

School Start Time Change: An In-Depth Examination of School Districts in the United States

The Children's National Medical Center's Blueprint for Change Team

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I. Executive Summary

In response to the scientific evidence documenting both profound changes in sleep and circadian rhythms during adolescence and the myriad of negative health, performance and safety outcomes associated with chronic sleep loss, some 70 school districts in the United States (U.S.), representing approximately 1,000 schools, have successfully implemented a delay in high school start times. However, despite the compelling evidence supporting school start time (SST) change as a key strategy in addressing the epidemic of adolescent sleep loss in the U.S., there are still many school districts across the country with early high school start times that have either not considered this option or have failed in their efforts to implement later bell schedules. In addition, while the scientific literature has clearly documented the positive *outcomes* associated with delayed high school start times, these studies contain limited information regarding the *process* by which school districts consider, approve and implement bell schedule changes. This can, in fact, be extremely challenging, as bell changes impacts not only the obvious stakeholders in the community (e.g., parents, students, teachers, school personnel) but also those citizens who may not have direct involvement in the school system (e.g., employers of adolescents, community members using school facilities).

Therefore, an in-depth examination of those school districts that have been successful in changing their bell schedules can be highly instructive to other districts at various stages of contemplating this measure. However, because there is no comprehensive national repository of information regarding start time change, a comprehensive summary necessitates the use of a multi-pronged approach to accessing relevant information in as comprehensive and up-to-date manner as is possible. Thus, in order to create this summary document, we identified and reviewed relevant scientific literature and existing information from a variety of sources, including online and print media articles, school reports, and case studies from other organizations, as well as personal notes of discussions with sleep experts, parents, and district officials conducted over the years. We also administered a brief web-based national survey to a select number of school districts that have successfully changed their school start times to obtain more specific information on methods and the process used to change schedules and gain community support. Finally, we conducted in-depth telephone interviews with personnel and stakeholders in several school districts to further identify and discuss challenges, opportunities and lessons learned in more detail.

The outcomes of this review process are presented as follows: 1) a summary grid of selected schools that have delayed start times with demographics, change strategies employed and additional comments, 2) results of the national school start times survey, and 3) in-depth case studies. An historical timeline of school start time change and advances in knowledge of sleep and circadian biology is included in the Appendix.

Finally, after reviewing all of the available information on the process of school start time change from a wide variety of sources as described above, we developed an integration and summary of the most common and salient points likely to best inform other school districts. While not necessarily exhaustive, as each school district has both unique challenges and solutions, the ten key messages, categorized according to major content themes, represent principles that have a basic foundation in successful implementation of start time change and are those that are most applicable to the majority of school districts, no matter their size or complexity of issues. It is our hope that this information will not only assist Fairfax County Public Schools in charting a course forward but will also be a useful tool for other school districts looking to protect the health, safety and academic opportunities of their students.

II. Introduction

Many studies have documented that the average adolescent in the United States is chronically sleep deprived and pathologically sleepy. As a result, many high school students are at risk for adverse consequences of insufficient sleep including impairments in mood, affect regulation, attention, memory, behavior control, executive function, and impulse control. In particular, many studies have shown an association between decreased sleep duration and lower academic achievement at the middle school, high school, and college levels, as well as higher rates of absenteeism and tardiness, and decreased motivation to learn (1,2). Other documented health-related effects of sleep loss in adolescents include increased use of stimulants (e.g., caffeine, prescription medications) to counter the effects of chronic sleepiness, which in turn may increase the risk of substance use later in adolescence and early adulthood (3). Adolescents are also at greater risk for drowsy driving-related crashes, as well as athletic and other injuries, due to insufficient sleep (4). Chronic sleep restriction increases subsequent risk of both cardiovascular disease and metabolic dysfunction such as type 2 diabetes (5). An association between short sleep duration and obesity in children and adolescents has been demonstrated in several cross-sectional and prospective studies, underscoring how chronic sleep restriction can undermine the health of our nation's youth (6).

While a number of factors, including biological changes in sleep, lifestyle choices and academic demands impact upon sleep in students, the evidence strongly supports that early school start times (i.e., before 8:00 am) are a key contributor to sleep loss in high school students (7-9). Numerous studies have demonstrated that early start times significantly impede high school students' abilities to obtain sufficient sleep (10, 11).

From a biological perspective, at about the time of the onset of puberty, adolescents begin to experience a sleep-wake "phase delay" (later sleep onset and wake times), as a result of well-documented changes in circadian rhythms. This is manifested as a shift in the fall-asleep time to about two-hours later relative to middle childhood. At the same time, adolescent sleep *needs* do not decline significantly from pre-adolescent levels, and optimal sleep amounts remain in the range of 8.5 to 9.5 hours per night for most teens (12). On a practical level, this means that the average adolescent cannot fall asleep before 11 pm and has significant difficulty in waking before 8 am (13).

A substantial body of research has now demonstrated that delaying school start times is an effective countermeasure to chronic sleep loss and has a wide range of potential benefits for students in regard to physical and mental health, safety, and academic achievement. Studies comparing high schools with start times even just 30 minutes earlier to those with later start times demonstrate adverse consequences such as shorter sleep duration, increased sleepiness, difficulty concentrating, behavior problems, and more school absences (14-16). Scientific literature has confirmed that delaying high school start times results in increased total sleep time, decreased tardiness rates and absenteeism, improved performance on standardized tests, reduced self-reported depression, and fewer automobile crashes (17, 18).

A precise tally of public high schools that have delayed school start times nationwide is not available, partly due to the fact that this tends to be a moving target, as more schools and districts make the decision to implement bell time changes. To the best of our knowledge, approximately 1,000 schools in some 70 school districts have taken this step. Importantly, only a handful of schools have subsequently returned to the original earlier bell time.

It is an important but under-appreciated fact that early high school start times are a relatively recent phenomenon that evolved as a result of factors, which had little to do with academics or what is best for the health and well-being of students. The overwhelming majority of modern day bell schedules in American public high schools are historically based on such "adult" considerations as school budgets, transportation logistics, parent work schedules, athletics, staff commute times, and

community use of fields and facilities. By and large, districts did not take into consideration the evolving scientific literature on biologically-based changes in sleep patterns and circadian rhythms associated with puberty and the evidence linking early school start times with detriments in the health, safety and well-being of students. While there are no systematic national databases of school start times, historical and media sources suggest that school districts in the U.S. began advancing school start times, especially at the high school level, first in the late 1950's and 1960's and then increasingly so during the 1970's. The move to earlier start times was likely in reaction to a number of increasing pressures (e.g., fiscal, political, sociological) faced by school districts to cut costs, to close neighborhood schools in favor of larger "feeder" schools, and basically to "do more with less" (a short summary timeline of public school bell schedule changes, contributing factors and the relationship to scientific advances in our understanding of sleep and circadian biology is included in Appendix A).

However, it should be noted that there are many school districts in the U.S. which have never succumbed to the same political, budgetary and social pressures described above and have maintained healthy start times for their high school students. For example, Loudon County, Virginia has had the same bell schedule since 1954, with high schools starting at 9:00 am, middle schools at 8:30 am and elementary schools at 7:50 am. Similarly, some large Texas districts, such as Dallas and Austin, have started their high schools at 9:00 am or later since the early 1990's. According to the U.S. Department of Education's National Center for Education Statistics, a majority (60%) of the 19,000 public high school in the US currently start at 8 am or later, with 45% starting between 8 and 8:30 a.m., and 15% starting 8:30 a.m. or later (19).

Fairfax County in Virginia, the 11th largest school district in the country and one of the most socioeconomically and ethnically diverse, has been wrestling with the issue of delaying high school start time for more than a decade. The current high school start time of 7:20 am makes it virtually impossible for high school students in Fairfax County to obtain enough sleep to allow them function at minimally acceptable levels, given adolescents' biologically-based delayed sleep/wake preferences. In fact, in the Fairfax County Youth Survey of 8th, 10th, and 12th grade students found that two-thirds of respondents reported sleeping seven hours or less on an average school night, more than two hours short of their sleep needs. Recognizing the need to address this issue and in keeping with Fairfax County Public Schools (FCPS) long-standing interest in improving the health, safety and academic and athletic opportunities of its student body, the school board adopted a resolution on April 12, 2012 targeting a goal of starting high schools in the FCPS system after 8:00 am.

Shortly afterward, the district engaged Children's National Medical Center's (CNMC) Division of Sleep Medicine to develop a "Blueprint for Change" to accomplish this task. As part of the development of a "Blueprint for Change," the CNMC team evaluated other school districts across the U.S., with a specific focus on those schools that have successfully implemented start time change, in order to fully explore and utilize any "lessons learned" by our predecessors. While FCPS is unique in many ways (e.g., size, diversity, community use of school facilities), an examination of strategies employed by other school districts to identify and address potential roadblocks as well as to develop creative and innovative approaches can contribute valuable information regarding the process of start time change and inform the development of targeted approaches applicable to Fairfax County. A summary of the key findings and a set of resulting "take home points" are the subject of this report. It is our hope that this information will not only assist Fairfax County Public Schools in charting a course forward but will also be a useful tool for other school districts looking to protect the health, safety and academic opportunities of their students.

III. Process

In order to assist FCPS in finding the best approach to change bell schedules for its high school students, the CNMC team undertook a number of steps to identify, collate and summarize lessons learned from other school districts that have successfully changed their start times in the past. Because there is no comprehensive national repository of information regarding start time change, the CNMC team utilized a multi-pronged approach to access relevant information in as comprehensive and up-to-date manner as is possible. Furthermore, while there are now a number of studies that have examined *outcomes*, there are no studies that have documented the *process* of school start time change. Thus, this analysis necessarily entailed the use of a number of diverse but complementary sources.

The team identified and reviewed relevant scientific literature and existing information from a variety of sources including: online and print media articles, school reports, and case studies from other organizations, as well as interviews and other documentation from sleep experts, parents, and district officials. We also conducted a brief web-based national survey of a select number of school districts that have successfully changed their school start times to obtain basic information on their strategies for changing bell schedules and gaining community support. Finally, the team conducted in-depth telephone interviews with personnel and stakeholders in three school districts (Wilton, CT; Arlington, VA; Milwaukee, WI) to further identify and discuss challenges, opportunities, and lessons learned in more detail.

The outcomes of this review process are presented as follows: 1) summary grid of selected (chosen for their instructive value) school districts which provide lessons on how they delayed start times along with demographic information, change strategies and comments, 2) national school start times survey results, 3) in-depth case studies, and 4) integration and summary of lessons learned. An historical timeline of school start time change and advances in knowledge of sleep and circadian biology is included as Appendix B.

IV. Select School Districts with Later Start Times Grid

The following districts were selected to provide a sample of different motivations (e.g., budgetary, sleep health) and strategies (transportation, curriculum, class scheduling, community engagement, etc.) that have been employed in school systems of various sizes, demographics, and economic backgrounds.

School District	Year	Original Bell Times	Current Bell Times	#Students #Schools	Change Strategy	Additional Strategy	Comments
Pulaski County Special SD, Arkansas	2012	HS: 7:30-2:40 MS: 7:30-2:40 ES: 7:20-2:20	HS: 8:35-3:45 MS: 8:20-8:40 ES: 7:20-2:20 7:50-2:35	17,501 38	Flip ES with HS & MS 1 tier to 2 HS late	Announced change in January to allow parents to make changes.	State's 2 nd largest district. Change done to improve sleep health & savings on buses.
Bentonville, Arkansas	2007	HS: 7:45-2:45 MS: 8:00-3:00 ES: 8:00-3:00	HS: 8:45-3:45 MS: 7:40-2:40 ES: 7:30-2:30	11,100 14	Flip HS with MS and ES	HS uses A/B block schedule.	Change due to address sleep health & growing traffic issues. Cost savings.
Albany Unified SD, California	2014	HS: 7:40-3:10 MS: 8:00-3:05 ES: 8:30-3:05	HS: 8:00-3:30 MS: 8:00-3:05 ES: 8:30-3:05	3,807 6	20 min shift as pilot HS/MS	Evaluate and consider future changes. Elimination of MS 7:00 zero hour proposed.	HS principal very influential in promoting sleep science.
Long Beach Unified SD, California	2014	HS: 7:50-2:40 MS: 8:00-2:40 ES: n/a	HS: 8:50-3:40 MS: 9:00-3:40 ES: 8:00-2:10 ES: 9:00-3:10	81,000 84	Pilot in 1 HS and changed ½ of all MS	ES have 40 min. preparation period on 1 day during the week.	3 rd largest district in state. Primary impetus for change was cost savings. ½ of MS already start at 9:00.
Denver PS, Colorado	2005	HS: 7:30-2:30 MS: 7:25-2:55 ES: 8:15-3:10 9:00-3:55	HS: 7:30-4:30 MS: 7:25-2:55 ES: 8:15-3:10 9:00-3:55	84,424 176	Added 2 hours to HS day for flexibility. Students pick their own start and end times.	District provides public transportation passes to eligible students & allows for flexible schedules.	Superintendent used change to allow students to choose their schedule. Saved \$750,000 & 60 buses.
Colorado Springs District 11, Colorado	2000	HS: n/a MS: n/a ES: n/a	HS: 7:40-3:00 MS: 8:45-3:45 ES: 8:00-2:30	30,296 60	HS shift.	Superintendent formed task force to improve sleep, attendance & academics.	HSST still before 8:00.
Academy District 20, Colorado	2013	HS: 7:05-2:10 MS: 7:25-2:25 ES: n/a	HS: 7:45-2:45 MS: 7:45-2:45 8:30-3:30 ES: 8:45-3:45	22,460 35	HS/MS shift.	ES to start no later than 8:45. Reduced tiers from 4 to 3. Rolling MS Window.	Decision based on sleep health & transportation efficiencies.
Wilton PS, Connecticut	2003	HS: 7:35-2:10 MS: 7:35-2:10 ES: 8:15-2:45	HS: 8:15-2:50 MS: 8:15-2:50 ES: 7:40-2:10	4,300 5	HS (6-12) and ES Flip	Inspired by a senator, a community group formed a task force to study the issue & conduct outreach. Conducted survey of students after change.	Students reported to be more alert and better behaved. More participation in HS athletics & ES after school activities. HS students reported high satisfaction & 35 mins. more sleep.

School District	Year	Original Bell Times	Current Bell Times	#Students #Schools	Change Strategy	Additional Strategy	Comments
West Hartford SD, Connecticut	2007	HS: 7:30-2:15 MS: n/a ES: n/a	HS: 7:30-2:15 8:15-2:15 MS: 8:00-2:50 ES: 8:35-3:20	10,222 16	Flex time for HS.	Made first hour a study hall & allowed students to use "flex" time to start 2 nd period.	District reported positive impacts on emotional health, stress & academic performance.
Milford County SD, Delaware	2012	HS: n/a MS: n/a ES: n/a	HS: 8:16-3:20 MS: 8:00-3:00 ES: 7:45-2:15	4,195 6	HS and ES flip.	Superintendent led. HS start at 9:35 on Wed. Block scheduling.	Decision based on sleep health, improvements in learning & bus cost savings.
Brevard PS, Florida	2000	HS: 7:30-2:15 MS: 8:50-3:35 ES: 9:50-4:20	HS 8:30-3:15 MS: 9:15-4:00 ES: 8:00-2:30	96,000 137	HS/MS shift. ES moves earlier.	MS activities changed to before school with own transportation required.	District reported large reduction in tardiness & absences.
Santa Rosa County SD, Florida	2006	HS: 8:00-2:45 MS: 8:20-2:55 ES: 7:30-1:30	HS: 9:15-3:15 MS: 8:30-2:30 ES: 7:30-1:30	26,144 36 200 buses	HS shift.	Used 3-tier bus system, MS & ED rolling windows.	Increased graduation rates, decreased delinquency & lowered bus costs.
Marion County PS, Florida	2002	HS: n/a MS: n/a ES: n/a	HS: 8:35-3:05 9:20-4:15 MS: 7:50-1:45 9:25-3:25 ES: 7:45-2:20	43,123 51	HS shift.	Added a MS rolling window.	
Bonneville Joint SD, Idaho	2000	HS: 7:45-2:39 MS: n/a ES: n/a	HS: 8:45-3:39 MS: 7:15-1:30 8:45-3:34 ES: 8:05-2:31 8:25-2:51	11,200 21	HS shift.	Superintendent led based on sleep science.	Study showed absences dropped 15% & tardiness 22%. Students got 44 min. more sleep on average.
Harlem School District 122, Illinois	2007	HS: n/a MS: n/a ES: n/a	HS: 8:55-3:46 MS: 8:55-3:46 ES: 8:10-2:45	6,721 11	HS/ES flip.	Superintendent & school board led the effort due to concern about sleep health of students.	Teachers' union defeated 1 st effort, but a new contract allowed a start time change of up to 90 min. without union approval. District reported \$750,000 in savings.
Fayette County PS, Kentucky	1996	HS: 7:30-2:20 MS: 8:00-2:50 ES: Abt. 8:30	HS: 8:25-3:15 MS: 9:05-3:55 ES: 7:45-2:35	40,000 66	HS/ES flip.	Parents went school board after <i>earlier</i> HS times were 1 st proposed. Superintendent was looking for way to boost attendance. Pre & post studies conducted. Plan was announced 10 months ahead of change.	Pre & post study 1 year after showed improved sleep & reduced auto crashes, increased sleep across all grades. District reported better attendance & a decrease in tardiness in 1999.
Jessamine County, Kentucky	Prior to 2005	HS: 7:30-2:15 MS: 7:40-2:25 ES: 8:30-3:15	HS: 8:40-3:25 MS: 8:50-3:35 ES: 8:00-2:45	7,000 11	MS/HS shift. ES 30 min. earlier.	Superintendent led. Community & student engagement was key.	Change based on sleep health. District reported lower tardiness & increased attendance.

School District	Year	Original Bell Times	Current Bell Times	#Students #Schools	Change Strategy	Additional Strategy	Comments
Needham, Mass.	2004	HS: 7:40-2:20 MS: 7:40-1:55 ES: 8:20-2:30 9:00-3:00	HS: 8:00-2:35 MS: 7:50-2:10 ES: 8:35-2:35	5,523 8	HS shift.	Superintendent formed advisory committee to study all issues.	Change based on concerns about sleep health.
North Andover PS, Mass.	2011	HS: 7:15-1:57 MS: 7:20-2:05 ES: 8:15-2:50	HS: 7:40-2:15 MS: 7:50-2:10 ES: 8:35-3:00	4,502 7	All shifted	Superintendent formed advisory committee to collect research, speak to sleep experts & conduct stakeholder meetings.	Did not shift as much as recommended. Reported outcomes included improved grades & attendance & decreased tardiness & disciplinary action.
Holyoke PS, Mass.	2005	HS: 7:15-1:52 MS: 7:15-1:52 ES: 9:05-3:05	HS: 8:15-2:52 MS: 8:15-2:52 ES: 9:05-3:05	5,573 14	Shift HS & MS	School board led based on sleep science.	School Board voted with hopes to improve sleep & tardiness.
Topsham PS, Maine	2005	HS: 7:30-2:00 MS: 7:20-2:00 ES: n/a	HS: 7:50-2:21 MS: 7:40-2:10 ES: 8:55-3:15	2,739 7	MS & HS shift	HS & MS shared buses.	Transportation cost savings.
Brunswick County PS, Maine	2001	HS: 7:25-1:50 MS: 7:40-2:10 ES: 8:40-2:55	HS: 7:45-2:10 MS: 8:08-2:30 ES: 9:00-3:30	2,645 5	MS/HS 30 min. shift. ES 15 min. shift	Superintendent & school board influenced by neighboring Topsham district & sleep science. Conducted district-wide student survey.	Decision based on sleep health & community & student body support.
Edina PS, Minnesota	1996	HS: 7:25-2:10 MS: n/a ES: n/a	HS: 8:25-3:10 MS: 7:40-2:38 ES: 8:30-3:05 9:15-3:50	8,300 9	HS shift.	Superintendent led based on sleep science & MN Medical Association recommendations.	One of the first districts to change; outcomes extensively documented. One year after, 92% of parents preferred the change. Decline in tardiness & absenteeism reported.
Mahtomedi PS, Minn.	2002	HS: 7:30-2:10 MS: n/a ES: n/a	HS: 8:00-2:30 MS: 8:00-2:30 ES: 9:10-3:30	3,305 4	HS/ES flip.	Encouraged use of personal transportation. 4-period day before & after change. Students agreed to shorten "passing" time between classes.	District saw improved attendance, test scores & grades. Decreased costs & tardiness rates. 65% decrease in auto crashes.
Minneapolis PS, Minn.	1997	HS: 7:15-1:45 MS: 7:05-1:35 ES: 9:40-4:10	HS: 8:10-3:00 8:35-3:00 MS: 9:40-4:10 ES: 7:30-2:00 8:05 -2:35	36,370 75	HS/MS flip.	School board led to reduce transportation costs. Sleep health of students was secondary motivation.	Most extensively documented outcomes of all school districts delaying start times. Students reported more sleep & fewer depressive symptoms. Lower tardiness rates also reported.

School District	Year	Original Bell Times	Current Bell Times	#Students #Schools	Change Strategy	Additional Strategy	Comments
South Washington County, Minnesota	2009	HS: 7:35-2:05 MS: 7:30-2:00 ES: n/a	HS: 8:35-3:05 MS: 7:55-2:25 ES: 8:10-2:40 9:20-3:50	17,418 26	HS/MS shifted later.	Superintendent formed task force to study to optimize learning & sleep. Initiated a 4x4 block schedule.	Part of 2014 study. Grades in 1 st and 3 rd period classes rose by as much as a full point. Scores on standardized tests improved. 58% of HS students slept 8 hrs. or more. Auto crashes fell by 6%.
Hattiesburg PSD, Mississippi	2013	HS: 7:20-2:45 MS: 8:30-3:50 ES: n/a	HS: 8:30-3:50 MS: 7:30-2:45 ES: 8:00-3:00	4,528 10	MS/HS flip.	Superintendent implemented in the last few days of the previous school year as an experiment.	Changed based on sleep science.
Ithaca City SD, New York	2006	HS: 8:00-2:37 MS: 8:00-2:21 ES: 7:55-1:55 9:00-3:00	HS: 8:55-3:32 MS: 9:10-3:25 ES: 8:00-2:00	5,273 11	HS/MS shift.	Superintendent led because buses were not arriving on time & students were late. Sleep expert's advocacy over a few years helped bring the change. Discussions held with employers, athletic clubs & public at board meetings.	Change primarily made to reduce bus costs. District realized about \$400-600K.
Moore County, North Carolina	2012	HS: 8:00-3:00 MS: n/a ES: 8:00	HS: 9:00-4:00 MS: 8:00-3:00 ES: 7:45/7:30	12,491 23	HS shift	Implemented 2-tiered bus system.	Saved \$700,000 in transportation costs.
Hudson City, Ohio	2010	HS: 7:30-2:30 MS: 7:20-2:10 ES: 8:30-9:15	HS: 8:00-3:00 MS: 7:56-2:50 ES: 8:55-3:40	4,941 6	All shifted later.	Superintendent & school board formed advisory committee to review health, transportation, outreach, & other school districts. Subcommittees held separate public meetings & conducted surveys. Phased-in over three years.	The whole process took about two years. Superintendent & school board worked together to study the issues & gain public support.
North Clackamas SD, Oregon	1999	HS: 7:30-2:20 MS: n/a ES: n/a	HS: 8:45-3:20 MS: 9:30-4:05 ES: 8:20-2:45	17,439 31	HS shift.	HS principals pushed change for a decade. Full year study proceeded change.	Improved attendance & GPA in 1 st period. Large community acceptance.
Beaufort County SD, South Carolina	2014	HS: 7:45-2:30 MS: n/a ES: n/a	HS: 8:35-3:25 MS: 7:15-2:30 ES: 8:30-3:30	20,000 36	Pilot 1 HS first.	HS principal led pilot based on sleep science provided by the superintendent. Students gave feedback.	Evaluation is expected following the 1-year pilot period.

School District	Year	Original Bell Times	Current Bell Times	#Students #Schools	Change Strategy	Additional Strategy	Comments
Dallas ISD, Texas	1990s & 2014	HS: n/a MS: n/a ES: n/a	HS: 9:15-4:15 MS: 8:35-3:35 ES: 7:55-2:55	158,932	HS shift.	Changed in the 90s, but little info exists.	Delayed HSs an additional 15 mins in 2014.
Austin ISD, Texas	1990s	HS: n/a MS: n/a ES: n/a	HS: 9:00-4:10 MS: 8:20-3:30 ES: 7:45-2:25	87,000 158	HS shift.	No public records could be found regarding change.	Large district where community works around the district's bell times.
Arlington, Virginia PS	2001	HS: 7:30-2:15 MS: 8:10-2:45 ES: 8:30-3:10	HS: 8:19-3:01 MS: 7:50-2:24 ES: 8:00-2:40 9:00-3:40	19,000 38	HS/MS flip.	School board & superintendent formed a large task force with working groups. Formed district team for implementation. 4-tier bus system.	Teachers & parents reported students were more alert & focused. Teachers raised concerns, but none left the district.
Bedford County PS, Virginia	2013	HS: 8:30-3:00 MS: 8:30-3:00 ES: 8:30-3:00	HS: 8:55-3:35 MS: 8:55-3:35 ES: 7:55-2:35	10,000 21	HS/MS flip with ES.	Added tier to bus system & students shared buses. Added online early classes & early dismissal for athletes.	Changes led to cost savings.
Loudoun County PS, Virginia	1954	HS: 9:00-3:48 MS: 8:30-3:18 ES: 7:50-2:35	HS: 9:00-3:48 MS: 8:30-3:18 ES: 7:50-2:35	70,000 82 854 buses	Never changed.	Same bell schedule since 1954.	Community built programs around existing schedules
River Falls SD, Wisconsin	2011	HS: 7:25-2:35 MS: 7:30-2:35 ES: 8:35-3:40	HS: 7:45-2:50 MS: 7:45-2:50 ES: 8:45-3:50	3,109 8	15 minute shift for all.	Superintendent formed committee. Surveyed parents, staff & others. Added change goal to strategic plan.	Change based on sleep science. Bell times did not change as much as leadership recommended.

PS = Public Schools
 ISD = Independent School District
 SD = School District

V. National School Start Time Survey

As part of the CNMC team’s compilation of successful practices and strategies related to delaying high school start times, we identified and surveyed public school districts across the country that had recently (within the past decade) changed their bell schedules. The team developed an online National School Start Time Survey and contacted a number of identified school districts that were successful in changing their start times. The survey consisted of three parts: Part One—background information on the districts; Part Two—in-depth information about their experience with school start time (SST) change strategies and implementation; and Part Three—perceived costs (financial and otherwise) and benefits associated with the changes (see Appendix B). This survey was intended to solicit input on a variety of experiences with later bell schedule changes and to supplement the grid (above) and the case studies (below) in this report; thus the results should neither be interpreted in isolation, nor viewed as a “scientific” survey.

Methods

The survey was designed to be completed by a single individual/superintendent with input as needed from ancillary school personnel. Over the summer of 2013, our team identified about 70 school districts that had previously delayed high school start times in the past ten years, using existing online compilations, scientific literature, documents previously collected by the team, media clips, and previous FCPS and other school reports. In the fall of 2013, the online survey was emailed to district superintendents in identified districts. There were 24 initial survey responses; however, many surveys were excluded from the final results due to incomplete crucial data that precluded further analysis (only surveys that reported at minimum the pre- and post-start times for high schools were included). A total of eight completed surveys were included in the final analyses. All participating districts for this report were de-identified.

Results

Part One: General Information (N=8) demonstrated a fair amount of variability in terms of the districts’ sizes (Table One) and in their final bell schedules (Table Two). The districts’ average delay in high schools’ bell schedules was 45 minutes with a range of 20 minutes to an hour and 15 minutes. About 75% (6/8) of the districts moved high school start times to after 8:30 am; only one district (FL) set the new start time to after 9:00 am.

Four districts (N=7) moved middle school start times earlier (range 10 minutes to 1 hour and 10 minutes), while the other districts moved middle school bell times later within a much narrower range (20-30 minutes). With two exceptions (VA and FL), all new middle school bell times were at 8:00 am or earlier. With regard to elementary schools (n=7), one district (CT) moved bell times earlier (by 5-30 minutes), two remained the same, and the rest delayed elementary start times (range 10-40 minutes). Two districts set new start times before 8:00 am; the latest ES start bell time was 8:50 am (MO).

Table One. Participating Districts and Population Indicators

(Listed in ascending order by total (ES/MS/HS) number of students in the district)

District	Elementary School (ES)	Middle School (MS)	High School (HS)	Total Buses (Current)
VA District	1,200 students (2 ES)	550 students (1 MS)	550 students (1 HS)	16
CA District	1,800 students (3 ES)	900 students (1 MS)	1,200 students (1 HS)	Unknown
CT District	1,900 students (2 ES)	1,050 students (1 MS)	300 students (1 HS)	33
MA District	2,300 students (5 ES)	1,200 students (1 MS)	1,200 students (1 HS)	20
MN District	4,600 students (6 ES)	2,300 schools (2 ES)	2,900 students (1 HS)	50
AK District	4,500 students (9 ES)	4,500 students (5 MS)	3,600 students (1 HS)	85
MO District	9,100 students (19 ES)	9,100 students (6 MS)	5,100 students (HS)	190
FL District	14,500 students (18 ES)	6,200 students (8 MS)	7,500 students (7 HS)	200

Table Two. Participating Districts and Bell Schedule Changes

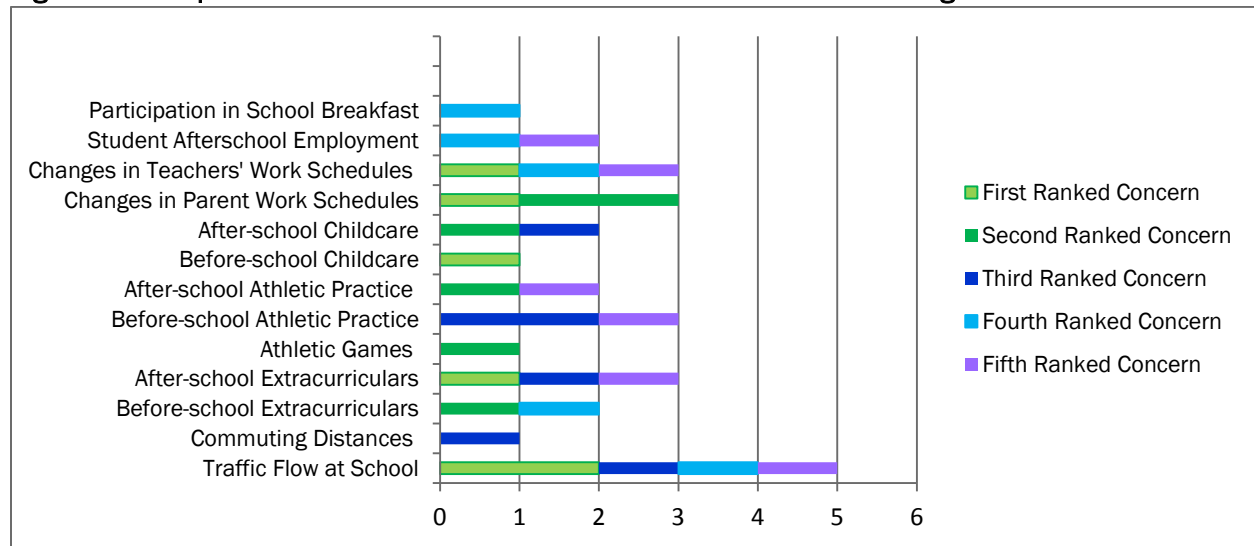
District	ES Start	MS Start	HS Start
VA District	7:55⇒8:30	8:30⇒8:55	8:30⇒8:55
CA District	8:30 (No Change)	8:00 (No Change)	7:40⇒8:00
CT District	(Pre-K -2) 9:00⇒8:55; (3-5) 8:10⇒7:40	8:15⇒7:35	7:35⇒8:15
MA District	8:15⇒8:25	7:50⇒7:20	7:15⇒7:45
MN District	8:00⇒8:40	9:15⇒7:50	8:00⇒8:40
AK District	7:30⇒8:00	7:40⇒8:00	8:00⇒8:55
MO District	8:20⇒8:50	7:30⇒8:00	7:45⇒8:55
FL District	7:30	8:30⇒8:20	8:00⇒9:15

Part Two: Change Strategy and Implementation (N=6) assessed districts' overall bell change strategies (with particular focus on transportation components) and concerns associated with these changes. The districts surveyed reported employing an array of change strategies: three districts employed a "slide" (moving ES/MS/HS bell times later), and two used a "modified slide" (moving ES/HS later with MS earlier). None of the districts responding to the survey employed a straight "flip" (i.e., exchanging ES and HS bell times). Several ancillary strategies were also used; these included a zero period (i.e., a class offered before the start of the school day) in two districts, and student choice (i.e., flexible scheduling based upon student preference) in one district. While only two districts (MA and MO) had tiered busing prior to bell changes, all schools used tiered busing after SST change. All districts eventually had middle and high schools share buses, with three districts making the change as part of a comprehensive set of bell-related transportation changes (MA, VA, CA). Additional strategies employed in other districts included: the consolidation of bus depots (MO), the continuation of a flat fee for transportation (MA), and maintaining public transit use (CA). Notably, no districts cut transportation funding for magnet schools, and only one school used a phased-in

approach (CA), which involved changes only for part of the district in year one and the remainder of the district in year two.

Part Two also assessed the top identified challenges associated with changing school start times. When weighted to give more credence to higher-ranked options, the top five concerns were: (1) traffic flow at school, (2) changes in parents' work schedules, (3) after-school extracurricular program attendance, (4) changes in teachers' work schedules, and (5) before-school athletics practices schedules (Figure One). Of note: when all athletic-related items (i.e., before/after school athletics and games) were combined, athletics represented the most significant concern. Finally, Part Two included an open-ended question that solicited information about additional strategies employed; these included substituting early morning classes with online courses, giving athletes early dismissal, adding lighting to athletic fields, and allowing for more flexible academic scheduling.

Figure One. Top-Ranked Concerns Associated with Later School Start Change



Part Three: Benefits/Costs (N=4) assessed benefits and costs associated with bell changes. With more weight given to higher ranked items, the top five identified benefits were: (1) increased daily attendance, (2) cost savings, (3) reduced tardiness rates, (4) improved standardized test scores, and (5) improved grades. Districts varied widely in terms of perceived benefits, with one district (AK) reporting no benefits other than cost savings. Attendance and academic measures were the most consistently reported benefits (Table Three), and all schools listed cost savings as a benefit, likely attributable to adaptation of an increased number of busing tiers. In regards to perceived costs, no districts identified loss of community support, changes in traffic patterns, or a reduction in student involvement in extracurricular activities as a consequence of SST change (Table Four). The negative impact was largely perceived to be on families (e.g., work schedules, financial issues).

Table Three. Perceived Benefits of School Start Time Change

District	AK District	MA District	FL District	VA District
Increased daily attendance	No	Yes	No	No
Reduced tardiness rates	No	Yes	No	No
Improve standardized test scores	No	N/A	Yes	Yes
Improved grades	No	Yes	Yes	No
Higher graduation rates	No	N/A	Yes	No
Fewer referrals for disciplinary action	No	Yes	No	No
Improved sports team performance	No	N/A	No	No
Fewer sports-related injuries	No	N/A	Yes	No
Cost savings for public school system	Yes	N/A	Yes	Yes
Fewer student visits to student health centers	No	N/A	Yes	No
Lower rates of depression/suicidal thoughts	No	N/A	No	Yes
Lower rates of car accidents	No	N/A	No	No

Table Four. Perceived Costs of School Start Time Change

District	AK District	MA District	FL District	VA District
Financial cost incurred by the school district	No	No	No	No
Loss of community support	No	No	No	No
Impact on parent work schedules	No	No	Yes	Yes
Limitations on student after-school employment	No	No	Yes	No
Financial cost incurred by families	No	No	Yes	No
Changes in traffic patterns	No	No	No	No
Reduction of student involvement in extracurricular activities/athletics	No	No	No	No
Negative impact on teacher schedules	No	No	Yes	No
Safety concerns for elementary students	No	No	No	Yes

Survey Conclusion

Given the small sample size, the conclusions that can be drawn from this survey are limited but nonetheless valuable, as they add to our understanding of how and why school districts choose to delay high school start times, and what benefits/costs they perceive as a result. While it is not possible to generalize from this limited sample, a few key points can be made. First, the districts responding were quite varied in the strategies employed in changing bell times across all tiers. Moreover, none of the districts changed to a bell schedule that could be termed "biologically optimal" from a circadian/sleep perspective for all three groups (i.e., MS and HS later and ES earlier). Cost savings, presumably largely as a result of increasing the number of busing tiers, was the most prominent benefit (and may have been the real "driver" for the change in some cases). Although not a consistent finding in the scientific literature, the districts surveyed tended to perceive academic-related benefits resulting from adopting later start times for secondary schools. Finally,

many of the negative outcomes raised as concerns by other communities contemplating a change in high school bell times did not materialize in the responses given.

While the majority of districts are significantly smaller than Fairfax County Public Schools, delving into the experiences of a variety of school districts may be useful in generating new strategies not previously explored by a large district like Fairfax or, conversely, in determining why particular change strategies might not be generalizable to a larger district. The sheer variety of (as well as lack of majority-endorsed) successful implementation strategies employed strongly suggest that there is no “one size fits all” plan and indicates that FCPS should explore a wide range of bell scenarios and strategies that take into consideration those that have been most successfully employed around the country. Additionally, several secondary strategies merit further consideration; these include consolidating bus depots, charging a flat-rate transportation fee, and bundling MS/HS on buses. Finally, some of the other districts’ “new” cost-saving strategies highlight the strength and sophistication of FCPS’ existing transportation infrastructure, particularly its four-tiered busing system and its previous cost-saving efforts as a result of previous attempts to change the bells schedules.

The survey results also provided a broader framework for understanding FCPS’ school start time change-related concerns and background information that allows for some tentative predictions of cost/benefit outcomes following any change. While many of the top reported concerns regarding delays in high school start times mirror those expressed by some in the FCPS community, it is important to note that most of the concerns raised were not actualized. In addition, many of the districts did not systematically measure health, academic, or satisfaction outcomes, again underscoring both the need for additional research on bell change-related data and highlighting this project’s unique opportunity to contribute to public health and policy research and to provide districts considering similar changes a roadmap and a menu of approaches.

VI. Selected Case Studies of Later Start Time Successes

The number of published outcome studies on the impact of delaying high school start times is still somewhat limited, and the motivations and implementation strategies of schools and school districts deciding to adopt bell schedule changes are not easily captured in scientific studies. School start time survey results, such as those presented above, examine the challenges involved and the solutions generated but may fail to do so in adequate detail and may not fully explore important nuances of the process. Thus, it is useful to supplement the available empirical data with more anecdotal information from communities that have been involved in changing start times. A more in-depth understanding of the process of school start time change in other districts can yield important information that may guide other school districts, suggest strategies that might not have been considered and help to avoid both repeating mistakes and “re-inventing the wheel.” The following brief case studies are therefore presented to serve as examples of the scope, process, and outcomes of individual high schools and school districts across the country that have successfully implemented a delay in high school start times. The sheer variety in the size of the student populations, geographic considerations, initial and final bell schedules, and strategies employed are a bit daunting; nonetheless, valuable lessons can be gleaned, which can inform other school districts in various stages of change contemplation. The following case studies were chosen based on their instructive value and are listed in alphabetical order by state.

Bentonville School District, Arkansas

In 2007, the Bentonville School District, the 5th largest in the state (11,100 students), implemented a later start time for its one high school, moving a one later from 7:45 am to an 8:45 am start time. District officials changed the start times to better accommodate a new “A/B block” class schedule that allowed students to rotate courses every other day. The teachers reported liking the A/B block schedule and used the extended class time to incorporate cooperative learning groups and hands-on activities. In order to accomplish the bell schedule change, the district moved all of the five middle schools earlier (8:00 am to 7:40 am) and also moved the nine elementary schools earlier (8:00 am to 7:30 am).

Following the changes in bell schedules, many teachers and administrators anecdotally reported a high level of satisfaction, with some teachers indicating feeling more rested and productive throughout the day. Students who were active in extracurricular activities or worked after school preferred the later start time because it allowed the opportunity for more sleep. The community also found that the bell schedule change assisted in alleviating traffic congestion. The district found that block scheduling gave their students more class choices and the later start time change gave the district more flexibility in dealing with traffic and addressing the students’ sleep needs.

Lessons: Bentonville is an example of a successful collaboration between district officials and the school board to change class and transportation schedules. The changes resulted in the promotion of sleep health and more flexibility in students’ class schedules. Improvements in sleep and quality of life for both students and teachers were also reported.

(Source: <http://normessasweb.uark.edu/bestpractices/papers/Casestudies/401003.pdf>.)

Pulaski County Special School District, Arkansas

In 2012, the Pulaski County Special School district, with a student population of 17,500, “flipped” the start times for its six middle and six high schools with those of its 24 elementary schools. The

middle schools moved 50 minutes later from 7:30 am to 8:20 am, and high schools moved later by 65 minutes, from 7:30 am to 8:35 am, with all elementary schools remaining at their start time of 7:20 am. The changes were spurred by the district's interest in reducing transportation costs and improving the sleep the health and safety of its students. To accomplish these changes, the district went from a single-tier to a two-tier busing schedule. The change was initiated by the district under the leadership of the new superintendent who was charged by the State Commissioner of the Department of Education with cutting costs following a period of financial mismanagement by the previous administration and the school board, which was dissolved. The district announced the change in January with implementation in September to allow enough time for parents to plan and change their childcare arrangements and utilized a toll-free line to field questions and comments from the community.

Lessons: The Pulaski County Special School district demonstrates that communities can successfully adapt to substantial changes if given appropriate time and if parents are provided with adequate information during implementation.

(Source: www.thv11.com/news/article/189874/2/PCCSD-proposes-changes-to-start-times www.pcssd.org/pcssd-bell-times-bus-schedules-may-change-for-next-school-year.)

Albany Unified School District, California

Albany High School has 1,800 students in a small school district with one other high school for at-risk students, one middle school and three elementary schools. In 2013, the Albany High School principal proposed moving the current bell time of 7:40 am to 8:30 am, based on research from economists and sleep researchers as well as feedback from a series of community engagement sessions. A task force, named the Challenge Success Committee, was formed and included parents, students, teachers, counselors, and school administrators. The committee researched the issue and developed a set of recommendations. After receiving the report and recommendations, the high school's Instructional Improvement Council (a small committee comprised of six staff members, two parents and two students) agreed to move the start time to 8:00 am as a one-year pilot and proposed to solicit feedback from the community through a series of surveys in order to gauge potential impact. The high school also sought input through several governance committees and a town hall forum. After reviewing the scientific rationale and as a result of these community discussions, the Albany Middle School principal also recommended eliminating the 7:00 am zero period and moving the start time to 8:00 am, which were both adopted.

(Source: <http://web.ahs510.org/news/administrative-news/iicagreestolaterstarttime> and <http://albany.patch.com/groups/schools/p/late-daily-start-time-for-albany-high-proposed>.)

Lessons: This district is a good example of a principal immersing himself in the sleep research and working hard to educate both his staff and community. His commitment to the issue and willingness to pilot the change had a positive impact on his colleagues in the rest of the district. The superintendent utilized local sleep experts and community members to educate the community about the health and safety benefits of changing start times.

Long Beach Unified School District, California

Long Beach Unified School District educates 81,000 students in six high schools, 15 middle schools and 51 elementary schools, with four charter and five alternative schools. In the 2013-2014 school year, the Long Beach Unified School District adopted a plan to move their high school from 7:50 am to 8:50 am with an end time of 3:40 pm, as part of a pilot program. The plan, debated about and approved by the school board early in 2013, also moved six middle schools to a 9:00 am to 3:40 pm bell schedule to be consistent with the district's nine other middle schools. As part of the plan, all

affected schools were to develop action plans to provide supervision for students in the morning. Budget reductions were the driving factor for the realignment of bell schedules. District officials anticipated that the changes would save the district over \$1 million, with much of the savings resulting from bus schedule adjustments for special education students requiring home pick-up and riding smaller buses.

Community outreach prior to schedule changes indicated mixed levels of support and initial reservations from key stakeholders. An online survey on school start time change, conducted by the district, showed that the respondents were about evenly split on the issue of changing start times. Additionally, the local teacher's union expressed concern regarding contractual issues and the change's impact on sports and other programs. The district worked closely with these groups to address their issues and ultimately to gain their support. Additionally, the district announced that it would convene a large, ad hoc committee (40-60 members) to evaluate the impact of the pilot program.

Lessons: While the motivation for changing start times in Long Beach was to cut transportation costs, this district is taking a unique approach in forming a large committee of stakeholders to evaluate the impact of the change. Most school districts typically form such committees prior to considering taking action and then disband once a decision to delay start times is made. The ad hoc committee report is due in the fall of 2014.

(Source(s): www.dailybreeze.com/general-news/20130326/long-beach-middle-schools-to-start-later-next-fall and www.lbschools.net.)

West Hartford Public High School, Connecticut

West Hartford Public Schools is a district with a student population of 10,222 in two high schools, three middle schools and 10 elementary schools. In the fall 2006, the West Hartford Board of Education voted 5-2 to adopt a flexible start time schedule for juniors and seniors at its two high schools beginning in the fall of 2007, with implementation for sophomores and freshmen beginning in 2008. The "flexible" start time option gave juniors and seniors the option of starting school at 8:15 am (second period), instead of at 7:30 am. The first period was converted to a study hall and the dismissal bell remained at 2:15 pm for all students, regardless of whether or not they elected the second period start. The "flexible" start time was a strategy developed in response to significant community resistance to a proposed "blanket" delay of high school start times. While acknowledging that this "flexible" option was a less-than-optimal compromise, the Board of Education concluded that at least it offered a delayed start time option to those students and parents who recognized the value of obtaining sufficient sleep. According to school administrators, the later start times had positive impacts on academic performance, student stress levels and emotional health.

Lessons: West Hartford Public Schools is a good example of a school board and administration continuing to seek solutions to provide choices to students and to encourage better sleep health, after deciding against full implementation of start time change due to community opposition.

(Source: Author's notes, 2006)

Wilton Public Schools, Connecticut

Wilton engaged in a two-year long process, which culminated in delayed start times for both its middle and high school (7:35 am to 8:15 am) in 2003. Initially, legislation was proposed by State Senator Kevin Sullivan in 2001 to delay start times across Connecticut, but subsequently it was decided that this should occur on a local district-by-district level. Wilton's local chapter of the League

of Women Voters became involved in the debate and distributed both a review of the literature on adolescent sleep and the results of a local survey of students and school staff, and recommended that Wilton Board of Education consider delaying start times. Existing community-planning teams consisting of teachers, administrators, parents, students and citizens were then engaged in studying the issue. Area superintendents met with physicians from the Connecticut Thoracic Society to ask for scientific input and to request their engagement in the process. It was decided by the superintendent with input from advisory groups that any potential solutions would need to meet three criteria: 1) be cost neutral, 2) require student bus rides no greater than 45 minutes and 3) avoid any student being picked up by a bus earlier than 7:00 am. Parents and teachers were offered the opportunity to participate in an “advisory vote” on the superintendent’s recommendations regarding start times, which yielded diametrically opposed results (parents supported two to one, teachers opposed two to one). While the Wilton Sports Council published full-page ads opposing the changes on a number of grounds, including compromising Wilton’s reputation of athletic excellence, the head of the Connecticut Interscholastic Athletic Conference provided a written statement in support of delayed start times. After the start time change, teachers reported that students were better rested and more alert during the school day. There was no appreciable effect on athletics, and within a year, the change became the “norm” and “part of the fabric of the community” (Robert O’Donnell, current superintendent). While there has been considerable interest expressed by neighboring school districts, no other schools in the surrounding area have followed Wilton’s lead.

Lessons: Wilton provides an illustration of several common themes related to changing school start times, including the vital role of the superintendent, community concerns regarding impact on athletics which were not subsequently substantiated, and the importance of ongoing stakeholder input. It also provides some unique perspectives (i.e., the potential for community groups to assume a leadership role, enlistment of local health professional societies, use of established models such as community planning teams to provide input), which may be applicable to other districts. In particular, the community’s identity as a self-styled “sports town” provides a striking example of “cultural” considerations that have the potential to derail efforts to change start times if not adequately addressed.

(Source: Owens, J [2013, October 30]. Telephone interview.)

Denver Public Schools, Colorado

Denver Public Schools is a large district with over 84,000 students in 22 high schools, 21 middle schools and 74 elementary schools, and 59 alternative and charter schools. Due to concerns regarding the impact of early start times on adolescents and seeking a way to cut transportation costs, the district conducted a feasibility study in 2004. In 2005, the district took one of the more unique approaches to changing start times for all of its high school students. Under the leadership of the superintendent, the school district adopted a “flexible” schedule and radically changed how it provided transportation to its students. While conducting the feasibility study, the district found that 2,400 high school and 1,300 middle school students purchased bus passes from the local public transit agency, the Regional Transportation District (RTD). In the “flexible” plan, students were allowed to choose their arrival and dismissal times within a 7:30 am to 4:15 pm bell schedule, as long as they met the instructional time requirements. The new transportation plan involved switching more students to public transportation and providing free bus passes to all students who lived more than 3.5 miles from their base school and to students going to magnet schools elsewhere in the district. Other students were still provided with bus transportation by the district.

As part of the district’s implementation plan, a series of public outreach sessions were held including two town hall meetings, a public hearing and a presentation by principals summarizing their discussions with parents and local communities. There were some initial concerns raised by parents

about students riding on public buses. The district also conducted surveys of students and found that many of the students were not initially open to taking advantage of the later start time options because of their involvement in after-school programs. However, in the 2006 school year, about 30 % students chose a start time of 8:00 am or later. As a result, the district was able to eliminate 60 buses and save \$750,000 in its transportation budget.

Lessons: The Denver public school district was open to unique solutions and working with the local public transportation system to allow options for its students. Those students who wished to take advantage of school schedule choices were presented with a number of options that were nonetheless within specific parameters. The process also involved significant community engagement through public meetings and online surveys. While the initiative lacked overwhelming community and stakeholder support, district officials decided to still pursue a course which they felt was in the best interests of the district, both financially and for the health and safety of its students.

(Source(s): National Sleep Foundation, www.sleepin Fairfax.org/docs/CS.Denver.pdf. High School Transportation: Report to the Board, Department of Research, Planning and Special Programs, Department of Transportation, March 18, 2004.)

Milford Public Schools, Delaware

Milford Public Schools is a small district with about 4,100 students who attend one high school, one middle school and four elementary schools. After many years of studying ways to mitigate scheduling conflicts resulting from state requirements that mandated professional development time and standardized testing, the Superintendent of Milford Public Schools formed a task force to study potential solutions. The task force included teachers and administrators who volunteered to research the issue and develop recommendations. In 2012, the task force recommended the adoption of an “A/B block” scheduling system as well as a delay in school start times, with the high school start times moving 40 minutes later from 7:35 am to 8:15 am, the middle school start times moving from 7:35 am to 8:00 am, and the elementary school start times moving earlier to 7:40 am. A unique feature of the plan was to start school at 9:35 am for both middle and high school students on Wednesdays. The school accommodated parents who were concerned about leaving their older children at home unsupervised on late start time days by opening the libraries to students who needed to be at school earlier. The superintendent expressed the belief that these changes – both later start times for secondary students and earlier start times for elementary students – would be beneficial for all students and would increase daytime alertness.

Lessons: Milford Public Schools illustrates a situation in which a district initially changed its bell times to accommodate state requirements for standardized testing and professional development but subsequently realized that this schedule better accommodated the biological and learning needs of its students. Parental opinions were mixed, with some elementary school parents concerned about winter civil twilight violations, while found the earlier times to be more accommodating for their work schedules.

(Source(s): <https://milfordlive.com/2012/06/19/msd-to-see-changes-next-year-2>
www.milfordbeacon.com/article/20120710/NEWS/307109954)

Brevard County School District, Florida

Brevard County School District is a large system with 82 elementary schools, 16 middle schools, 21 high schools, 18 specialized centers, and a student population of 96,000 that is delivered on a three-tier bus system. Each bus has three routes that service all three school tiers. In 2000, the district delayed high school start times by a full hour, from 7:30 am to 8:30 am and middle school times by 25 minutes from 8:50 am to 9:15 am. The elementary schools, which incorporate grades K-

6, were moved earlier by a full hour and fifty minutes, from 9:50 am to 8:00 am. The change was implemented after extensive community outreach was conducted through public meetings to allow stakeholders the opportunity to express their concerns and share their views. The district also conducted research on other school districts that had successfully changed their start times and provided information to the public and school staff about improvements in academic performance and attendance rates. District staff also worked with a local hospital to provide scientific and health education presentations to the community and the school board, using information from the National Sleep Foundation. A proposal was developed by the superintendent and submitted to the school board, which subsequently approved the change. In order to offset some of its transportation related costs, the district charges students for special or out-of-boundary services.

Following the change, the school district found a significant reduction in the rate of first period tardiness and absences. Some of the negative outcomes reported by the district were limited availability of school buses for field trips and an increased need for after-school childcare.

Lessons: Brevard County demonstrates that students and the community in a large county can adapt to significant changes in school bell schedules. The district solicited a tremendous amount of public input but did not let negative opinions proffered by some constituencies and individuals deter them from finding solutions. Many of the non-academic concerns typically raised by parents regarding potential impact on after-school employment and on athletics were not realized. Finally, Brevard's strategy of charging for non-academic and magnet transportation services may help reduce costs significantly in districts that provide substantial special transportation services.

(Source(s): Author's notes, 2006. <http://www.neola.com/brevardcofl/search/policies/po8600.htm>)

Bonneville School District, Idaho

In the 1999-2000 school year, the Bonneville School District adopted a new school start time for its two high schools by shifting from a 7:45 am start time to 8:50 am. The district, which has 21 schools (including three middle and 14 elementary schools) and a student population of 11,200, was the first in the state to move start times later. In the year following the change, the district studied the impacts on attendance and found that absences dropped by 15 percent and tardiness decreased by 22 percent. The study also found that high school students were getting about 44 minutes more sleep on average after the change. Many students reported that they were more alert, and their teachers concurred. Some students also reported using part of the extended period morning before school to seek help from their teachers. For unclear reasons, the start times at the two high schools were subsequently shifted earlier to 8:25 am before 2014.

Lessons: The Bonneville School District is an example of a district evaluating the impact of the change in school start times and reporting the positive data back to its staff, students and the local community.

(Source(s): Author's notes, 2006)

Needham Public School District, Massachusetts

Needham Public School District is a small district consisting of six elementary schools, one middle school, and one high school with a student population of 5,476. Under the direction of the superintendent, an advisory body called the School Starting Time Advisory Committee was formed in the fall of 2002 to determine if start times for all schools should be changed to be more compatible with students' biological rhythms. The committee included one teacher, one administrator and a parent representative from each level, a school committee representative, a school nurse, a

representative from the transportation department, two high school students and the director of the arts department.

The committee reviewed the existing sleep and education research available at the time and conducted surveys of high school teachers regarding the level of alertness of students while in class. They also surveyed a small sample of students regarding their sleep habits and preferences regarding start times. The committee launched a website to provide information about their activities and encouraged members of the community to provide feedback. The committee also made a concerted effort to contact school districts that had successfully changed their start times and consulted sleep experts, health professionals and The National Institutes of Health.

As a result of their research and fact-finding, the committee concluded that, “the research about the educational and health benefits of a later high school starting time are clear and compelling.” Based on a review of the potential impact on athletics, after-school programs, religious activities, performing arts and transportation, the committee recommended changing the start times later for both primary and secondary schools. The committee developed five options, all of which had the high school start time moving from 7:40 am to 8:05 am, with middle schools either staying at their current time or also moving to 8:05 am, and all elementary schools staying at their current time or starting at 8:45 am. Due to redistricting in 2003, the school board delayed their decision a full year and conducted further community engagement. In 2004, the school board moved start times for all middle and high schools close to the time recommended by the committee with high schools starting at 8:00 am, middle schools starting at 7:50 am, and elementary school starting 15 minutes later, moving from 8:20 am to 8:35 am.

Lessons: Needham Public School District exemplifies many of the strategies used by other districts that have successfully changed their start times. It created a small working group composed of key department members and parent and teacher representatives to collect information on the scientific research (including interviews with sleep experts), to consider the potential impact and develop possible mitigating strategies, and to conduct meetings with stakeholders. The committee carefully studied the issues over a protracted period of time, developed and articulated a compelling rationale for changing the bell schedule and presented a range of options to the community based on an assessment of feasibility.

(Source(s): Needham Public Schools School Starting Time Report and Recommendation, January 2003.)

Arlington Public Schools, Virginia

Arlington Public Schools is a large urban district just outside of Washington, DC. Currently, the school district has more than 19,900 students in 22 elementary schools, five middle schools, and four high schools. In 1999, based on the growing interest of some parents and the school board in emerging sleep science and in order to reduce transportation costs and to improve academic performance, the district began a comprehensive and intricate two-year process to change its school start times.

The school board requested that the district’s Advisory Council for Instruction (ACI), a large body of 50 members, form a School Start Time Steering Committee to compile research on sleep and adolescence and to study the potential impact of changing bell schedules on transportation and extracurricular activities. In December of 1999, the committee recommended that the school board move high school start times 45 minutes later (from 7:30 am to 8:45 am) starting in the fall of 2000. Based on this recommendation, the school board voted unanimously to direct district staff to develop plans to change start times for high schools. As part of its direction, the school board provided four guiding principles: 1) the change should improve student achievement, 2) no school

should start before 7:50 for safety reasons, 3) change in high school start times should not negatively impact any group or school level, and 4) the ability of students being able to participate in extracurricular activities should not be affected. The board also expressed a desire that an evaluation study be conducted following implementation.

Following the board action, the superintendent formed a working group, comprised of both staff and community members, to review the ACI's findings, study all relevant issues, and make recommendations for implementation in the fall of 2001. The working group consisted of a steering committee and several subcommittees to study and make recommendations regarding such issues as transportation, public engagement, after-school activities, and sleep research. The district also hired a transportation consultant to study bus schedule options and to look for additional efficiencies in the system. The consultant and the working group initially developed 12 options, eventually settling on a total of four, one of which included keeping the current bell schedules (status quo).

Once the options were refined, the steering committee and representatives from a couple of the subcommittees engaged in significant community engagement to educate the community about sleep science and to obtain feedback on the models. Materials were developed and distributed in back-to-school packets, at the superintendent's public meetings, the local county fair as well as in press releases. Information was also posted on the district's website and community feedback was requested via email through the website. Letters were sent to all of the local parent teacher associations (PTAs) and representatives from the steering committee attended meetings to provide information and answer questions. As part of its process, the working group worked with the University of Maryland to conduct surveys of parents, students and teachers and held two public forums to solicit input from the community.

Based on a few different periods of community engagement and staff input, the steering committee developed additional options and made further adjustments throughout. Finally, in October 2000, the steering committee made a recommendation to the school board, which voted unanimously to change start times for high schools from 7:30 am to 8:15 am, middle schools from 8:10 am to 7:50 am, and elementary schools from 8:10 am and 8:50 to three tiers of 8:00 am, 8:25 am and 9:00 am. Following the vote, the school board requested that district staff survey teachers about the proposed changes on whether or not they would leave the school district with the change taking place. The survey found that 14% reported that they would consider leaving their jobs.

During the implementation phase, the steering committee and school board continued to meet with the community and key stakeholder groups in order to discuss issues and foster support for the bell changes. A toll-free line was established to help parents and students ask questions about the implementation, but was rarely used. A series of surveys were conducted to gauge community, teacher and student satisfaction following the school start time changes.

In 2005, the school district's Office of Planning and Evaluation did an analysis of surveys conducted after implementation and grades collected pre (2000-2001) and post (2001-2002) implementation. The results were largely inconclusive and the Office stated that its analysis "should be interpreted with caution" because it was "impossible to isolate the impact of the start time change on academic performance." However, the Office found a "very slight" improvement in the first period grades for the graduating class of 2003. Other findings were insignificant improvements in academic performance but negligible or largely inconclusive results regarding tardiness and attendance. The Office did report that more high school students reported (41% vs. 47%) participating in "class discussions" and "being prepared for class" (41% vs. 47%) all of the time.

Lessons: Arlington is a good example of a district that conducted considerable research, did comprehensive planning, and included community members and key stakeholders throughout the process, including after implementation. This district staff, working group and school board conducted significant community engagement efforts and adjusted models and plans during the process, but did not let any opposition deter them from achieving what they believed was best for students. This case also demonstrates that while people express strong concerns about change, such fears rarely ever come to fruition in regard to making changes to bell schedules (no teachers left as a result of the change). As time goes by, people adapt, traffic patterns and personal schedules adjust.

(Source(s): Changing School Start Times: Arlington, Virginia. Sleep for Teens Toolkit. National Sleep Foundation, 2005. Accessed by <http://www.sleepin Fairfax.org/research.htm>. Impact of 2001 Adjustments of High School and Middle School Start Times. Lewin, D. [2013, October 31] Telephone interview. Arlington Public Schools, Office of Planning & Evaluation, June 2005. <http://www.fcps.edu/fts/taskforce07/documents/arlington605.pdf>.)

VII. A Summary of Lessons Learned From Other School Districts

After reviewing all of the available information on the process of school start time change from a wide variety of sources as described above, including the in-depth case examples, the CNMC team has compiled a summary of the most common and salient points to best inform school districts, such as Fairfax County, that are actively contemplating a change in bell schedules. While not necessarily exhaustive, as each school district will have both unique challenges and solutions, these ten key messages represent principles that have a basic foundation in successful implementation of start time change and are those that are most applicable to the majority of school districts, no matter their size or complexity of issues. The following are categorized according to major content themes.

1. The Importance of Leadership

Very often, the publically stated position of the district superintendent is the key determinate as to whether or not a school district is successful in changing school start times. This individual can set the tone for other staff, and can control communications, planning, logistics and community engagement, etc. The relationship and trust (i.e., political capital) that the superintendent has established in the community and with the school board is also extremely important. If the superintendent and district officials do not communicate their strong support for the bell time change and do not keep discussions focused on the health, safety and academic performance of students, then the process may get bogged down with special-interest concerns.

The school board's public support for the superintendent and for school start time change is also critical. The school board's support is especially vital in communicating to the broader public both the justification (e.g., health and safety benefits) for changing bell schedules and the message that any challenges can be addressed and most likely overcome. Those school districts that seemed to have been most successful in changing their start times are those in which the superintendent, district staff and the school board have become well-informed regarding the sleep science and have worked with key community organizations to address logistical challenges and study the truly relevant logistical or financial concerns or issues and to promote the benefits to student health, safety, and academic and athletic performance (e.g., Jessamine, KY; Bentonville, AR; Edina, MN; Minneapolis, MN; Needham, MA; Brunswick, ME; South Washington County, MN).

2. Education of the Entire Community

Change agents and stakeholders should have a working knowledge of the research on adolescent sleep and early start times in order to effectively communicate the rationale for changing bell schedules (Arlington, VA). It is important for school district leadership (i.e., superintendents, school board members, principals) to refute misconceptions (e.g., "if school starts later, teens will just stay up later and won't get more sleep") while also responding to the legitimate concerns of students, parents, and teachers. Community members and staff may either discount the scientific literature or choose to focus on perceived (whether or not valid) complications related to logistical or personal convenience concerns; thus, the more educated that district staff becomes about the sleep science, the more persuasive they will be in communicating these messages.

It is extremely important to emphasize the health and safety benefits associated with providing students the opportunity to get more sleep and that the potential benefits go far beyond academic improvements. When communicating the short and long-term consequences of chronic sleep loss (and, by implication, the potential dangers associated with failing to delay high school start times), it should be emphasized that these extend not only beyond the school grounds (e.g., drowsy driving, depression, obesity) but very well may set students up for debilitating (e.g., insomnia) or life-

threatening medical conditions (e.g., cardiovascular consequences such as hypertension or metabolic dysfunction such as type 2 diabetes) in the future.

Districts should seek to provide appropriate targeted education for the entire community (students, parents, teachers, school nurses) on sleep, sleep disorders, and the consequences of sleep deprivation. Efforts should be made to work with local sleep centers and hospitals to provide medically accurate information and to present that information in a variety of forums (e.g., fact sheets, slide presentations, webinars) for a range of audiences, and include ample time for discussion and addressing questions (Albany, CA; Fayette, KY). Teachers and other school personnel, especially health and counseling professionals, should be well educated about adolescent sleep needs and patterns, taught to recognize the signs of sleep-related difficulties among their students, and report such symptoms to parents and school health providers (20, 21). Superintendents, school boards and principals should consider integrating sleep-related education into curricula so students can learn about the physiology of sleep, the consequences of sleep deprivation, and the importance of sleep to their overall health. This education can be provided in science, health and athletic classes.

Finally, it is particularly important that information be provided to support families throughout the implementation phase in culturally sensitive ways. This includes translating basic print educational materials into multiple languages, providing translation services at community-wide online forums and reaching out to local press venues that serve minority communities.

3. Consensus Building Among Stakeholders

It is important to inform and engage all stakeholders early in the process to understand potential concerns and to seek potential solutions. This includes community members or organizations that use school district fields and facilities on a regular basis as well as other city or county agencies that provide programs and services to students (i.e., libraries, parks and recreation, police, employers). The district should notify these groups of any changes once the decision is made in order to allow them time to adjust their schedules and for planning, and should continue to engage them throughout implementation in a spirit of partnership.

Districts should consider the views of school staff and teachers in decision-making about implementation and develop policies that provide flexibility for teachers and other staff to adapt to the changes (e.g., easing periods to make transfer requests). It is also important to involve principals from all three levels (elementary, middle and high schools) in internal discussions because it is likely that all schools and students in the district will be impacted to some degree, whether or not their own bell times change. Engagement of the students themselves is also critical in garnering support for the change, and often they can be the most passionate and articulate voices in the community.

At all stakeholder levels, it should be noted that expressed concerns are sometimes based on contractual or personal issues rather than what is good for the health, safety and well-being of students. In these situations, the superintendent, school board and stakeholder group leaders' public support for start time change will be critical in overcoming any staff or community opposition.

When considering bell changes, the district should first bring together key staff representing several areas (e.g., transportation, curriculum, special or health services, athletics) to do their own fact-finding before engaging additional outside consulting groups. This allows internal staff to identify logistical issues early and begin to develop potential solutions before opening up the debate to the wider community.

In regard to process, it may be prudent to engage the leadership of key community groups in face-to-face meetings in order to build trust, air mutual concerns, and establish an open dialogue prior to establishing working groups or task forces. In general, smaller working groups focused on specific tasks tend to be more productive and successful than large cumbersome ones that include many stakeholders.

4. Transportation as a Major Logistical and Cost Factor

Transportation of students determines most start time schedules and is typically the largest cost and logistical factor that districts consider. However, in many districts, transportation is actually the main driver for seeking changes in an attempt to lower costs by adopting a multi-tiered bus delivery schedule (Academy District 20, CO; Santa Rosa, CO). Districts that already employ a multi-tiered delivery schedule may have to use more creative strategies to find transportation savings. One strategy that is commonly used to overcome potential transportation costs is what is commonly referred to as “flipping” secondary/high school and elementary bell schedules. This may have the added benefit of being more “in sync” with circadian rhythms in both groups (e.g., younger children typically fall asleep earlier and wake earlier). For some districts, new approaches should be considered; these include encouraging car pools, providing incentives for using public transportation (e.g., Denver, CO), creating bus depots for special program and centers, charging a flat-rate transportation fee to students for special activities (e.g., Brevard, FL), and allowing middle school and high school students to ride on the same buses.

5. Athletics and Community Use of Recreational Facilities

Community members in districts contemplating school start time changes frequently are concerned about impact on after-school sports practices and competition; however, most of these concerns do not actually materialize or can easily be mitigated by scheduling or policy changes (e.g., game day early dismissal, more flexible instruction time and scheduling). There appear to be no districts in which athletic programs were cancelled or significantly adversely affected following start time changes. To the contrary, a number of districts found that more students participated in athletics and that sports programs grew after high school bell times were delayed (e.g., Edina, MN,) and reported that their teams performed better following the change (e.g., Wilton, CT; Edina, MN; Seattle, WA). Thus, it is important for administration officials, coaches and student athletes to not only appreciate the likely lack of negative impact on athletics of delayed start times, but to also understand the potential repercussions on relevant health (e.g., metabolic dysfunction, weight gain), performance and safety (e.g., increased sport-related injuries) outcomes related to chronic sleep loss (22, 23).

6. One Size Does Not Fit All

While there are clearly general overarching principles that can (and should) be applied across diverse communities, it should also be emphasized that the extent to which changing school start times impacts a given community and the relative importance of the different challenges and benefits (anticipated and experienced) varies widely across school districts. Thus, it follows that there is also no “one-size-fits-all” or singular optimal approach to tackling this issue. Among the myriad of variables that need to be considered on a case-by-case basis include average (and range of) student commute times, number and length of school bus routes, availability of public transportation, traffic patterns, community use of school recreational facilities, the number of students enrolled in free breakfast programs, and the impact of later dismissal times on after-school programming both for disadvantaged students and for high-achieving students seeking additional academic enrichment opportunities. For example, concerns about access to personal transportation tend to be more prevalent in less affluent school districts than in more affluent ones. Similarly, modes of transportation are typically much more of an issue for larger districts, especially those in urban or metropolitan centers with high traffic congestion (Denver, CO).

7. Prioritizing Sleep Health is an Important Corollary to School Start Time Change

Despite the best of efforts, there is likely to be some variability in how much individual students within a district benefit from start time change. While studies definitively show that students overall obtain more sleep when start times are delayed, there will be families and students who choose not to take advantage of the additional sleep opportunity (24, 25). This underlines the importance of providing education about sleep health and time management to both parents and students in conjunction with schedule changes. In addition, schools may undermine the benefits of delayed start times by rescheduling after-school programs and activities to before school (e.g., early morning sports practices). Excessive homework, an issue frequently raised by students and parents, may also diminish students' abilities to obtain optimal sleep. Districts should consider using the change in start times as an opportunity to make other adjustments that are in the best health interests of students and which complement the benefits associated with increased sleep.

8. Adjustments Take Time

It is critical to allow adequate time prior to implementing changes for families and other community members to become informed and make sufficient plans (e.g., childcare, transportation, family time). Once finalized, district leadership should communicate the details of the new schedules soon as possible, along with information on the rationale for making changes (e.g., Pulaski, AR). District-level organized and comprehensive communication and outreach efforts are absolutely key in conveying information in a timely manner to the community and in addressing the misinformation and misconceptions that often circulate in the advent of such an important (and often controversial) societal change.

9. Anticipation is Often Worse than the Reality

Similar to concerns regarding the impact of delayed start and dismissal times on athletic practices and games, many of the other potential problems typically raised in the community prior to the change are often not substantiated (Arlington, VA; Wilton, CT). For example, several studies have shown that participation by students in extracurricular activities does not decline when start times are delayed (16). Teacher retention is another commonly expressed concern that may not be realized; in Arlington VA, for example, the predicted mass exodus of teachers in the district never occurred and in fact, only one teacher left. Communities often make adjustments to accommodate changes in schedule; for instance, employers shift work hours for student workers and parents utilize after-school childcare for elementary students instead of before school options if start times are "flipped." Finally, some problems dissipate over time; for example, traffic may temporarily worsen when bus routes are changed, until drivers in the community adjust their commuting patterns.

10. Monitoring Outcomes

Districts should monitor the results and outcomes following the change to later start times, communicate positive results to the community and seek ways to mitigate or address negative or unforeseen impacts (Arlington, VA). Ideally, districts should work with county health professionals or local university or medical centers to design pre- and post-surveys and other methods to measure the impact of changing school start times on student health, safety and academics. Districts that have conducted outcomes research have been able to communicate the findings to the community to foster further acceptance of changing school start times. Additionally, they have been able to provide important data for the growing scientific literature in this area as well as invaluable resources for other districts contemplating school start time change.

V. Conclusions

Establishing healthy school start times has a clear scientific rationale but can introduce considerable challenges for communities, including school administrators, families, students and other stakeholders. While the potential benefits to the health, safety and performance of students are irrefutable, many school districts remain reluctant to “take the plunge” and commit time, effort, resources and political capital to this effort. It is our hope that providing this “blueprint for change” with general recommendations regarding the process involved in changing school start times will be an impetus for school districts across the country take this important step.

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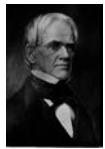
IX. Appendices

A. History of School Start Times and Sleep Research on Adolescents in the United States

Historically, public school bell times across the nation evolved as a result of economic, social, legal and political pressures on school districts and municipalities – not from sleep science pertaining to adolescents (which essentially did not exist until the 1970's) or concerns about the health, safety and academic performance of students. Below is an overview of the interplay between influential factors in the development of public education and its transportation systems as well as major milestones in science of sleep and circadian biology.

1800s

Until the 1840s, the educational system is highly localized and largely accessible only to certain privileged groups (i.e., the wealthy, whites, males).



Mid 1800s

Educational reform movement led by Horace Mann and Henry Barnard leads to free public education at the elementary level for all American children.

Late 1800s

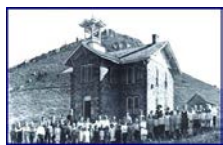
17 states had operable public school transportation programs, starting with Massachusetts in 1869 (e.g., horseback, wagon).



At the end of the nineteenth century, 93% of the highways in the country are dirt roads. Horse-drawn carriages and the railroad are the leading means of transportation. Automobiles first came into use in the 1890s, and the first auto arrived in Seattle in 1900. By the 1950s, the “Age of the Automobile” had come into its own and there is great pressure to create an improved transportation infrastructure; i.e., to build more and better roads that link new houses being built outside cities and jobs that still exist mostly in urban centers.

1900s

1915—Navistar manufactures the first “school bus” for Ravinia School District in South Dakota.



By 1918, all states have passed laws requiring children to attend at least elementary school.

1919—All 48 states have laws allowing the use of public funds for transporting children to and from school.



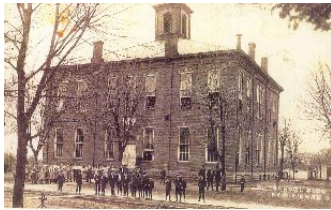
1920s

Dr. Nathaniel Kleitman, one of the earliest and most influential sleep researchers, begins to study the regulation of sleep and wakefulness at the University of Chicago.

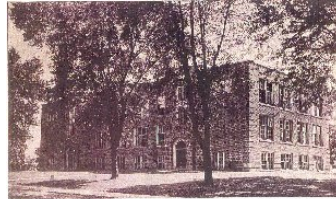
1925—Supreme Court rules in *Pierce v. Society of Sisters* that states cannot compel children to attend public schools and that children can instead attend private schools.

As the 20th century progresses, most states enact legislation extending compulsory education to age 16.

The availability of and access to affordable motor vehicle transportation helps transport children from more rural and remote areas and helps lead to the consolidation and modernization of schools.



New Vienna, OH 1850-1917



New Vienna, OH 1917-1963

1939—Dr. Nathaniel Kleitman publishes his seminal book *Sleep and Wakefulness*.

1940s

In the 1940s, responsibility for financing public education becomes more regionalized at the state, district and municipality levels. In 1940, local property taxes finance 68% of public school expenses, while state governments contribute 30%. By 1990, local districts and states each contribute 47% to public school revenues. The federal government provides most of the remaining funds.

1941-1945—U.S. in World War II: Industrialization and a post-war economic boom dramatically change the prosperity of Americans and they buy more houses, automobiles and start families, which will become the “baby boomers.”

By the middle of the 20th century, most states take a more active regulatory role in public education than in the past. Many states consolidate school districts into larger units. In 1940, there are over 117,000 school districts in the United States, but by 1990 the number decreases to just over 15,000. This regionalization often results in transporting a greater number of students over longer distances.

1950s

All in all, new highways, faster & cheaper vehicles, and economic prosperity stimulate a tremendous urban sprawl and the “suburbanization of America” from the 50s to present day.

1950s-1960s—“Baby boomers” begin to reach school age. More than 50% of today’s schools are built during this period.

1953—Dr. Nathaniel Kleitman and his graduate student, Eugene Aserinsky, make the landmark discovery of rapid eye movement (REM) during sleep. Shortly afterwards, their student, Dr. William Dement describes the “cyclical” nature of sleep and the relationship between REM and dreaming.

1954—*Brown v. Board of Education* outlaws “separate but equal” facilities. “White flight” from urban centers begins, leading to the rapid development of suburban school districts. In many regions of the country, children are bused longer distances to assist in integrating schools.

1956—President Dwight D. Eisenhower signs the Interstate and Defense Highways Act and helps accelerate the suburbanization of America. 47,000 miles of federal highway are built.

1960s

By the early 1960s, there is a rapid increase in the school population due to the consolidation of remaining schools—larger and more complicated school districts are created. Educators begin looking for new ways to deal with the problem of overcrowding, which leads to staggered start times being considered and implemented in some school districts. With little or no sleep science available to guide decision-making, high school start times are typically placed earlier than elementary schools.

1961—Fairfax joins Montgomery and Prince Georges Counties in MD in staggering start times for elementary and secondary schools to reduce operating costs. All high schools except Herndon and Luther Jackson start at 8:15 am.

1970s

During the 1970s, recession, inflation, increasing fuel costs and budget cuts further contribute to a “do more with less” mentality in school systems and in state and local governments. As a result of waning enrollment and decreasing property tax revenues, many school districts look for ways to cut transportation costs and adopt tiered bell schedules so that they could move the same number of students with fewer buses.

1970—Court-ordered busing begins to help integrate schools, but in some regions of the country, this leads to an even greater exodus from urban centers. The further consolidation of schools and the creation of still larger school districts result in longer commutes for some students.

Dr. William Dement, “the father of sleep medicine,” founds the first sleep research center at Stanford University.

1972—Animal studies lead to the discovery of the suprachiasmatic nuclei in the hypothalamus is the center of the “biologic (or circadian) clock” in the human brain.

The Fairfax County School Board adopts ½ Mondays in elementary schools to allow for planning time for teachers.

1973-1974—Stock market crash causes inflation and devaluation of the dollar.

U.S. experiences an energy crisis due to an oil boycott by the Organization of Arab Petroleum Exporting Countries (OAPEC). President Nixon asks the nation to adopt measures to conserve energy. School districts lower thermostats, consider shorter days and many adopt tiered-busing to save fuel, which will more than double in price by the end of the decade.

1974—Daylight Saving Time is expanded to more states and for a more extended time period, which leads to concerns regarding younger students waiting for the bus in the dark.

1976—Using a standardized protocol (the Multiple Sleep Latency Test), Dr. Mary Carskadon establishes sleep latency (time to fall asleep) as a physiologic measurement of sleep propensity (likelihood of falling asleep). This allows researchers to objectively measure the extent of daytime sleepiness resulting from acute and chronic sleep loss and begin to quantify the impact of sleep loss on daytime performance.

1975-1976—The Fairfax County School Board cancels plans to buy 80 new replacement busses and instead adjusts bell schedules earlier by 10-15 minutes and adds a fourth tier to its busing schedule.

Late 1970s—Dr. Mary Carskadon at Brown University and others conduct initial research on normal biological and circadian changes in adolescent sleep.

1979—Second energy crisis hits the nation following the Iranian revolution; increasing pressure on school districts and municipalities to lower transportation costs.



1979–1986 – During the next decade, Fairfax County Public Schools moves its high school start times from 8:00-8:15 am to 7:40 am.

After peaking in 1970, total school enrollment falls during the 1970s and early 1980s.

1980s

During the 1980s, an increase in the birth rate and new immigration contributes to the growth of the nation’s student population, adding pressure on many school systems.

Starting in the 1980s, important research on adolescent sleep needs and sleep schedules is conducted by Dr. Carskadon and others.

1982—Researchers develop a hypothesis about how sleep may play a key role in learning and memory consolidation.

1986—Dr. Charles Czeisler and colleagues describe for the first time how bright light influences the human biological clock.

1987—Fairfax County Pubic Schools’ high schools move start times earlier by 10 minutes to 7:30 am.

1988—U.S. Congress appoints Dr. William Dement as Chair of the National Commission on Sleep Disorders Research to study the prevalence of sleep deprivation and sleep disorders and their impact on the health of all Americans.

1990s

Sleep researchers begin to describe delayed phase preference in teenagers and the impact of school schedules and employment on their sleep. Researchers also begin to study sleep disorders and the relationship between sleep loss and depression in adolescents.

1990—Fairfax County Public Schools increases its secondary school day by 30 minutes by adopting a 7-period day, with high schools going from 7:30 am to 2:20 pm.

1992—The National Commission on Sleep Disorders Research issues its report and declares, “America is seriously sleep-deprived with disastrous consequences.”

1993—The Minnesota Medical Association adopts a resolution calling on local school districts to eliminate early start times for adolescents.

The National Center for Sleep Disorders Research (NCSDR) is established at the National Institutes of Health; its mission is to coordinate research and national educational efforts about sleep and sleep disorders.

1994—The CLOCK gene is discovered, which both demonstrates the genetic influence on normal human circadian functioning and emphasizes the importance of circadian regulation on health and disease.

1996—Edina, Minnesota becomes the nation’s first school district to delay start times for high school students based on sleep research showing the impact of sleep loss on young people.

High school start time in Fairfax County is adjusted 10 minutes earlier to 7:20 am, where it currently remains.

1997—The National Institutes of Health (NIH) declares that adolescents and young adults (ages 12 to 25 years) are a population at high risk for problem sleepiness based on “evidence that the prevalence of problem sleepiness is high and increasing with particularly serious consequences.”

1997—As a means of mitigating after-school criminal activity by unsupervised teenagers, Congresswomen Zoe Lofgren introduces Concurrent Resolution 227 (ZZZ’s to As Act) expressing the “sense of Congress that secondary schools should begin the school day no earlier than 9:00.”

1998—Dr. Kyla Wahlstrom and colleagues publish the preliminary findings of their research on the impact of changing start times in 3 Minneapolis high schools.

1999—Congresswoman Zoe Lofgren introduces H.R. 1267, “Zs to As Act.” The bill provides grants up to \$25,000 to local educational institutions that agree to begin school for secondary students after 9:00 am. This time, the bill focuses on the sleep needs of adolescents. It does not pass, but gains significant media attention and helps spur a “national conversation” about the issue.

1999—The National Research Council holds *Sleep Needs, Patterns and Difficulties of Adolescents Workshop*, which raises awareness amongst federal agencies and other health professionals about more than two decades of sleep research on teens. Dr. William Dement declares, “Adolescence is the time of greatest vulnerability from the standpoint of sleep.”

Dr. Eve Van Cauter and her colleagues describe the effects of sleep debt in young adults, establishing an association between sleep loss and metabolic and hormonal function. The research later leads to findings linking sleep loss with an increased risk of obesity.

2000s

Sleep researchers increasingly focus on cultural and international differences in sleep habits, including public policies related to work and school hours and their impact on sleep, etc. There is also emerging evidence that puberty-related changes in sleep patterns may affect middle school students as well, thus highlighting the importance of considering later start times in this population as well.

2000—The National Sleep Foundation releases an *Adolescent Sleep Research Report and Resource Guide* at a press conference on Capitol Hill with Congresswomen Zoe Lofgren in order to draw national media attention to the consequences of early start times on the health and safety of adolescents.

2001—A state senator in Connecticut introduces the first statewide legislation to change school start times in the nation, but it does not pass.

2002—Dr. Kyla Wahlstrom publishes *Changing times: Findings from the first longitudinal study of high school start times*, the nation’s first major study that details the positive impacts of later school start times.

2002—A bill is introduced in the Connecticut Senate that bans administering state tests before 9:00, but does not pass.

2003—Stickgold and colleagues at Harvard Medical School publish evidence of the relationship between sleep and memory and learning.

2004—The State of Connecticut passes legislation that allows districts to administer the tenth grade mastery test as early as 8:30.

2006—The National Sleep Foundation issues its annual “Sleep in America” poll. The national poll is the first of its kind, detailing the findings of telephone interviews from a random sample of 1,602 caregivers and their adolescent children about the student’s sleep and sleep habits. It finds that only 9% of high school-aged respondents get the amount of sleep recommended by physicians on school nights.

2009—The Centers for Disease Control and Prevention (CDC) releases data from a national survey used to assess the prevalence of unhealthy sleep behaviors in 12 states and declares “insufficient sleep is a public health epidemic.”

1900-2010—The percentage of teenagers who graduate from high school increases from about 6% in 1900 to about 85% in 1996, and then declines over the next decade and a half to 75% in 2010.

2010s

2010—The Department of Health and Human Services releases Healthy People 2020, which for the first time gives sleep it’s own focus area and sets the objective of increasing “the proportion of students in grades 9 through 12 who get sufficient sleep.”

2010—The American Medical Association (AMA) adopts Resolution 503, “Insufficient Sleep in Adolescents,” – sponsored by the American Sleep Apnea Association – which confirms “adolescent insufficient sleep and sleepiness as a public health issue” and supports “education about sleep health as a standard component of care for adolescent patients.”

2011—Vorona et al publish findings on adolescent automobile crash rates in Virginia Beach and Chesapeake, Virginia showing a significant increase in crashes in the district with earlier high school start times.

The Brookings Institute issues its report, *Organizing Schools to Improve Student Achievement: Start Times, Grade Configurations, and Teacher Assignments*, identifying high school start time delay as one of the 3 most important strategies to improve America’s schools and projecting a potential benefit-to-cost ratio of 9:1.

The CDC publishes an epidemiological study showing that almost 70% of high school students are not getting sufficient sleep and sleep loss is associated with 10 at-risk behaviors including smoking, alcohol and marijuana use, sexual activity, feelings of sadness, and thoughts of suicide.

2012—The Florida Chapter of the American Academy of Pediatrics issues a position statement supporting, “considerations to policy changes where students’ physical and mental health is promoted. The FCAAP/FPS supports efforts to change high school start times after 8:00 a.m.”

2013—U.S. Department of Education Secretary Arne Duncan tweets, “Common sense to improve student achievement that too few have implemented: let teens sleep more, start school later.

Virginia Chapter of the American Academy of Pediatrics issues a statement supporting later school start times for all Virginia high schools.

2014—Dr. Kyla Wahlstrom, with funding from the CDC, publishes the findings from a 3-year research study looking at the impacts of later start times in 8 public high schools in 3 states. The study finds that later start times improve sleep, academic performance and reduce motor vehicle crashes.

B. National School Start Time Survey

You are being asked to fill out this survey because your school district has prior experience with delaying high school start times and you participated in and/or have knowledge about the process. Thank you for your time.

General Information

1. Name and title of individual filling out survey:
2. Name and location of school district:

- 3a. What year did your school district begin to implement school start time change?

- 3b. If your district employed a phased-in approach, over how many years was start time change implemented?

4. Please indicate the number of schools in your district in the following categories:
 - Elementary School
 - Middle School
 - High School

5. Please indicate the approximate number of students enrolled in each category:
 - Elementary School
 - Middle School
 - High School

6. Please indicate the total number of school buses transporting students in your district:

7. Please indicate the school start/end times PRIOR to the change for:
 - Elementary School
 - Middle School
 - High School

8. Please indicate the school start/end times AFTER the change for:
 - Elementary School
 - Middle School
 - High School

9. Please indicate the current school start and end times (2013-14 academic year)
 - Elementary School
 - Middle School
 - High School

II. Change strategy and Implementation

10. Which best describes your district's school start time change strategy (select all that apply)?
 - "Flip" (e.g., switch high school and elementary school start times)
 - All school start times (ES, MS, HS) delayed ("slide" later)
 - Addition of a "zero period" in the morning
 - Students chose late or early start times
 - Other (please describe)

11. Please indicate which transportation approaches were in place before and/or after the start time change (may select more than one):

- Tiered bus delivery schedule
- Decreased transportation budget
- Increased transportation budget
- Consolidated “bus depots”
- MS /HS ride together
- ES/MS ride together
- ES/MS/HS ride together
- No Buses provided for magnet schools
- Students pay flat-rate for buses for year
- Increased utilization of public transportation
- Other (please describe)

12. Please mark “Yes” or “No” for the following *challenges* that your school district faced in changing school start times.

Yes No N/A

- 1) Traffic flow at the school during drop off and pick up
- 2) Commuting distances
- 3) Before-school extracurricular program attendance
- 4) After-school extracurricular program attendance
- 5) Before-school academic enrichment program attendance
- 6) After-school academic enrichment program attendance
- 7) Use of school facilities by non-school community groups (e.g., Boy Scouts)
- 8) Athletic game schedules
- 9) Before-school athletics practice schedules
- 10) After-school athletics practice schedules
- 11) Use of practice fields by non-school groups (e.g., Parks and Recreation)
- 12) Before-school child care
- 13) After-school child care
- 14) Changes in parents’ work schedules
- 15) Changes in teachers’ work schedules
- 16) Changes in staff commute times
- 17) Student after-school employment
- 18) Participation in school breakfast programs
- 19) “Civil twilight” violations (i.e., leaving home before dawn or after dusk) for elementary students
- 20) Other (please specify):

13. Please rank order the top five issues that were the most challenging (from 1=most challenging to 5=least challenging)

- 1) Traffic flow at the school during drop off and pick up
- 2) Commuting distances
- 3) Before-school extracurricular program attendance
- 4) After-school extracurricular program attendance
- 5) Before-school academic enrichment program attendance
- 6) After-school academic enrichment program attendance
- 7) Use of school facilities by non-school community groups (e.g., Boy Scouts)
- 8) Athletic game schedules
- 9) Before-school athletics practice schedules
- 10) After-school athletics practice schedules
- 11) Use of practice fields by non-school groups (e.g., Parks and Recreation)
- 12) Before-school child care
- 13) After-school child care
- 14) Changes in parents’ work schedules
- 15) Changes in teachers’ work schedules
- 16) Changes in staff commute times
- 17) Student after-school employment

- 18) Participation in school breakfast programs
- 19) "Civil twilight" violations (i.e., leaving home before dawn or after dusk) for elementary students

14. Please mark "Yes" or "No" for the following *strategies* that your school district employed in changing school start times.

Yes No N/A

- 1) Substitute online education for early morning classes
- 2) Substitute summer school for early morning classes
- 3) Substitute Saturday classes for early morning classes
- 4) Increasing the length of winter break to reduce early morning travel for elementary students ("civil twilight violations") and decreasing the summer break by a corresponding number of days
- 5) Flexible start and end-time scheduling (not requiring school bus transportation)
- 6) Adding lighting for selected athletic playing fields
- 7) Increased use of public transportation (e.g., providing incentives for use)
- 8) Increased use of personal transportation (e.g., "kiss and ride")
- 9) Decreased use of personal transportation
- 10) Student athletes' early dismissal
- 11) Extracurricular programs on Saturdays
- 12) Mid-morning "breakfast break" for students
- 13) Other (please specify):

15. Please rank order the top five issues that were the most challenging (from 1=most challenging to 5=least challenging)

- 1) Substitute online education for early morning classes
- 2) Substitute summer school for early morning classes
- 3) Substitute Saturday classes for early morning classes
- 4) Increasing the length of winter break to reduce early morning travel for elementary students ("civil twilight violations") and decreasing the summer break by a corresponding number of days
- 5) Flexible start and end-time scheduling (not requiring school bus transportation)
- 6) Adding lighting for selected athletic playing fields
- 7) Increased use of public transportation (e.g., providing incentives for use)
- 8) Increased use of personal transportation (e.g., "kiss and ride")
- 9) Decreased use of personal transportation
- 10) Student athletes' early dismissal
- 11) Extracurricular programs on Saturdays
- 12) Mid-morning "breakfast break" for students
- 13) Other (please specify):

III. Benefits/Costs

16. Please mark "Yes" or "No" for the following *beneficial outcomes* that your school district observed at the high school level as a result of school start time changes; if you did not measure an outcome, please check "Not Applicable" N/A

Yes No N/A

- 1) Increase in daily attendance
- 2) Reduced tardiness rates
- 3) Improved standardized test scores
- 4) Improved grades
- 5) Higher graduation rates
- 6) Fewer referrals for disciplinary action
- 7) Improved sports team performance
- 8) Fewer sports-related injuries
- 9) Cost saving for public school system
- 10) Fewer student visits to school health centers
- 11) Lower rates of depression/suicidal thoughts
- 12) Lower rates of car accidents
- Other (please describe):

17. Please rank order the top five beneficial outcomes that you believe were the most important (from 1=most important to 5=least important).

- 1) Increase in daily attendance
- 2) Reduced tardiness rates
- 3) Improved standardized test scores
- 4) Improved grades
- 5) Higher graduation rates
- 6) Fewer referrals for disciplinary action
- 7) Improved sports team performance
- 8) Fewer sports-related injuries
- 9) Cost saving for public school system
- 10) Fewer student visits to school health centers
- 11) Lower rates of depression/suicidal thoughts
- 12) Lower rates of car accidents

18. Please mark “Yes “or “No” for the following *negative outcomes* that your school district observed as a result of school start time changes; if you did not measure an outcome, please check “Not Applicable”
N/A Yes No N/A

- 1) Financial cost incurred by the school district
- 2) Loss of community support
- 3) Impact on parent work schedules
- 4) Limitations on student after-school employment
- 5) Financial cost incurred by families (loss income, additional child care expenses)
- 6) Changes in traffic patterns
- 7) Reduction of student involvement in extracurricular activities/athletics
- 8) Negative impact on teacher schedules
- 9) Safety concerns for ES students

19. Please rank order the top five negative outcomes that you believe were the most important (from 1=most important to 5=least important).

- 1) Financial cost incurred by the school district
- 2) Loss of community support
- 3) Impact on parent work schedules
- 4) Limitations on student after-school employment
- 5) Financial cost incurred by families (loss income, additional child care expenses)
- 6) Changes in traffic patterns
- 7) Reduction of student involvement in extracurricular activities/athletics
- 8) Negative impact on teacher schedules
- 9) Safety concerns for ES students

Thank you very much for completing this survey!

The Children’s National Medical Center’s Blueprint for Change Team

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