Edina teachers approved of the schedule change, while Minneapolis teachers were evenly divided. Edina teachers were nearly unanimous in their view that students were more alert throughout the day. In contrast, only a slight majority of Minneapolis teachers believed the new schedule improved students' alertness and sleepiness during the first two class periods and about half agreed that fewer students were sleeping at their desks. In Edina, teachers reported an increase in the number of students

coming to school early to get additional help. In Minneapolis, teachers reported no increase in the number of students coming to school early to get extra help and a decrease in the number of students seeking extra help after school. In both districts, teachers expressed concern about the need for students to be excused from the last class of the day in order to participate in athletic events and after-school activities. In addition, teachers in both districts stated that the new schedule had a negative impact on field trips and other after-school activities that required busing of students.

In general, the later school starting time had a positive impact on teachers' personal lives before school, but an adverse impact on their after-school schedules. Teachers cited time to exercise before going to work, feeling more rested at the start of the day, and having more personal family time in the morning as benefits of the later starting time. The most frequently cited disadvantage of the later starting time was driving in heavier traffic both to and from school. Teachers also reported being more tired at the end of the day than in previous years.

- Wahlstrom, Wrobel, and Kubow (1998) surveyed teachers at three Minneapolis high schools. When asked about their overall feelings toward the later starting time, 45 percent stated they "liked it" or "loved it," 44 percent responded they "didn't like it" or "hated it," and 11 percent were neutral. Surprisingly, only 3.5 percent of the respondents indicated they would choose to return to the previous starting time of 7:15 a.m. The ideal starting time for Minneapolis high schools, according to these teachers, was 8:00 a.m., with 73 percent of respondents choosing a starting time of 8:00 a.m. or later.
- The Public Schools of North Carolina (1999) examined the impact of later high school starting times on districts around the country. They found that overall, teachers in schools with later starting times reported that students were more alert during their early classes, but also noted that some students appeared tired at the end of the day. Among teachers who were also athletic coaches, concerns were expressed about the number of times student-athletes had to be excused from last period classes in order to get to events on time. In general, teachers reported they liked the extra time in the morning, either to better prepare for their classes or to enjoy personal time before work, but some stated they disliked driving in heavier traffic in the afternoon. In one North Carolina high school that had delayed its starting time, interviews and a focus group conducted with the school's teachers and administrators revealed that staff believed the later starting time had significantly enhanced the learning environment during the early periods of the day because both students and teachers were more alert.

### Student Perceptions

- Kubow, Wahlstrom, and Bemis' (1999) study concluded that students attending Minneapolis and Edina high schools perceived the delayed starting time very differently. Focus groups conducted with Minneapolis students indicated they felt they had less time for homework, athletics, and other after-school activities. In addition, conflicts in scheduling often restricted the number of extracurricular activities in which students could participate. The Minneapolis students also felt the later dismissal time limited the number of hours they could work, the amount of money they could earn, and the types of jobs available to them. A number of students did acknowledge, however, that they were less tired at the end of the day than they had been when they woke up earlier.

In contrast, focus groups conducted with students from suburban Edina High School found these students were satisfied with the new schedule and reported feeling less tired during the day. Nearly all students reported they were more alert for the first hour of class and were getting more sleep each night. They did not feel that the new schedule had a negative impact on their involvement in extracurricular activities. Both Minneapolis and Edina students reported that some athletic practices had been moved from the afternoon to the early morning, defeating the purpose of the delayed starting time.

- Wrobel (1999) conducted focus groups to examine Minneapolis high school students' perceptions of the delayed schedule. He found that many students reported a desire to go back to the earlier starting time. These students reported they enjoyed getting up early so they would have more time at the end

of the day for after-school activities and socializing. Students reported that a later dismissal time often resulted in fewer hours available to work at their after-school jobs. In addition to the fewer available hours, students stated that late arrivers were often assigned the least desirable job duties, such as cleaning up and closing activities.

- In Fayette County, Kentucky, some high school students preferred the later starting time and some preferred the earlier starting time. The reason most often cited by students who indicated a preference for the earlier starting time was the opportunity to participate in a variety of after-school activities. District officials noted that it was impossible to accommodate all of the different student and family preferences (Lawton, 1999).

### Employer Perceptions

Several studies indicate that later dismissal times have little or no impact on students' employment opportunities.

- The National Sleep Foundation (2008b) reported that studies have shown employers do not believe a change in high school starting times affects their businesses or the number of hours their student employees can work. Employers stated that extra help was not usually needed until school was released anyway.
- The Public Schools of North Carolina (1999) talked to schools around the country that had implemented later high school starting times. They reported that the consensus among these schools was that area businesses accommodated students' later arrival at work, as long as the change was not too drastic.
- University of Minnesota's (1998a) *School Start Time Study* surveyed Minnesota businesses to determine the effect of later high school dismissal times on local employers. Employers indicated that later dismissal times had little or no impact on students' employment opportunities.

### **Impact of Delayed Starting Times on the Community**

Many issues must be considered when delaying the start of the school day. Most experts agree that complicating factors vary by location and depend on the number of students enrolled in the school system, the socioeconomic characteristics of the community, and stakeholders' support of the schedule change (Lamkin-Carughi, 2007; Yan & Slagle, 2006; Delisio, 2003; Downs, 2001). The National Sleep Foundation (2000) stated: "Individual communities can vary greatly in their priorities and values, and adopting a policy of later starting times in high schools might not be optimal for every community or even for every school within a community."

Key issues that must be resolved before later starting times can be implemented include:

- **Bus schedules.** School districts often operate on a tiered bus system that uses the same buses to transport elementary, middle, and high school students by staggering pick up and drop off times. This system saves districts millions of dollars in the purchasing of buses and hiring of bus drivers. Therefore, in order to avoid a significant increase in transportation costs, later high school starting times often have to be countered by earlier starting times for younger students (National Sleep Foundation, 2008b; Downs, 2001; Public Schools of North Carolina, 1999).

The National Sleep Foundation (2000) stated that transportation services may be the single most complex and costly factor in delaying high school starting times, especially if the schedule change results in the need for additional buses. Other transportation issues include the number of hours that bus drivers work (which may be influenced by the amount of other traffic while en route); the effect of school buses on commuter traffic; and the availability of school buses for transportation to extracurricular activities (National Sleep Foundation, 2000).

- **Student safety.** When high school and elementary school starting times are switched, young children may have to wait at bus stops or walk to school in the dark, presenting a significant safety hazard. Many community members believe it is safer for older children to commute in the morning darkness. In Arlington, Virginia, the school district switched middle school, instead of elementary school, starting times with high school starting times (Truempy, 2008; Robinson, 2006; Delisio, 2003; National Sleep Foundation, 2000; Public Schools of North Carolina, 1999).
- **Family schedules.** Wahlstrom (1999) stated that changing a school's starting time provokes the same kind of emotional reaction from stakeholders as closing a school or changing its attendance boundaries. Most families have devised highly coordinated schedules that balance each member's multiple activities and commitments. A new school schedule means creating a whole new family schedule. Established work, child care, and drop off and pick up schedules have to be revised to match the school's new starting and dismissal times. Other issues to consider when changing school starting times include the availability of adolescents to care for younger siblings or other household members and their responsibilities for household chores and meal preparation (National Sleep Foundation, 2008b; Dean, 2006; Strauss, 2006; Downs, 2001; National Sleep Foundation, 2000; Public Schools of North Carolina, 1999).

In 2008, Orange County Public Schools reversed high school and middle school starting times. The change, which moved high schools to 9:30 a.m. and middle schools to 7:30 a.m., saved the district over \$4 million in bus driver and fuel expenses during the 2008-09 school year. In May 2009, the school board voted to return to the original starting times. Board members cited opposition from students and parents and middle school student safety issues as reasons they voted for the schedule reversal. The board hopes the district can find other ways to cut transportation costs that don't create as much disruption for students. Reinstating the old schedule will cost the district approximately \$5 million. Superintendent Ronald Blocker stated that other programs will be cut to make up for the funds that will have to be returned to the transportation department's budget (Hobbs, 2009; Thomas, 2009; WFTV, 2009). Similarly, in 2005 the superintendent of Pinellas County Schools dropped a plan to move high school starting times from 7:05 a.m. to 9:00 a.m. after a *St. Petersburg Times* poll found that most parents opposed the plan, with many citing fear that students' after-school jobs would be in jeopardy (Strauss, 2006). In Fairfax County, Virginia Public Schools, a year-long study with a 50-person task force was unable to identify a way to change bell schedules that would not generate the opposition of parents in the local community (Covino, 2001).

- **After-school extracurricular and athletic activities.** When dismissal times are delayed, extracurricular activities and athletic events must also shift to later in the day. Athletic coaches contend that delayed dismissal times disrupt game schedules and practice times. Teachers worry that athletes will be required to leave class early in order to attend games. Greater competition for field and gym space may result in the cancellation of some programs. Schools may have to install lights for their athletic fields due to fewer hours of daylight for practices and games. If dismissal times differ among schools in the same competitive league, adjustments may be needed to maintain programs. The general consensus among districts that have implemented delayed starting times is that a small change (30 to 45 minutes) has been manageable (National Sleep Foundation, 2008b; Truempy, 2008; Dean, 2006; Strauss, 2006; Delisio, 2003; Keller, 2001; Public Schools of North Carolina, 1999).
- **After-school instructional activities.** After-school instructional activities, such as tutoring sessions, homework clubs, and study groups, are pushed even later into the afternoon when dismissal times are delayed. Students have less time to use the library and other community resources (National Sleep Foundation, 2008b; Public Schools of North Carolina, 1999).
- **After-school jobs.** Many stakeholders are concerned that delayed dismissal times will have a negative effect on students' after-school employment opportunities. Later release times leave students with fewer hours to work. The delayed release time may disproportionately affect low income families who depend on adolescents' income for substantive needs (Hui, 2009; Hagan, 2008; National Sleep Foundation, 2008b; Strauss, 2006; Public Schools of North Carolina, 1999).

- **Use of school facilities for community activities.** Delayed dismissal times complicate the scheduling of community activities that are held at school facilities, such as gyms and pools. When student events are pushed later into the day, they may conflict with the time the facilities would have been used by community groups. Revenue potential from leasing facilities must also be considered (National Sleep Foundation, 2000; Public Schools of North Carolina, 1999).
- **Students driving during rush hour.** When students are released from school later in the day, they may have to drive home in rush hour traffic (Public Schools of North Carolina, 1999).
- **Food service.** A change in bell schedules may require a change in meal times or the addition of breakfast services. These changes often result in the need to revise employee schedules or even increase their hours (National Sleep Foundation, 2000).
- **Teachers' Schedules.** A later dismissal time may create difficulties for teachers who work second jobs at night, such as teaching at a local college, or who are enrolled in evening classes (Public Schools of North Carolina, 1999).

### Guidelines for Implementing High School Schedule Changes

A change to the high school schedule affects many different aspects of the community. Most researchers agree that school starting and dismissal times are a local decision and there is no single schedule that will suit every district (Hagan, 2008; Truempy, 2008; Lawton, 1999). Following are some guidelines districts can follow if they decide it is in the best interests of their students and the community to delay high school starting times:

- Form committees to examine logistical problems associated with delayed starting times and identify possible solutions (National Sleep Foundation, 2008c; Wahlstrom, 1999).
- Talk to other districts that have changed their starting times to learn from their experiences (National Sleep Foundation, 2008c; Robinson, 2006).
- Consider starting with a pilot program. For example, Wake County Public School System is currently considering a delay in starting times for only a few high schools and may first make the option available to its lower-performing schools (Hui, 2009).
- The National Sleep Foundation (2008c) urged districts to “keep your eye on the bottom line - the academic performance, safety, and quality of life for students. Don't get overwhelmed by the logistics and obstacles. Continue to emphasize the positives of the overall goal. Students' needs are foremost.”
- Some districts have found that the simplest and most cost-efficient way to delay high school starting times is to switch them with elementary or middle school starting times. Earlier elementary and middle school starting times are also more aligned with younger children's sleep patterns (National Sleep Foundation, 2008b).
- For many districts, the biggest obstacle to changing starting times is the cost and scheduling of buses. In addition to flipping elementary or middle school starting times with high school starting times, some districts have switched high school students from a district-operated bus system to public transportation. In Denver, for example, the school district saved approximately \$750,000 per year and decommissioned about 60 buses when they issued high school students public bus passes that could be used during the day, as well as on evenings and weekends at no additional cost (Trudeau, 2007; National Sleep Foundation, 2005c).
- Consider all relevant environmental factors, such as local traffic patterns, rush hours, and faculty and staff commutes (Robinson, 2006).

- Consider shorter periods of time between classes to reduce the delay in dismissal times. Concerned that after-school sports schedules would be affected by later dismissal times, students attending a high school in the Mahtomedi School District in Minnesota agreed to shorten the number of minutes allotted to get from one class to another. Although first bell was delayed by 35 minutes, the school day ended at about the same time (Trudeau, 2007).
- It is important to involve all stakeholders in the decision-making process and listen carefully to their concerns. Districts should gather input from and have open discussions with all parties affected in the local community to debate the range of possible options before the decision is made to implement a schedule change. Some school districts have distributed stakeholder surveys to determine the preferences of the community at large. Districts should keep stakeholders educated and involved in a variety of ways, including letters, emails, message boards, public hearings, and town forums (Hagan, 2008; Robinson, 2006; National Sleep Foundation, 2005b; Wolfson & Carskadon, 2005; Downs, 2001; Graham, 2000; Lawton, 1999).
- Communities can adjust more easily to a new schedule when they are given ample time to prepare for the change. Staff members and parents need time to adjust their personal and family schedules and providing them with that time is one key to a smooth transition. In Minneapolis, schools that were notified in the spring that their starting times would change in the fall encountered much less resistance from parents and staff members and reported less difficulty making the necessary adjustments than schools that learned about the change shortly before the school year began (National Sleep Foundation, 2008b; Downs, 2001; Wahlstrom, 1999; Wrobel, 1999).
- Once a schedule change is made, districts should make efforts to obtain support from the local community. For example, districts can encourage community agencies to provide childcare since adolescents may no longer be available to supervise younger siblings after school. In one Kentucky community, the local YMCA responded by offering daycare for younger students. Another concern is that young children will have to wait at bus stops in the dark when schedules are flipped and elementary schools start earlier. Parents in some communities have been encouraged to organize a rotating schedule of “bus stop supervisors” for each neighborhood (National Sleep Foundation, 2008c; National Sleep Foundation, 2005d).
- Inform and involve students in the decision-making process. Material on the impact of insufficient sleep on student performance can be incorporated into different subjects at all grade levels. In Minneapolis, it was reported that in schools where student involvement in the schedule change was limited, students were more likely to stay up later instead of using the later start time to get more sleep (National Sleep Foundation, 2008b; Wrobel, 1999).
- A change in schedules can be especially difficult for certain types of students and programs, such as special education students and career centers. Consideration of delayed starting times should carefully consider the impact schedule changes will have on these populations (National Sleep Foundation, 2008b).

### **When Delayed School Starting Times Are Not An Option: Alternative Ways to Improve Students’ Academic Performance**

Since it may not be practical to implement later starting times in every school district, researchers have recommended alternative actions districts can take to enhance students’ learning.

- **Rotate course schedules.** Some students are more alert in the morning, while others are more alert in the afternoon. Experts believe that a rotating course schedule, in which the time academic subjects are taught changes each day of the week, equalizes the learning process. For example, the scheduling of core academic subjects and non-academic subjects can be flip-flopped throughout the week (i.e., math on Monday, Wednesday, and Friday mornings and Tuesday and Thursday afternoons; art on Tuesday and Thursday mornings and Monday, Wednesday, and Friday afternoons). Another variation

of the rotating schedule is to start subjects at progressively later times each day of the week (i.e., math at 9:00 a.m. on Monday, 10:00 a.m. on Tuesday, 11:00 a.m. on Wednesday, etc.) (Banks & Atkinson, 2002; Ammons et al., 1995).

Teachers are also affected by the time of day. Ammons, Booker, and Killmon (1995) asked: "Is it fair for one class to consistently benefit from being instructed by a teacher who is most alert and enthusiastic in the morning while the afternoon class gets the same instruction but when the teacher is much less enthusiastic?" A rotating course schedule also accommodates these differences.

- **Stop scheduling core academic courses immediately after lunch.** The slump in alertness after lunch is widely recognized by educators but seldom accommodated by school schedules. Course schedules can be revised to work around this less than optimal learning time (Banks & Atkinson, 2002; Ammons et al., 1995).
- **Engage students in active learning.** Learning that involves activities such as role-playing, debate, cooperative learning, oral presentations, and laboratory experiments is a useful strategy for fighting students' daytime sleepiness (Wolfson, 2002).
- **Educate school staff.** Teachers, school health providers, and other school personnel should be educated about adolescents' sleep needs and patterns and about the signs of sleep deprivation (Graham, 2000; National Sleep Foundation, 2000).
- **Educate students.** Many adolescents are unaware of their sleep needs or circadian rhythms. Sleep-related education can be integrated into the curriculum to educate students about the physiology and benefits of sleep and the consequences of sleep deprivation. Relevant subjects include biology, health, and psychology. In addition, driver's education courses should cover the prevalence and prevention of automobile accidents caused by drivers who are sleepy. Students can be taught basic information about sleep, such as maintaining consistent bedtimes and rise times throughout the week; avoiding caffeine, alcohol, nicotine, or other drugs that have disruptive effects on sleep; and exercising regularly (Wolfson, 2002; National Sleep Foundation, 2000; Carskadon, 1999).
- **Napping.** Although the usefulness of napping for high school students is not well researched and may be difficult to implement effectively, napping has been found to improve performance and alertness in adults and college students (Rosekind et al., 1995; Gorin et al., 1994; Dinges & Broughton, 1989). The *San Diego Union-Tribune* reported that students at one high school formed a nap club that met once a week during lunch. Students who were tired went to a classroom to sleep, relax, or watch movies (Saavedra, 2006). The National Sleep Foundation (2009c) cited research indicating that a 10-minute nap produced the most benefits in terms of reduced sleepiness and improved cognitive performance. Wolfson (2002) suggested that future studies evaluate the effectiveness of nap rooms as a way to improve the alertness and performance of high school students.
- **Limit time in after-school jobs.** Several researchers have recommended that communities limit high school students' time in after-school jobs (Wolfson, 2002; Carskadon, 1990). Carskadon's (1990) study of Rhode Island high school students found that students who reported working more than 20 hours per week were significantly more sleep deprived than students who reported working fewer than 20 hours per week. Students whose out-of-school time commitments were greatest (those who reported participating in extracurricular activities at least 20 hours per week and working at least 20 hours per week) reported the latest bedtimes.



## Summary

Educators around the country are questioning whether the traditional early starting times used by the majority of high schools are most conducive to high levels of academic performance. Research indicates that American adolescents are not getting enough sleep, in part because their inborn biological clocks direct them to stay up later and wake up later during their teenage years. Effects of insufficient sleep include daytime sleepiness and fatigue, memory lapses, decreased productivity and creativity, and difficulty concentrating. Several studies have also correlated insufficient sleep with decreases in students' overall academic performance.

While the research reviewed in this report confirmed that adolescents don't get enough sleep and that insufficient sleep is negatively associated with their academic performance, studies have not determined whether delaying high school starting times is the answer to this problem. A limited number of studies have been conducted to specifically investigate the impact of later high school starting times. In general, these studies have found that students attending schools with delayed starting times sleep longer than students attending schools with earlier starting times. No definitive conclusions can be drawn regarding the impact of delayed starting times on students' academic performance, although schools that start later tend to have lower levels of tardiness and, in some cases, absenteeism. Several studies have also suggested that students attending schools with delayed starting times report fewer depressive feelings and behaviors and are less likely to be involved in traffic accidents.

After-school jobs appear to be unaffected by delayed schedules, although later release times have been reported to cause some conflicts between after-school activities and last period classes. While teacher and student perceptions of delayed high school starting times are mixed, parent opposition to schedule changes is one of the biggest obstacles districts face.

Considering the lack of empirical evidence supporting improved academic achievement as a result of setting back school starting times and the potential for collateral harm the change might cause to other facets of school, personal, and family life, school districts should thoroughly deliberate before instituting such a change in policy. Although the research to date has not empirically demonstrated reliable improvements in academic achievement, the multitude of personal and social benefits derived from starting school later may by themselves be sufficient justification. Therefore, starting times at a limited number of senior high schools willing to experiment and pilot test the policy accompanied by a thorough follow-up evaluation regarding the efficacy of the policy change might be a prudent course of action.

This Information Capsule included a discussion of key issues districts must resolve before delaying high school starting times, such as bus schedules, student safety, family schedules, and student participation in after-school activities. Guidelines districts can follow if they decide it is in the best interests of their students and the community to delay high school starting times were also summarized. Since it may not be practical to push back starting times in every school district, alternative actions districts can take to improve students' academic performance are reviewed. These include rotating course schedules, engaging students in active learning, and educating school staff and students about adolescent sleep needs and the signs of sleep deprivation.

## References

- Acebo, C., & Carskadon, M.A. (2002). Influence of Irregular Sleep Patterns on Waking Behavior. In M.A. Carskadon (Ed.), *Adolescent Sleep Patterns: Biological, Social, and Psychological Influences*. Cambridge, England: Cambridge University Press.
- Allen, R.P., & Mirabile, J. (1989). Self-Reported Sleep-Wake Patterns for Students During the School Year from Two Different Senior High Schools, *Journal of Sleep Research*, 18, 132.
- Ammons, T.L., Booker, J.L., & Killmon, C.P. (1995). *The Effects of Time of Day on Student Attention and Achievement*. ERIC Document Reproduction Service No. ED384592.
- Banks, R., & Atkinson, B. (2002). *What Is the Best Time of Day for Student Learning?* Clearinghouse on Early Education and Parenting, University of Illinois at Urbana-Champaign, Urbana, IL.
- Baroni, E.M., Naku, K., Spaulding, N., Gavin, M., Finalborgo, M., LeBourgeois, M.K., & Wolfson, A.R. (2004). Sleep Habits and Daytime Functioning in Students Attending Early Versus Late Starting Middle Schools. *Sleep* (Abstract Supplement), 27, A396-A397.
- Carskadon, M.A. (1990). Adolescent Sleepiness: Increased Risk in a High-Risk Population. *Alcohol, Drugs and Driving*, 5(4), 317-328.
- Carskadon, M.A. (1999). When Worlds Collide: Adolescent Need for Sleep Versus Societal Demands. *Phi Delta Kappan*, 80(5), 348-353.
- Carskadon, M.A., Wolfson, A.R., Acebo, C., Tzischinsky, O., & Seifer, R. (1998). Adolescent Sleep Patterns, Circadian Timing, and Sleepiness at a Transition to Early School Days. *SLEEP*, 21(8), 871-881.
- Covino, J.F. (2001). Eliminating the Snooze Button. *Curriculum Administrator*, 37(6), 44-45.
- Danner, F., & Phillips, B. (2008). Adolescent Sleep, School Start Times, and Teen Motor Vehicle Crashes. *Journal of Clinical Sleep Medicine*, 4(6), 533-535.
- Dean, L. (2006). High School Start Times: How to Get Them on the Same Schedule as Adolescents' Biological Clocks. *The York Scholar*, 3(Fall 2006), 12-22.
- Delisio, E.R. (2003). It's About Time (and Sleep): Making the Case for Starting School Later. *Education World*. Retrieved from [http://www.educationworld.com/a\\_admin/admin/admin314.shtml](http://www.educationworld.com/a_admin/admin/admin314.shtml).
- Dinges, D.F., & Broughton, R.J. (1989). *Sleep and Alertness: Chronobiological, Behavioral, and Medical Aspects of Napping*. New York, NY: Raven Press.
- Downs, G.C. (2001). *On My Own Time: The Conflict Between Adolescent Sleep Needs and High School Start Times*. Occasional Paper No. 38, Center for Research & Evaluation, University of Maine, Orono, ME.
- Epstein, R., Chillag, N., & Lavie, P. (1995). Sleep Habits of Children and Adolescents in Israel: The Influence of Starting Time of Schools. *Journal of Sleep Research*, 24a, 432.
- Goldstein, D., Hahn, C.S., Hasher, L., Wiprzycka, U.J., & Zelazo, P.D. (2007). Time of Day, Intellectual Performance, and Behavioral Problems in Morning Versus Evening Type Adolescents: Is There a Synchrony Effect? *Personality and Individual Differences*, 42(3), 431-440.

- Gorin, A., Kelly, L., & Wolfson, A. (1994). First Year College Students: Effects of Coping Intervention on Sleep Hygiene and Cognitive Arousal. *Sleep Research*, 23, 124.
- Graham, M.G. (2000). *Sleep Needs, Patterns, and Difficulties of Adolescents: Summary of a Workshop*. Washington, D.C.: National Academy Press.
- Hagan, C. (2008). Falling Asleep in Class? Blame Biology. *CNN International*. Retrieved from <http://edition.cnn.com/2008/HEALTH/12/12/sleep.teenagers.school/index.html>.
- Hobbs, E. (2009). Orange County Schools Start-Time Change: Will It Be Worth It? *Orlando Sentinel*, May 23, 2009.
- Hui, T.K. (2009). Teens Should Sleep Before Class. *The News & Observer*, February 16, 2009.
- Keller, B. (2001). Schools Seen as Out of Sync With Teens. *Education Week*, 20(33), 17-18.
- Kelly, W.E., Kelly, K.E., & Clanton, R.C. (2001). The Relationship Between Sleep Length and Grade-Point Average Among College Students. *College Student Journal*, 35, 84-86.
- Kowalski, N.A., & Allen, R.P. (1995). School Sleep Lag is Less but Persists with a Very Late Starting High School. *Journal of Sleep Research*, 24, 124.
- Kubow, P.K., Wahlstrom, K.L., & Bemis, A.E. (1999). Starting Time and School Life: Reflections from Educators and Students. *Phi Delta Kappan*, 80(5), 366-371.
- Lamkin-Carughi, T. (2007). Barriers Confront Later High-School Start Times. *Palo Alto Weekly*, June 6, 2007.
- Lawton, M. (1999). For Whom the School Bell Tolls. *School Administrator*, 56(3), 6-12.
- McElroy, T., & Mosteller, L. (2006). The Influence of Circadian Type, Time of Day and Class Difficulty on Students' Grades. *Electronic Journal of Research in Educational Psychology*, 4(3), 611-622.
- Mayo Clinic. (2007). *Teen Sleep: Why Is Your Teen So Tired?* Retrieved from <http://edition.cnn.com/HEALTH/library/teens-health/CC00019.html>.
- Mitru, G., Millrood, D.L., & Mateika, J.H. (2002). The Impact of Sleep on Learning and Behavior in Adolescents. *Teachers College Record*, 104(4), 704-726.
- National Sleep Foundation. (2000). *Adolescent Sleep Needs and Patterns: Research Report and Resource Guide*. Retrieved from <http://www.sleepfoundation.org>.
- National Sleep Foundation. (2005a). *Changing School Start Times: Wilton, Connecticut*. Retrieved from <http://www.sleepfoundation.org>.
- National Sleep Foundation. (2005b). *Changing School Start Times: Fayette County, Kentucky*. Retrieved from <http://www.sleepfoundation.org>.
- National Sleep Foundation. (2005c). *Changing School Start Times: Denver, Colorado*. Retrieved from <http://www.sleepfoundation.org>.
- National Sleep Foundation. (2005d). *Changing School Start Times: Jessamine County, Kentucky*. Retrieved from <http://www.sleepfoundation.org>.

- National Sleep Foundation. (2006). *2006 Sleep in America Poll: Summary of Findings*. Retrieved from <http://www.sleepfoundation.org/site/c.hulXKjM0lxF/b.2419037>.
- National Sleep Foundation. (2008a). *Teens and Sleep*. Retrieved from <http://www.sleepfoundation.org>.
- National Sleep Foundation. (2008b). *Eight Major Obstacles to Delaying School Start Times*. Retrieved from <http://www.sleepfoundation.org>.
- National Sleep Foundation. (2008c). *General Advocacy Tips for Changing School Start Times*. Retrieved from <http://www.sleepfoundation.org>.
- National Sleep Foundation. (2009a). *School Start Times and Sleep*. Retrieved from <http://www.sleepfoundation.org>.
- National Sleep Foundation. (2009b). *Backgrounder: Later School Start Times*. Retrieved from <http://www.sleepfoundation.org>.
- National Sleep Foundation. (2009c). *Napping*. Retrieved from <http://www.sleepfoundation.org>.
- New York State United Teachers. (1998). *Adolescent Sleep Needs and School Performance*. Division of Research and Educational Services Information Bulletins and Briefing Bulletins. Retrieved from <http://nysut.org/research/bulletins/981202adolescentsleep.html>.
- Public Schools of North Carolina. (1999). *Report on Delaying the Start of the School Day*. Instructional and Accountability Services, Division of Accountability Services, Evaluation Section. Retrieved from <http://www.ncpublicschools.org/docs/accountability/evaluation/DSchDay.PDF>.
- Robinson, S. (2006). Late-Start High Schools at Low Cost in Arlington (Va.) Public Schools. *The Center for Public Education*, Alexandria, VA.
- Rosekind, M.R., Gander, P.H., Gregory, K.B., Smith, R.M., Miller, D.L., Oyung, R., et al. (1995). Managing Fatigue in Operational Settings: An Integrated Approach. *Behavioral Medicine*, 21(4), 166-170.
- Saavedra, S. (2006). From Naps to Zombies to Atheism, High School Kids Have a Club For It. *San Diego Union Tribune*. February 13, 2006.
- Strauss, V. (2006). Schools Waking Up to Teens' Unique Sleep Needs. *The Washington Post*, January 10, 2006.
- Taras, H., & Potts-Datema, W. (2005). Sleep and Student Performance at School. *Journal of School Health*, 75(7), 248-254.
- Thomas, M. (2009). Orange Set to Remove Students' Advantage. *Orlando Sentinel*, May 3, 2009.
- Tonn, J.L. (2006). Later High School Start Times a Reaction to Research. *Education Week*, 25(28), 5, 17.
- Trockel, M.T., Barnes, M.S., & Egget, D.L. (2000). Health-Related Variables and Academic Performance Among First-Year College Students: Implications for Sleep and Other Behaviors. *Journal of American College Health*, 49(3), 125-131.
- Trudeau, M. (2007). High Schools Starting Later to Help Sleepy Teens. *National Public Radio*, January 18, 2007. Retrieved from <http://www.npr.org/templates/story/story.php?storyId=6896471>.

- Truempy, L. (2008). *The Implications of Later High School Starting Times*. Retrieved from <http://edweb.fdu.edu/anyfile/TruempyL/LaterHighSchoolStartTimes.doc>.
- University of Minnesota. (1998a). *School Start Time Study: Final Report Summary*. Center for Applied Research and Educational Improvement, College of Education and Human Development, Minneapolis, MN. Retrieved from <http://cehd.umn.edu/carei/Reports/docs/SST-1998VI.pdf>.
- University of Minnesota. (1998b). *School Start Time Study: Technical Report, Volume II, Analysis of Student Survey Data*. Center for Applied Research and Educational Improvement, College of Education and Human Development, Minneapolis, MN. Retrieved from <http://cehd.umn.edu/carei/Reports/docs/SST-1998VII.pdf>.
- University of Minnesota. (2002). *Later Start Times for High School Students*. College of Education and Human Development, Minneapolis, MN. Retrieved from <http://cehd.umn.edu/Pubs/ResearchWorks/sleep.html>.
- Wahlstrom, K.L. (1999). The Prickly Politics of School Starting Times. *Phi Delta Kappan*, 80(5), 344-347.
- Wahlstrom, K. (2000). School Start Time and Teen Sleep. *High School Magazine*, 7(9), 40-41.
- Wahlstrom, K. (2002). Changing Times: Findings From the First Longitudinal Study of Later High School Start Times. *NASSP Bulletin*, 86(633), 3-21.
- Wahlstrom, K., & Freeman, C. (1997). *Final Report Summary from School Start Time Study*. Center for Applied Research and Educational Improvement, College of Education and Human Development, Minneapolis, MN.
- Wahlstrom, K.L., Davison, M.L., Choi, J., & Ross, J.N. (2001). *Minneapolis Public Schools Start Time Study Executive Summary*. Center for Applied Research and Educational Improvement, College of Education and Human Development, Minneapolis, MN. Retrieved from <http://cehd.umn.edu/carei/Reports/docs/SST-2001ES.pdf>.
- Wahlstrom, K., Wrobel, G., & Kubow, P. (1998). *Minneapolis Public Schools Start Time Study, Executive Summary, November 1998*. Center for Applied Research and Educational Improvement, College of Education and Human Development, Minneapolis, MN. Retrieved from <http://cehd.umn.edu/carei/Reports/docs/SST-1998ES.pdf>.
- WFTV. (2009). *Board Considers School Start Time Change*. Retrieved from <http://www.wftv.com/news/19135473/detail.html>.
- Wolfson, M.A. (2002). Bridging the Gap between Research and Practice: What Will Adolescents' Sleep-Wake Patterns Look Like in the 21<sup>st</sup> Century? In M.A. Carskadon (Ed.), *Adolescent Sleep Patterns: Biological, Social, and Psychological Influences*. Cambridge, England: Cambridge University Press.
- Wolfson, A.R., & Carskadon, M.A. (1998). Sleep Schedules and Daytime Functioning in Adolescents. *Child Development*, 69(4), 875-887.
- Wolfson, A.R., & Carskadon, M.A. (2003). Understanding Adolescents' Sleep Patterns and School Performance: A Critical Appraisal. *Sleep Medicine Review*, 7(6), 491-506.
- Wolfson, A.R., & Carskadon, M.A. (2005). A Survey of Factors Influencing High School Start Times. *NASSP Bulletin*, 89(642), 47-66.

- Wrobel, G.D. (1999). The Impact of School Starting Time on Family Life. *Phi Delta Kappan*, 80(5), 360-364.
- Yan, B., & Slagle, M. (2006). *School Start Time and Academic Achievement: A Literature Review*. Blue Valley School District, Overland Park, KS. ERIC Document Reproduction Service No. ED493187.