JOINT STATE GOVERNMENT COMMISSION

General Assembly of the Commonwealth of Pennsylvania

SLEEP DEPRIVATION IN ADOLESCENTS: THE CASE FOR DELAYING SECONDARY SCHOOL START TIMES

Report of the Advisory Committee on Later School Start Times at Secondary Schools

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REPORT

Report of the Advisory Committee on
Later School Start Times at Secondary Schools

Project Manager:	Yvonne Llewellyn Hursh, Counsel
Project Staff:	Lydia Hack, Staff Attorney Maureen Hartwell, Public Policy Intern (Summer 2019) Yelena Khanzhina, Public Policy Analyst Allison Kobzowicz, Public Policy Intern (Fall 2019) Frank Lill, Public Policy Analyst Kahla Lukens, Administrative Assistant

The report is also available at http://jsg.legis.state.pa.us/publications.cfm

JOINT STATE GOVERNMENT COMMISSION

Room 108 Finance Building
613 North Street
Harrisburg, PA 17120-0108

Telephone: 717-787-4397
Fax: 717-783-9380
E-mail: jntst02@legis.state.pa.us
Website: http://jsg.legis.state.pa.us

The Joint State Government Commission was created in 1937 as the primary and central non-partisan, bicameral research and policy development agency for the General Assembly of Pennsylvania.[1]

A fourteen-member Executive Committee comprised of the leadership of both the House of Representatives and the Senate oversees the Commission. The seven Executive Committee members from the House of Representatives are the Speaker, the Majority and Minority Leaders, the Majority and Minority Whips, and the Majority and Minority Caucus Chairs. The seven Executive Committee members from the Senate are the President Pro Tempore, the Majority and Minority Leaders, the Majority and Minority Whips, and the Majority and Minority Caucus Chairs. By statute, the Executive Committee selects a chairman of the Commission from among the members of the General Assembly. Historically, the Executive Committee has also selected a Vice-Chair or Treasurer, or both, for the Commission.

The studies conducted by the Commission are authorized by statute or by a simple or joint resolution. In general, the Commission has the power to conduct investigations, study issues, and gather information as directed by the General Assembly. The Commission provides in-depth research on a variety of topics, crafts recommendations to improve public policy and statutory law, and works closely with legislators and their staff.

A Commission study may involve the appointment of a legislative task force, composed of a specified number of legislators from the House of Representatives or the Senate, or both, as set forth in the enabling statute or resolution. In addition to following the progress of a particular study, the principal role of a task force is to determine whether to authorize the publication of any report resulting from the study and the introduction of any proposed legislation contained in the report. However, task force authorization does not necessarily reflect endorsement of all the findings and recommendations contained in a report.

Some studies involve an appointed advisory committee of professionals or interested parties from across the Commonwealth with expertise in a particular topic; others are managed exclusively by Commission staff with the informal involvement of representatives of those entities that can provide insight and information regarding the particular topic. When a study involves an advisory committee, the Commission seeks consensus among the members.[2] Although an advisory committee member may represent a particular department, agency, association, or group, such representation does not necessarily reflect the endorsement of the department, agency, association, or group of all the findings and recommendations contained in a study report.

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[1] Act of July 1, 1937 (P.L.2460, No.459); 46 P.S. §§ 65 – 69.

[2] Consensus does not necessarily reflect unanimity among the advisory committee members on each individual policy or legislative recommendation. At a minimum, it reflects the views of a substantial majority of the advisory committee, gained after lengthy review and discussion.

Over the years, nearly one thousand individuals from across the Commonwealth have served as members of the Commission's numerous advisory committees or have assisted the Commission with its studies. Members of advisory committees bring a wide range of knowledge and experience to deliberations involving a particular study. Individuals from countless backgrounds have contributed to the work of the Commission, such as attorneys, judges, professors and other educators, state and local officials, physicians and other health care professionals, business and community leaders, service providers, administrators and other professionals, law enforcement personnel, and concerned citizens. In addition, members of advisory committees donate their time to serve the public good; they are not compensated for their service as members. Consequently, the Commonwealth of Pennsylvania receives the financial benefit of such volunteerism, along with their shared expertise in developing statutory language and public policy recommendations to improve the law in Pennsylvania.

The Commission periodically reports its findings and recommendations, along with any proposed legislation, to the General Assembly. Certain studies have specific timelines for the publication of a report, as in the case of a discrete or timely topic; other studies, given their complex or considerable nature, are ongoing and involve the publication of periodic reports. Completion of a study, or a particular aspect of an ongoing study, generally results in the publication of a report setting forth background material, policy recommendations, and proposed legislation. However, the release of a report by the Commission does not necessarily reflect the endorsement by the members of the Executive Committee, or the Chair or Vice-Chair of the Commission, of all the findings, recommendations, or conclusions contained in the report. A report containing proposed legislation may also contain official comments, which may be used in determining the intent of the General Assembly.[3]

Since its inception, the Commission has published more than 350 reports on a sweeping range of topics, including administrative law and procedure; agriculture; athletics and sports; banks and banking; commerce and trade; the commercial code; crimes and offenses; decedents, estates, and fiduciaries; detectives and private police; domestic relations; education; elections; eminent domain; environmental resources; escheats; fish; forests, waters, and state parks; game; health and safety; historical sites and museums; insolvency and assignments; insurance; the judiciary and judicial procedure; labor; law and justice; the legislature; liquor; mechanics' liens; mental health; military affairs; mines and mining; municipalities; prisons and parole; procurement; state-licensed professions and occupations; public utilities; public welfare; real and personal property; state government; taxation and fiscal affairs; transportation; vehicles; and workers' compensation.

Following the completion of a report, subsequent action on the part of the Commission may be required, and, as necessary, the Commission will draft legislation and statutory amendments, update research, track legislation through the legislative process, attend hearings, and answer questions from legislators, legislative staff, interest groups, and constituents.

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[3] 1 Pa.C.S. § 1939 ("The comments or report of the commission . . . which drafted a statute may be consulted in the construction or application of the original provisions of the statute if such comments or report were published or otherwise generally available prior to the consideration of the statute by the General Assembly").

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Pennsylvania State University

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Pennsylvania Association of School
Business Officials (PASBO)

Annabel Zhao
Student
Radnor High School

In Memory of

Korri Brown

Glenolden, Pennsylvania
May 22, 1977 – May 18, 2019

With sadness we note the passing of Korri Brown, who had been a member of the Advisory Committee on Later School Start Times at Secondary Schools when she passed away unexpectedly prior to the completion of this report. Ms. Brown was serving on the advisory committee in her capacity as Vice President of the Pennsylvania State Education Association.

General Assembly of the Commonwealth of Pennsylvania
JOINT STATE GOVERNMENT COMMISSION
Room 108 – Finance Building
Harrisburg, Pa 17120

717-787-4397 *Fax* 717-783-9380

To the Members of the General Assembly of Pennsylvania:

We are pleased to release *Sleep Deprivation in Adolescents: A Case for Delaying Secondary School Start Times*, as authorized by Senate Resolution 417 of 2018 (Printer's No. 2022). SR 417 directed the Joint State Government Commission to appoint an Advisory Committee to study the "issues, benefits and options related to instituting a later start time to the school day at secondary schools in the Commonwealth." The Advisory Committee drew on the expertise and experience of its members, which included students, parents, educators, school nurses, psychologists, pediatricians, and school transportation administrators, along with other experts. Discussions focused on the public health threat caused by chronic sleep deprivation, as the Advisory Committee sought to thread solutions through the challenges faced by the Commonwealth's demographically, geographically, and economically diverse schools.

The report includes the Advisory Committee's recommendations, the most important being that districts give consideration to later start times for secondary schools. To this end, the Advisory Committee recommended that districts gather robust data and substantiate their decisions with evidence. Further, sleep health literacy should be included as a component of school health curricula. Finally, the Advisory Committee suggested that there may be ways for the Commonwealth to assist districts with guidance and incentives.

The full report is available on our website at http://jsg.legis.state.pa.us/publications.

Respectfully submitted,

Glenn J. Pasewicz
Executive Director

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EXECUTIVE SUMMARY

Public health officials and the medical community at large have declared that a public health crisis of epidemic proportions is affecting American adolescents. Most adolescents do not get enough sleep, leading to a myriad of mental, behavioral, and physical effects, as well as public safety concerns. Adolescent sleep needs are driven by a temporary biological shift in sleep onset and wake times that occurs concurrently with the onset of puberty, and ends in early adulthood. Early school start times run counter to this biological condition, and can contribute substantially to adolescent sleep deprivation.

Insufficient sleep affects adolescent school performance in terms of cognitive function and performance, graduation rates, attendance, and tardiness. Insufficient sleep increases the risk of adolescent motor vehicle accidents, athletic injuries, and other injuries. Insufficient sleep affects adolescent behavioral health in terms of poor self-esteem, and risky behavior, including crime and delinquency. Insufficient sleep affects adolescent mental health in terms of affect and mood, anxiety, depression, and suicidality. Insufficient sleep affects adolescent physical health in terms of higher cardiometabolic disease risk and immune system compromise. These effects can be further intensified by socioeconomic status and racial/ethnic differences. These effects on youth and their scientific bases are discussed at length in this report.

A number of ways to address insufficient sleep in adolescents exist, but the response that garners the most attention, has the greatest potential to impact large numbers of students at the same time, and has been endorsed by numerous professional organizations, is delaying secondary school start times. The American Academy of Pediatrics and the American Medical Association were among the first organizations to call for an 8:30 AM or later start time, and many others followed. Policy Statements from several of these organizations are included in this report.

A review of the status of school start times in Pennsylvania reveals that the majority of Pennsylvania's school districts have start times between 7:30 AM and 7:59 AM. At least eight of the 500 school districts across the Commonwealth have secondary start times of 8:30 AM or later. Overall, charter schools and nonpublic schools have slightly later secondary school start times, but few meet the 8:30 AM or later goal. Further details on these findings can be found in this report.

A survey conducted by the Commission in conjunction with the Pennsylvania Department of Education, as well as additional information provided by the Start Schools Later organization, helped to identify at least 25 school districts that delayed their secondary school start times during the period 2011-2019. At least 28 districts were found to be publicly engaged in researching the matter, and at least 15 more self-identified as having had informal discussions at the administrative level about the suitability of delaying

school start times within their home districts. This report contains information about the timeline and process used by the 25 districts that have delayed their school start times recently, and the current state of the process in the 28 districts publicly contemplating changes.

The Commission's survey also identified common perceived challenges that have been encountered or were anticipated to be encountered in efforts to delay secondary school start times. Among the challenges identified were instructional school day requirements (number of days and hours of school), transportation in general, bus driver shortages, transportation mandates, coordination and logistics, athletics and other extracurricular activities, impact on elementary school students and families, impact on teachers and staff, and other perceived challenges. These challenges have been identified, relevant information about the concerns addressed, and strategies to counter these concerns have also been addressed in this report. Appendix A provides advice for school districts considering a change in secondary school start times from advisory committee members who have successfully navigated the process.

Senate Resolution 417 of 2018 directed the Joint State Government Commission to appoint an Advisory Committee to assist the Commission in a study of the issues, benefits, and options relating to instituting a later school start time in Pennsylvania's secondary schools. The Advisory Committee's most salient recommendation is that Pennsylvania's school districts should consider studying the advisability of changing their secondary school start times to improve the health and welfare of their students.

This report is a consensus document; it does not reflect unanimity of opinion, nor does it reflect an endorsement of all its parts by each individual advisory committee member or the organization the member may represent.

New findings that reinforce the previous science about insufficient sleep and adolescents are released almost daily. More Pennsylvania school districts are announcing efforts to study the advisability of delaying school start times at a similar pace. The resources identified in Appendix C can be useful in identifying further developments in the subject.

INTRODUCTION

Most adolescents do not get enough sleep. Insufficient sleep has broad implications for the physical and mental health of youth. For several decades, it has been known that sleep deprivation acutely affects adolescents in high schools with early school start times.[4] One of the potential and realistic answers to this problem is to acknowledge established science that shows adolescent sleep habits biologically favor a late bedtime and wake-time and that shifting school start times can accommodate this delayed biological clock and allow for sufficient sleep. This potential solution has been endorsed by the American Academy of Pediatrics, the American Psychological Association, the National Association of School Nurses/Society of Pediatric Nurses, the American Medical Association, the American Academy of Sleep Medicine, the Society of Behavioral Medicine, the American Sleep Association, the National Parent Teacher Association, and the National Education Association. However, there are barriers to changing the hours of secondary school including coordinating schedules for elementary and middle school, busing, athletics and other afterschool activities as well as inertia for change. But as the science has accumulated and favorable outcomes are reported by districts which have shifted start times, it is time to recognize the benefits and to encourage districts with early start times to effect change. The U.S. Centers for Disease Control and Prevention have declared that "[A]mong the possible public health interventions for increasing sufficient sleep among adolescents, delaying school start times has the potential for the greatest population impact by changing the environmental context for students in entire school districts."[5]

In light of this information, the Senate of Pennsylvania adopted Senate Resolution 417 (Printer's No. 2022) on October 17, 2018, directing the Joint State Government Commission to appoint an advisory committee of experts to study the "issues, benefits and options related to instituting a later start time to the school day at secondary schools in the Commonwealth." The advisory committee included state education officials, school administrators, school board members, intermediate unit representatives, a certified school nurse, pediatricians, psychologists, teachers, parents, students, a person representing students with disabilities, representatives of inter-scholastic athletes, private schools and rural school districts, and school bus transportation organizations.

The Commission, with the assistance of the Advisory Committee, was directed by the resolution do the following with regard to later secondary school start times:

1. Conduct a thorough and comprehensive study of secondary school start times in the Commonwealth;

[4] Amy R. Wolfson and Mary A. Carskadon, "Sleep Schedules and Daytime Functioning in Adolescents," *Child Development* vol. 69 no. 4. (1998): 875-887.
[5] *Ibid.* at 812-813.

2. Evaluate studies or initiatives promoted by national education advocacy organizations;
3. Assess the effect of establishing a later school start time on the health, safety and academics of students;
4. Evaluate any potential negative impacts on both public and private school entities and families and consider strategies for addressing potential problems;
5. Review all available literature on the experiences of public and private school entities in other states;
6. Include any recommendations on the advisability of establishing a pilot program to test later school start times at select secondary schools that are interested.

The Advisory Committee met in person six times, on February 8, March 28, May 9, June 20, August 1 and September 13, 2019, by conference call on October 4, 2019, and had a final meeting via conference call on October 11, 2019. The committee members reached general consensus on the following items. However, it should be noted that this report does not represent the formal endorsement of these findings and recommendations by any of the individual organizations represented on the advisory committee.

Findings and Recommendations

The Advisory Committee acknowledges the medical community consensus that a public health crisis in the form of an epidemic of chronic sleep loss and daytime sleepiness in U.S. adolescent exists.

The Advisory Committee agrees that the benefits of later school start times for secondary students are supported by robust research.

The Advisory Committee realizes that biologically-driven changes in adolescent sleep patterns are beyond the control of adolescents, their parents, or their teachers. Adapting the daily schedule of adolescents to recognize and accommodate their sleep needs is a potentially manageable response and can be accomplished by establishing later secondary school start times.

The Advisory Committee recognizes that establishing later school starts times has the potential to positively impact the epidemic of sleep deprivation, but also recognizes that there are other factors that contribute to the problem. Therefore, appropriate education and support for healthy sleep habits is also recommended to strengthen and sustain those benefits.

The Advisory Committee believes that school districts should consider studying the advisability of changing their secondary school hours. The Advisory Committee further acknowledges that schools across Pennsylvania reflect a widely varying demography; each

secondary educational entity contemplating later school start times would be well-served by adopting an attitude of flexibility and innovation. Each effort should acknowledge the unique character and makeup of the school and its surrounding community.

Accordingly, the Advisory Committee does not recommend a specific, detailed plan of action, but notes best practice standards:

- The ideal start time for secondary school students is 8:30 AM or later. This recommendation is also that of medical organizations and supported by scientific evidence. This includes the recommendation of no early practices and rehearsals, or activity periods scheduled before the official start time.
- Sleep health literacy is an important component of any school health curriculum.

The Advisory Committee encourages all schools that implement later school start times to continue to collect data on the effects of school start time changes. These outcomes could include the following: graduation rates, state, local and national testing, grade point averages (GPAs), other measures of academic performance, attendance, tardiness, disciplinary referrals, number of school nurse visits, and other measures of student well-being. Some relevant information may exist in publicly available data sources, such as the Pennsylvania Youth Survey and other school-based risk assessments.

The Advisory Committee does not believe that a pilot proof-of-concept program is needed. Several school districts have changed their start times before the SR417 project was initiated and provide proof of the successfulness of change. The Advisory Committee believes that it would be advantageous for the Commonwealth to offer incentives and other assistance to school entities desiring to make such a change. Specifics of potential assistance and means of solving perceived barriers to implementation can be found in the chapter entitled "Common Perceived Challenges and Potential Solutions."

The Advisory Committee also acknowledges that there is inconsistent awareness regarding the benefits of later school start times across the Commonwealth and entrenched routines can be a formidable obstacle. Accordingly, the Advisory Committee has prepared some guidance for school entities on how to engage and communicate with a community to provide information and solicit input. The guidance can be found in Appendix A, and was written by advisory committee members who have participated in the process of changing school start times in their own communities and school districts.

INSUFFICIENT SLEEP AND ADOLESCENT HEALTH, WELL-BEING, AND ACADEMIC PERFORMANCE

There is a great deal of evidence that chronic sleep loss in adolescents contributes negatively to their behavioral and mental health, physical health and safety, and academic performance. The National Institutes of Health's Institute of Medicine has identified deleterious effects of sleep deprivation on health and longevity, daily functioning, performance, accidents and injuries, and emotional well-being.[6] The United States Centers for Disease Control and Prevention (CDC) has declared that "adolescents who do not get enough sleep are more likely to be overweight; not engage in daily physical activity; suffer from depressive symptoms; engage in unhealthy risk behaviors such as drinking, smoking tobacco, and using illicit drugs; and perform poorly in school."[7] Insufficient sleep can also result in memory loss, impaired information processing, excessive daytime sleepiness, increased irritability, anxiety and depression, decreased socialization and humor, sexual risk-taking, mental fatigue, and decreased ability to handle complex tasks. In addition, research has indicated that chronically sleep-deprived individuals are at risk for poor executive function, poor impulse control and behavior control, cardiovascular disease, and metabolic dysfunction such as type 2 diabetes. These conclusions have been borne out by numerous scientific studies.[8] This chapter will discuss some of the major impacts of sleep deprivation among adolescents from the perspectives of physical health, mental/behavioral health, and school performance, and how early school start times, to the extent they deprive adolescents of quality sleep in sync with their biological needs, contribute to chronic sleep loss.

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[6] Institute of Medicine (US) Committee on Sleep Medicine and Research; H.R. Colten and B.M. Altevogt editors. "Sleep Disorders and Sleep Deprivation: An Unmet Public Health Problem." Washington (DC): National Academies Press (US); 2006. 3, Extent and Health Consequences of Chronic Sleep Loss and Sleep Disorders. Available from: https://www.ncbi.nlm.nih.gov/books/NBK19961/.

[7] Anita G. Wheaton, PhD, Gabrielle A. Ferro, PhD, and Janet B. Croft, Ph.D. United States Centers for Disease Control and Prevention, "School Start Times for Middle School and High School Students – United States, 2011-2012 School Year," *Morbidity and Mortality Weekly Report,* 2015; 64(30). https://www.cdc.gov/mmwr/pdf/wk/mm6430.pdf

[8] *See, for example,* Anne G. Wheaton, PhD, Emily O'Malley Olsen, MSPH, Gabrielle F. Miller, PhD, and Janet B. Croft, PhD, "Sleep Duration and Injury-Related Risk Behaviors Among High School Students—United States, 2007–2013," *Morbidity and Mortality Weekly Reporter*, 2016; 65:337–341.6; Osamu Itani, Maki Jike, Norio Watanabe, Yoshitaka Kaneita,"Short sleep duration and health outcomes: a systematic review, meta-analysis, and meta-regression." *Sleep Medicine*. 2017; 32:246–256.7, https://doi.org/10.1016/j.sleep.2016.08.006; Emily K. Snell, Emma K. Adam, and Greg .J. Duncan "Sleep and the body mass index and overweight status of children and adolescents." *Child Development*. 2007; 78 (1):309–323.8.

Adolescent Sleep Needs

A 2016 consensus statement from the American Academy of Sleep Medicine recommends that "teenagers 13 to 18 years of age should sleep 8 to 10 hours per 24 hours on a regular basis to promote optimal health."[9] However, estimates indicate that 25 percent of adolescents sleep six hours a night or less.[10] Other estimates find that at least 20 percent of adolescents report insufficient sleep.[11] In a 2015 study of short sleep duration (defined as less than eight hours of sleep per 24 hours) among middle and high school students in the United States, 72.7 percent of high school students reported short sleep duration. In the same study, 74.3 percent of Pennsylvania high school students reported short sleep duration, while 80.3 percent of Philadelphia high school students reported short sleep duration.[12] This is below the eight to 10 hours of sleep recommended for teenagers by the U.S. Centers for Disease Prevention and Control and the National Sleep Foundation.[13]

Physiology

The principal determinant of adolescent sleep needs is biologically-driven. Chronobiology is the study of circadian rhythms, which are physical, mental, and behavioral changes that follow a daily cycle. "They respond primarily to light and darkness in an organism's environment. Sleeping at night and being awake during the day is an example of a light-related circadian rhythm."[14] Sleep experts have found that adolescent sleep deficits are partially attributable to the biological changes in circadian rhythms during puberty, along with environmental factors.

At about the time of the onset of puberty, adolescents begin to experience later sleep onset and wake times. This shift is known as a sleep-wake 'phase delay' and results from hormonally-induced changes in circadian rhythms.[15] This change is largely driven by a

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[9] Shalini Paruthi, MD, et al. "Recommended Amount of Sleep for Pediatric Populations: A Consensus Statement of the American Academy of Sleep Medicine," *Journal of Clinical Sleep Medicine,* 2016;12(6):785–786. http://dx.doi.org/10.5664/jcam.5866.

[10] *Ibid.*

[11] Tara W. Strine and Daniel P. Chapman, "Associations of frequent sleep insufficiency with health-related quality of life and health behaviors," *Sleep Medicine* 2005;6(1):23–27; Vishesh Kapur et al., "Underdiagnosis of sleep apnea syndrome in U.S. communities." *Sleep & Breathing* 2002;6(2):49–54.

[12] Anne G. Wheaton, MD, Sherry Everett Jones, PhD, Adina C. Cooper, MA, Med, and Janet B. Croft, PhD, "United States United States Centers for Disease Control and Prevention, "Short Sleep Duration Among Middle School and High School Students – United States, 2015," *Morbidity and Mortality Weekly Report,* Vol. 67, No.3, January 26, 2018. https://www.cdc.gov/mmwr/volumes/67/wr/mm6703a1.htm.

[13] "How Much Sleep Do I Need?" United States Centers for Disease Control and Prevention, Sleep and Sleep Disorders, accessed September 11, 2019, https://www.cdc.gov/sleep/about_sleep/how_much_sleep.html; "National Sleep Foundation Recommends New Sleep Times, National Sleep Foundation, Washington, DC: February 2, 2015, https://www.sleepfoundation.org/press-release/national-sleep-foundation-recommends-new-sleep-times.

[14] United States National Institutes of Health, National Institute of General Medical Services, "Circadian Rhythms," accessed August 14, 2019.
https://www.nigms.nih.gov/education/pages/factsheet_circadianrhythms.aspx.

[15] Mary A. Carskadon, Amy R. Wolfson, Christine Acebo, Orna Tzischinsky, and Ronald Seifer, "Adolescent sleep patterns, circadian timing, and sleepiness at a transition to early school days." *Sleep: Journal of Sleep Research and Sleep Medicine*, 1998;21:871–881

later production of melatonin in adolescents compared to their adult and younger-child counterparts. Melatonin signals the body that it is biological night time. This shift is unique to adolescents and transitory. Research shows that the adolescent body does not begin producing melatonin until approximately two hours later than occurred pre-puberty and peaks several hours later than adult melatonin production. Early school start times run counter to this biological shift, as students are required to wake up to before their bodies are ready to acknowledge the shift from night to day. From a melatonin production perspective, waking up a teenager at 7 AM is comparable to waking up an adult at 4 AM.[16]

Role of Later School Start Times

Delaying school start times is only one effort to address a multi-factorial problem. The AAP 2014 Policy Statement asserts that "[I]t should also be emphasized that delaying school start times alone is less likely to have a significant effect without concomitant attention to other contributing and potentially remediable factors, such as excessive demands on students' time because of homework, extra-curricular activities, afterschool employment, social net-working, and electronic media use."[17] However, while a number of other approaches to address adolescent sleep needs exist, the CDC has declared that "[A]mong the possible public health interventions for increasing sufficient sleep among adolescents, delaying school start times has the potential for the greatest population impact by changing the environmental context for students in entire school districts."[18]

Other Factors Contributing to Adolescent Sleep Reduction

In addition to the constraints of biology, adolescents in high school also adapt their schedules to accommodate greater social opportunities, increased academic responsibilities, and extracurricular activities such as athletics, clubs, and activities.

Technology

Adolescents are increasingly reliant on technology for both social and academic purposes, which leads to increases in screen time. This additional use of technology is not used exclusively for recreational purposes such as social media and gaming apps. Student screen time is also necessary to meet academic needs, as schools often distribute tablets and laptops for students to complete assignments electronically.

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[16] Scott E. Carrell, Teny Maghakian, and James E. West, "A's from Zzzz's? The Causal Effect of School Start Time on the Academic Achievement of Adolescents," *American Economic Journal: Economic Policy,* 2011 3(3): 62-81.

[17] American Academy of Pediatrics. "School Start Times for Adolescents." *Pediatrics*, at p. 646. https://pediatrics.aappublications.org/content/pediatrics/134/3/642.full.pdf.

[18] *Supra,* note 4 at 812-813.

Adolescents who report using an electronic device that emits light - especially blue light - shortly before bed may be artificially disrupting their natural sleep rhythms.[19] Exposure to such visual input inhibits normal melatonin release, the most important sleep promoting hormone. Nighttime use of computers or watching television can lead to following negative effects: difficulty falling asleep, problems with mood, behavior, and daytime cognitive functioning.[20] In addition, the stimulating content of social media, video games, etc., as well as notifications or other sounds from devices can also disrupt adolescent sleep. In a circular manner, aside from the direct consequence of sleep deprivation, sleep deprivation's adverse impact on mood and behavior can perpetuate difficulty sleeping.

Self-Medication

Students often compensate for inadequate sleep by seeking out stimulants like coffee, energy drinks, tea, soda, and other caffeine- and sugar-based consumables. A 2014 survey of 8th, 10th, and 12th grade students found that approximately 30 percent of students consume energy drinks or shots; more than 40 percent reported daily regular soft drink use, and about 20 percent reported daily diet soft drink use.[21] Though these stimulants are intended to keep the student awake, they often cause the student to sleep less overall due to the know sleep-disrupting effects of caffeine, which can lead to a cycle of sleep loss leading to caffeine intake, leading to more sleep loss, and so on.

Academic, Social, and Time Pressures

Adolescents face numerous stressors including academic demands, social pressures, and conflicts with parents and concerns about their future. Adolescents from socioeconomically disadvantaged backgrounds face additional stressors stemming from poverty, living in unsafe neighborhoods, and food security, to name a few. These additional academic and social pressures as well as afterschool activities take up time in students' schedules which can cause them to get even less sleep. Homework, athletic practices, performing arts practices, and tutoring can all consume many hours of the average high school student's day. Many students also hold afterschool jobs to financially assist their families or save for college. Time to relax and socialize with friends can also eat away at available sleep hours.

[19]Christine J. Calamaro, Thorton B.A. Mason and Sarah J. Radcliffe, "Adolescents living the 24/7 lifestyle: Effects of caffeine and technology on sleep duration and daytime functioning," *Pediatrics*, 2009, 123, 1005-1010. doi: 10.1542/peds.2008-3641.

[20] Anne-Marie Chang, Daniel Aeschbach, Jeanne F. Duffy and Charles A. Czeisler, "Evening use of light-emitting eReaders negatively affects sleep, circadian timing, and next-morning alertness, *Proceedings of the National Academy of Sciences (PNAS)* January 27, 2015 112 (4) 1232-1237; first published December 22, 2014 https://doi.org/10.1073/pnas.1418490112.

[21] Yvonne M. Terry-McElrath, Patrick M. O'Malley, and Lloyd D Johnston, "Energy drinks, soft drinks, and substance use among US secondary school students," *Journal of Addiction Medicine,* 8 no. 1 (January-February 2014): 6-13; https://doii.org/10/1097/01.ADM.0000435322.07070.53.

Insufficient Sleep and Physical Health

Not obtaining adequate sleep is associated with risky behaviors, poor health such as obesity and diabetes risk, and myriad other negative health outcomes.[22]

Cardiometabolic Disease Risk

Cardiometabolic risk refers to the risk of future chronic disease related to metabolism, such as type 2 diabetes, and cardiovascular disease, and are further increased by obesity. Rates of overweight status and obesity in adolescents have long been increasing in the United States,[23] and are positively associated with short sleep. Cross-sectional associations between adolescent sleep duration and body weight[24] provide data for an estimate of an 80 percent reduction in obesity risk for every additional hour of sleep in adolescence.[25] A meta-analysis combined results from 11 longitudinal studies and revealed that short sleep duration in adolescents doubles the risk of overweight/obesity.[26] In adults, a clear relationship has emerged showing that short sleep duration and poor-quality sleep (*e.g.*, insomnia symptoms) are related to a broad range of cardiometabolic diseases,[27] including diabetes,[28] heart disease, stroke, and perhaps not surprisingly, early mortality.[29]

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[22] Osamu Itani, Maki Jike, Norio Watanabe, Yoshitaka Kaneita, "Short sleep duration and health outcomes: a systematic review, meta-analysis, and meta-regression." *Sleep Medicine*. 2017; 32:246–256.7, https://doi.org/10.1016/j.sleep.2016.08.006; Emily K. Snell, Emma K. Adam, and Greg .J. Duncan "Sleep and the body mass index and overweight status of children and adolescents." *Child Development*. 2007; 78 (1):309–323.8.

[23] Susan Wile Schwarz and Jason Peterson, "Adolescent obesity in the United States: facts for policymakers." *National Center for Children in Poverty,* 2010; http://www.nccp.org/publications/pdf/text_977.pdf.

[24] Neeraj K. Gupta, William H. Mueller, Wenyaw Chan, Janet C. Meininger, "Is obesity associated with poor sleep quality in adolescents? *American Journal of Human Biology* 2002;14(6):762–768. https://doi.org/10.1002/ajhb.10093; Yaqoot Fatima, Suhail A. Doi, and Abdullah Mamun, "Longitudinal impact of sleep on overweight and obesity in children and adolescents: a systematic review and bias-adjusted meta-analysis. *Obesity Review* 2015;16(2):137–149. DOI: 10.1111/obr.12245; Michelle A Miller, Marlot Kruisbrink, Joanne Wallace, Chen Ji, and Francesco P Cappuccio, "Sleep duration and incidence of obesity in infants, children and adolescents: a systematic review and meta-analysis of prospective studies," *Sleep* 2018. doi:10.1093/sleep/zsy018.

[25] *Ibid.*

[26] Yaqoot Fatima, Suhail A. Doi, and Abdullah Mamun, "Longitudinal impact of sleep on overweight and obesity in children and adolescents: a systematic review and bias-adjusted meta-analysis. *Obesity Review* 2015;16(2):137–149. DOI: 10.1111/obr.12245.

[27] Marie-Pierre St-Onge, PhD, FAHA, Chair, Michael A. Grandner, PhD, MTR, Devin Brown, MD, MS, Molly B. Conroy, MD, MPH, Girardin Jean-Louis, PhD, Michael Coons, PhD, CPsych, CBSM, and Deepak L. Bhatt, MD, MPH, Vice Chair, On behalf of the American Heart Association Obesity, Behavior Change, Diabetes, and Nutrition Committees of the Council on Lifestyle and Cardiometabolic Health; Council on Cardiovascular Disease in the Young; Council on Clinical Cardiology; and Stroke Council. "Sleep Duration and Quality: Impact on Lifestyle Behaviors and Cardiometabolic Health: A Scientific Statement from the American Heart Association, *Circulation*, 2016 Nov 1; 134(18): e367–e386.
Published online 2016 Sep 19. doi: 10.1161/CIR.0000000000000444.
https://www.ncbi.nlm.nih.gov/pubmed/27647451.

[28] Zhilei Shan, et al., "Sleep Duration and Risk of Type 2 Diabetes: A Meta-analysis of Prospective Studies," *Diabetes Care* 2015 Mar; 38(3): 529-537. https://doi.org/10.2337/dc14-2073.

[29] Jaiwei Yin, MD, "Relationship of Sleep Duration with All-Cause Mortality and Cardiovascular Events: A Systematic Review and Dose-Response Meta-Analysis of Prospective Cohort Studies," *Journal of the*

Controlled experimental studies conducted in the laboratory have consistently shown that the mechanisms of cardiometabolic risk emerge within a week or less of restricting sleep duration,[30] including reductions in insulin sensitivity that worsen glucose metabolism and increase diabetes risk,[31] alterations of fat metabolism,[32] increases in hunger and eating behaviors leading to weight gain.[33] Sleep thus represents a modifiable factor to improve cardiometabolic health.

Immune System Compromise

Insufficient sleep has long been associated with susceptibility to illness. Chronic sleep loss has been found to stimulate a persistent low-grade systemic inflammation, an enhanced susceptibility to infections, including the common cold, and a reduced immune response to vaccination.[34] Poor sleep efficiency and shorter sleep duration prior to exposure to a rhinovirus (cold virus) were associated with lower resistance to the common cold.

In a study of 153 healthy adults, conducted between 2000 and 2004, participants with less than 7 hours of sleep per night were nearly three times more likely to develop a cold than persons who slept 8 hours or more.[35] Shorter sleep duration, assessed objectively, was associated with increased risk for the development of the cold. Individuals sleeping fewer than 6 hours per night were at elevated risk of developing a cold, whereas those sleeping more than 6 hours per night were not.[36]

American Heart Association, 2017 Sep; 6(9): e005947.Published online 2017 Sep 9. doi: 10.1161/JAHA.117.005947.

[30] Orfeu M. Buxton, Josiane L. Broussard, Alexa Katherine Zahl, and Martica Hall, "Effects of sleep deficiency on hormones, cytokines, and metabolism," in: Redline S, Berger NA (eds) Energy Balance and Cancer Volume 8: Impact of Sleep and Sleep Disturbances on Obesity and Cancer. Springer, New York https://doi.org/10.1007/978-1-4614-9527-7_2.

[31] *Ibid.*

[32] Josiane L. Broussard, Florian Chapotot, Esra Tasali et al, "Sleep restriction increases free fatty acids in healthy men," *Diabetologia,* 2015,DOI:10.1007/s00125-015-3500-4. Epub 2015 Feb 22. https//www.ncbi.nlm.nih.gov/pubmed/25702040.

[33] *Supra,* note 28.

[34] Luviana Besedovsky, Tanka Langer and Jan Born, "Sleep and immune function." *European Journal of Physiology,* 2012: 463:121-137. DOI: 10.1007/s00424-011-1044-0.

[35] Sheldon Cohen, PhD, William J. Doyle, PhD, Cuneyt M. Alper, MD, Denise Janicki-Deverts, PhD, and Ronald B. Turner, MD, "Sleep Habits and Susceptibility to the Common Cold," *Archives of Internal Medicine,* 2009; 169(1):62-67.

[36] Prather AA, Janicki-Deverts D, Hall MH, Cohen S. Behaviorally Assessed Sleep and Susceptibility to the Common Cold. Sleep. 2015;38(9):1353–1359. doi:10.5665/sleep.4968.

Insufficient Sleep and Mental Health

Affect and Mood

Affect is often described in terms of positive and negative in which positive affect refers to joy, contentment, and engagement whereas negative affect refers to anger, fear, and sadness.[37] Adequate sleep has been found to contribute to improved affect.[38] Conversely, sleep deprivation has been found to increase negative affect and decrease positive affect.[39]

Anxiety

Researchers have found that sleep disturbance can give rise to the development of an anxiety disorder. For example, persistent insomnia is associated with an increased risk of developing an anxiety disorder[40] and sleep disturbance often predicts the subsequent development of Post-Traumatic Stress Disorder.[41] Research testing the correlation between sleep loss and anxiety have found that healthy participants report an increase in anxiety following a night of sleep deprivation.[42] These findings, when compounded with low levels of sleep in adolescents, indicate that adolescents may experience heightened anxiety as a result of sleep deprivation.

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[37] Courtney Ackerman, "What is Positive and Negative Affect in Psychology," *Positive Psychology.com*. Accessed June 25, 2019.

[38] [38] Jennifer S. Silk, Ella Vanderbilt-Adriance, Daniel S. Shaw, et al., "Resilience among Children and Adolescents at Risk for Depression: Mediation and Moderation across Social and Neurobiological Contexts," *Development and Psychopathology* 19, no. 3 (June 2007): 841–865, https://doi.org/10.1017/S0954579407000417.

[39] Dov Zohar, Orna Tzischinsky, Rachel Epstein, et al., "The Effects of Sleep Loss on Medical Residents' Emotional Reactions to Work Events: A Cognitive-Energy Model," *Sleep* 28, no. 1 (January 2005): 47–54, https://doi.org/10.1093/sleep/28.1.47; Peter L. Franzen, Greg J. Siegle, and Daniel J. Buysse, "Relationships between Affect, Vigilance, and Sleepiness Following Sleep Deprivation," *Journal of Sleep Research* 17, no. 1 (March 2008): 34–41, https://doi.org/10.1111/j.1365-2869.2008.00635.x.

[40]Naomi Breslau, Thomas Roth, Leon Rosenthal, et al., "Sleep Disturbance and Psychiatric Disorders: A Longitudinal Epidemiological Study of Young Adults," *Biological Psychiatry* 39, no. 6 (March 1996): 411–418, https://doi.org/10.1016/0006-3223(95)00188-3.

[41] Danny Koren, Isaac Arnon, Peretz Lavie, et al., "Sleep Complaints as Early Predictors of Posttraumatic Stress Disorder: A 1-Year Prospective Study of Injured Survivors of Motor Vehicle Accidents," *American Journal of Psychiatry* 159, no. 5 (May 2002): 855–857, https://doi.org/10.1176/appi.ajp.159.5.855.

[42] Patricia Sagaspe, Montserrat Sanchez-Ortuno, André Charles, et al., "Effects of Sleep Deprivation on Color-Word, Emotional, and Specific Stroop Interference and on Self-Reported Anxiety," *Brain and Cognition* 60, no. 1 (February 2006): 76-87, https://doi.org/10.1016/j.bandc.2005.10.001; Lisa S. Talbot, Eleanor L. McGlinchey, Katherine A. Kaplan, et al., "Sleep Deprivation in Adolescents and Adults: Changes in Affect." *Emotion (Washington, D.C.)* 10, no. 6 (2010): 831-41, https://doi.org/10.1037/a002013806;60:76–87.

Depression

Depression is a mood disorder in which individuals experience persistent feelings of sadness and hopelessness, and lose interest in activities once enjoyed.[43] As with anxiety, insomnia increases subsequent risk of major depression.[44] Associations have been found between sleep deprivation and increased risk of depression in adolescents.[45] Conversely, "good sleep" can promote a positive affect to prevent against depression.[46]

Suicidality

In 2016, the AAP urged pediatricians to screen patients for suicidal thoughts and identify risk factors linked to teen suicide attempts, in light of the identification of suicide as the second leading cause of death among adolescents.[47] The statement further recognized and reiterated earlier research that had identified sleep disturbances as a contributing factor to suicidality.[48] The CDC reported a 30 percent increase in suicides in the United States from 2000 to 2016, [49] and review of that data indicated that adolescent suicide rates had reached their highest level since 2000.[50] Research has identified an association between sleep deprivation and suicidality. Sleeping less than eight hours has been associated with an increased risk for adolescent suicidal behavior,[51] and sleep

[43] Jessica Shelton, "Depression Definition and DSM-5 Diagnostic Criteria," Psycom, last modified March 18, 2019, accessed September 12, 2019, https://www.psycom.net/depression-definition-dsm-5-diagnostic-criteria/.

[44] Robert E. Roberts and Hao T. Duong, "Perceived Weight, Not Obesity, Increases Risk for Major Depression among Adolescents," *Journal of Psychiatric Research* 47, no. 8 (August 2013): 1110-17, https://doi.org/10.1016/j.jpsychires.2013.03.019.

[45]Daniel B. Chorney, Michael F. Detweiler, Tracy L. Morris, et al., "The Interplay of Sleep Disturbance, Anxiety, and Depression in Children," *Journal of Pediatric Psychology* 33, no. 4 (2008): 339-349, https://doi.org/10.1093/jpepsy/jsm105.

[45] Robert E. Roberts and Hao T. Duong, "The Prospective Association Between Sleep Deprivation and Depression among Adolescents," *Sleep* 37, no. 2 (February 2014): 239-244, https://doi.org/10.5665/sleep.3388.

[46]Ronald E. Dahl and Mona El-Sheikh, "Considering Sleep in a Family Context: Introduction to the Special Issue," *Journal of Family Psychology* 21, no.1 (March 2007): 1-3, https://doi.org/10.1037/0893-3200.21.1.1.

[47] American Academy of Pediatrics, News Room. "With Suicide Now Teens' Second-Leading Cause of Death, Pediatricians Urged to Ask About Its Risks" June 27, 2016. https://www.aap.org/en-us/about-the-aap/aap-press-room/pages/With-suicide-Now-Teens%E2%80%99-Second-Leading-Cause-of-Death-Pediatricians-Urged-to-Ask-About-its-Risks.aspx.

[48] Benjamin Shain, Committee on Adolescence, American Academy of Pediatrics, "Suicide and Suicide Attempts in Adolescents," *Pediatrics* Jul 2016, 138 (1) e20161420; DOI: 10.1542/peds.2016-1420

[49] United States National Institutes of Health, National Institute of Mental Health, "Suicide", Table 1. Accessed August 14, 2019. https://www.nimh.nih.gov/health/statistics/suicide.shtml.

[50] Oren Miron, MA; Kun-Hsing Yu, MD, PhD; Rachel Wilf-Miron, MD, MPH; et al., "Suicide Rates Among Adolescents and Young Adults in the United States, 2000-2017." JAMA. 2019;321(23):2362–2364. doi:10.1001/jama.2019.5054.

[51] Xianchen Liu, X. "Sleep and adolescent suicidal behavior," *Sleep*, 2004, 27: 1351–1358. https://doi.org/10.1093/sleep/27.7.1351.

deprivation has been associated with increasing the odds of both suicidal ideation and suicide attempts among adolescents.[52]

Insufficient Sleep and Behavioral Health

Sleep problems are both a symptom of most mental health problems and can predict the onset of future mental health problems. Among adolescents, several aspects of mental health can be impacted by insufficient sleep. Insufficient sleep can contribute to a range of mental health conditions, including moodiness, poor self-esteem, anxiety, depression and suicidality. Engaging in risky behaviors, including tobacco, alcohol and drug use, risky sexual behavior, and delinquency are all potential effects of persistent insufficient sleep.

Poor Self Esteem

Students with shorter durations of sleep at the beginning of sixth grade have been found to exhibit lower self-esteem and grades and higher levels of depressive symptoms at that point. This same study found that students who obtained less sleep over time experienced heightened depressive symptoms and decreased self-esteem.[53]

Risky Behavior

An association between sleep duration and personal safety risk-taking behavior has been recognized.[54] Outcomes included risky driving, tobacco, alcohol, marijuana and other drug use, risky sexual behaviors, aggressive behaviors, depressed mood and self-harm behaviors.[55] Mood and self-harm outcomes showed the strongest associations with decreased sleep, as well as suicidality. Student attitudes about school and risky behaviors can be found in the Pennsylvania Youth Survey (PAYS) conducted by the Pennsylvania

[52] Lela R. McNight-Eily, Danice K. Eaton, Richard Lowry, et al., "Relationships between Hours of Sleep and Health-Risk Behaviors in US Adolescent Students," *Preventative Medicine* 53, no. 4-5 (October-November 2011): 271-273, https://doi.org/10.1016/j.ypmed.2011.06.020.

[53] Katia Fredriksen, Jean Rhodes, Ranjini Reddy, et al., "Sleepless in Chicago: Tracking the Effects of Adolescent Sleep Loss during the Middle School Years," *Child Development* 75, no. 1 (February 2004): 84-95, https://doi.org/10.5665/sleep.3388.

[54] Anne G. Wheaton, PhD, Emily O'Malley Olsen, MSPH, Gabrielle F. Miller, PhD, and Janet B. Croft, PhD, "Sleep Duration and Injury-Related Risk Behaviors Among High School Students—United States, 2007–2013," Morbidity and Mortality Weekly Reporter, 2016; 65:337–341.6.

[55] Matthew D. Weaver, PhD; Laura K. Barger, PhD; Susan Kohl Malone, PhD, RN, NCSN; et al "Dose-Dependent Associations Between Sleep Duration and Unsafe Behavior Among US High School Students," *JAMA Pediatrics* 2018;172(12):1187-1189. doi:10.1001/jamapediatrics.2018.2777. *See also* Mary A. Carskadon, "Adolescent sleepiness: Increased risk in a high-risk population." *Alcohol, Drugs, and Driving*. 1990a; 5:317–328. https://psycnet.apa.org/record/1990-27983-001

Commission on Crime and Delinquency[56] and the CDC's Youth Risk Behavior Surveillance System (YRBSS).[57]

Crime and Delinquency

An indirect relationship has also been found to exist between sleep deprivation and delinquency. Sleep deprivation is positively related to low self-control; low self-control is positively related to delinquency; and the relationship between sleep deprivation and delinquency is indirect and operates through low self-control.[58]

Insufficient Sleep, Accidents, Injuries, and Public Safety

Public Safety

It is well documented statistically that teens experience and cause higher rates of motor vehicle crashes. The number of crashes that claim the lives of children begins to climb sharply at age 13 and peaks at ages 17 - 18. This increased crash risk associated with passengers is completely unique to teen drivers, having the obverse effect for adults. This increased rate has been attributed to a multitude of factors from driving inexperience, socializing with passengers, non-use of seatbelts, driving at night, drunk driving, and sleep deprivation. [59]

Students who sleep less than the recommended amount experience both higher levels of inattention[60] and slower reaction times.[61] Both of these factors contribute to motor vehicle crashes among adolescents. Aside from inattention and reaction time-induced

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[56] Pennsylvania Commission on Crime and Delinquency. https://www.pccd.pa.gov/Juvenile-Justice/Pages/Pennsylvania-Youth-Survey-(PAYS).aspx.

[57] U.S. Centers for Disease Control and Prevention, Youth Risk Behavior Surveillance System (YRBSS). https://www.cdc.gov/healthyyouth/data/yrbs/index.htm

[58] Ryan Charles Meldrum, James C. Barnes, and Carter Hay, *"*Sleep Deprivation, Low Self-Control, and Delinquency: A Test of the Strength Model of Self-Control*" Journal of Youth Adolescence* (2015) 44: 465. https://doi.org/10.1007/s10964-013-0024-4. *See also* Mike Sepanic, "Later start times for school days can also reduce crime, says Rutgers University-Camden researcher," Rutgers-Camden News Now, https://news.camden.rutgers.edu/2019/08/later-start-times-for-school-days-can-also-reduce-crime-says-rutgers-university-camden-researcher/. Referencing Daniel C. Semenza, Ryan C. Meldrum, Dylan B. Jackson, Michael G. Vaughn, and Alex R. Piquero, "School Start Times, Delinquency, and Substance Use: A Criminlogical Perspective, *Crime and Delinquency,* First published online April 26, 2019, https://doi.org/10/1177/0011128719845147. Accessed August 23, 2019.

[59] Jean T. Shope and C Raymond Bingham. "Teen Driving: Motor-vehicle crashes and factors that contribute," *American Journal of Preventative Medicine*. (2008): S261-S271. *See also* Allan F. "Teenage drivers: patterns of risk." *Journal of Safety Research* 2003;34:5–15. https://doi.org/10.1016/S0022-4375(02)00075-0.

[60] Dean W. Beebe, Douglas Rose, and Raouf Amin, "Attention, Learning, and Arousal of Experimentally Sleep-Restricted Adolescents in a Simulated Classroom," *Journal of Adolescent Health* 47, no.5 (November 2010): 523- 525, https://doi.org/10.1016/j.jadohealth.2010.03.005.

[61] [61] Peter L Franzen, Greg J Siegle, and Daniel J Buysse, "Relationships between Affect, Vigilance, and Sleepiness Following Sleep Deprivation," *Journal of Sleep Research* 17, no. 1 (March 2008): 34-41, https://doi.org/10.1111/j.1365-2869.2008.00635.x.

motor vehicle accidents, it has been noted that teens who report insufficient sleep are more likely to drink while driving, ride with a driver who has been drinking, and not wear seatbelts or safety helmets.[62]

Research has found that vigilance is the component of cognition most consistently affected by periods without sleep.[63] Using a test known as the "psychomotor vigilance test," researchers have found four broad correlations between sleep deprivation and vigilance: sleep deprivation causes a general slowing of reaction times, sleep deprivation results in increased errors of omission and commission, sleep deprivation enhances the time-on-task effect, and tests of vigilant attention during periods of sleep deprivation are sensitive to both circadian and homeostatic drives.[64]

Multiple studies have demonstrated that higher accident rates are associated with earlier school start times. Both lower quantity and quality of sleep have been associated with a higher rate of self-reported accidents among teen drivers.[65] Attention levels have been found to be responsive to the amount of sleep received. In a study, researchers administered tests to students which measured presumed attention level in students. Students were monitored by actigraphy (a wristwatch device that records sleep and wakefulness over time). Researchers found that students obtained an average of 55 minutes longer each night for 5 nights following a one-hour delay in school start time. Attention in students who obtained more sleep was assessed and analyzed in light of reaction times and tests requiring attention.[66] The experimental group with delayed start times and longer sleep performed better during the first of two weeks, when they slept longer. By comparison, the control group performed poorer in the first week of the study, supporting the hypothesis that sleep quantity influences reaction time. [67]

For example, higher rates of adolescent automobile accidents were found in a city that had an earlier high school start time than a neighboring and demographically similar city.[68] A two-year study of high school and middle schools in one county in another state found that students who sleep more experience fewer motor vehicle accidents. In the

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[62] Kelly Wallace, "Why letting teens sleep in could save lives," *CNN Health*, retrieved from www.cnn.com/2016/04/14/health/teens-sleep-school-start-times/index.html; Anne G. Wheaton, Emily O. Olsen, Gabrielle F. Miller, et al., "Sleep Duration and Injury-Related Behaviors among High School Students – United States, 2007-1013," *Morbidity and Mortality Weekly Report* 65, no. 13 (April 2016): 337-341, http://dx.doi.org/10.15585/mmwr.mm6513a1.

[63] Julian Lim and David F Dinges, "Sleep Deprivation and Vigilant Attention," *Annals of the New York Academy of Sciences* 1129 (June 2008): 305-22, https://doi.org/10.1196/annals.1417.002.

[64] *Ibid.*

[65] Fabio Pizza, Sara Contardi, Alessandro B. Antognini, et al., "Sleep Quality and Motor Vehicle Crashes in Adolescents," *Journal of Clinical Sleep Medicine* 6, no. 1 (February 2010), 41-45, https://doi.org/10.1177/1099800411408414.

[66] Dubi Lufi, Orna Tzischinsky, and Stav Hadar, "Delaying School Starting Time by One Hour: Some Effects on Attention Levels in Adolescents," *Journal of Clinical Sleep Medicine* 7, no.2 (2001): 137-143, retrieved from http://jcsm.aasm.org/Articles/07_02_137.pdf.

[67] *Ibid*

[68] Robert Daniel Vorona, Mariana Szklo-Coxe, Andrew Wu, et al., "Dissimilar Teen Crash Rates in Two Neighboring Southeastern Virginia Cities with Different High School Start Times," *Journal of Clinical Sleep Medicine* 7, no.2 (April 2011): 145-151, retrieved from: http://www.aasmnet.org/JCSM/.

second year of the study, the school start times were delayed by one hour for both high school and middle school students, so that school started at 8:30 AM and 9:00 AM respectively. Researchers used the first year of the study as a control and compared their results against other schools in the area which maintained the status quo in the second year. While motor vehicle crashes decreased by 16.5 percent in the test county, crashes increased by 7.8 percent in the rest of the state.[69]

However, sleep deprivation is not solely responsible for the rate of motor crashes among teens. Rather, with respect to sleep deprivation's effects on attention, researchers provide evidence of how sufficient sleep can help ameliorate these negative effects and provide additional benefits such as increased attention and reduced rates of motor vehicle crashes.

Risk of Injury

Sleep deprivation in athletes threatens both performance and health.[70] Sleep deprivation is known to slow reaction times, affect mood, and impair cognitive function, all of which could increase the risk of injury in athletes. A study of the sleeping habits of 160 student athletes in a metropolitan area found that those who slept on average less than 8 hours per night were 1.7 times more likely to have had an injury compared with athletes who slept for 8 hours or more. Hours of sleep per night and grade level in school were the best independent predictors of injury (increasing grade level may be factor due to advancing levels of competitiveness).[71] Another study found that increased sleep duration and improved sleep quality was associated with improved performance and competitive success. Beyond optimizing health, better sleep can potentially enhance performance through increased participation in training.[72]

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[69] Fred Danner and Barbara Phillips, "Adolescent Sleep, School Start Times, and Teen Motor Vehicle Crashes," *Journal of Clinical Sleep Medicine* 4, no. 6 (2008): 533-535 retrieved from http://jcsm.aasm.org/Articles/040602.pdf.

[70]Stephen P. Bird, "Sleep, Recovery, and Athletic Performance: A Brief Review and Recommendations," *Strength and Conditioning Journal* 35, no.5 (October 2013): 43-7, https://doi.org/10.1519/SSC.0b013e3182a62e2f.

[71] Matthew D. Milewski, David L Skaggs, Gregory A Bishop, et, al., "Chronic Lack of Sleep is Associated with Increased Sports Injuries in Adolescent Athletes," *Journal of Pediatric Orthopedics* 34, no. 2 (March 2014): 129-133, https://doi.org/10.1097/BPO.0000000000000151.

[72] Andrew M. Watson, "Sleep and Athletic Performance," *Current Sports Medicine Reports*. (2017): 413-418, https://doi.org/10.1249/JSR.0000000000000418.

Insufficient Sleep and School Performance

Insufficient sleep can negatively affect academic performance as well as attendance. Being in school, being on time for school, and intellectually functioning at full capacity are all dependent upon being well-rested.

Cognitive Function and Performance

Sleep deprivation is associated with memory deficits[73] and impaired memory consolidation.[74] In addition, the level of inattentive behavior is higher among students who have had less sleep than recommended.[75] Students who do not obtain enough sleep before the start of their school day are more likely to experience difficulty in understanding the material taught that day.[76] Such students are more likely to struggle to complete assignments and tests regardless of the amount of time they had spent in preparation.[77] Insufficient sleep has also been associated with a decreased motivation to learn.[78]

Conversely, adequate sleep quantity and good sleep quality show a positive relationship with academic outcomes for students in middle school through college.[79] Students who achieved the recommended amount of sleep have also shown stronger performance in individual areas of study such as english, mathematics, science, and social studies in addition to demonstrating improved scores on state and national achievement

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[73] Maureen J. Anderson, Thomas V. Petros, Bill E. Beckwith, et al., "Individual Differences in the Effect of Time of Day on Long-Term Memory Access," *American Journal of Psychology* 104, no. 2 (Summer 1991): 241–255, https://doi.org/ 10.2307/1423157.

[74] Robert Stickgold, "Sleep Dependent Memory Consolidation," *Nature* 437 (October 2005): 1272-8, https://doi.org/10.1038/nature04286.

[75] Dean W. Beebe, Douglas Rose, and Raouf Amin, "Attention, Learning, and Arousal of Experimentally Sleep-Restricted Adolescents in a Simulated Classroom," *Journal of Adolescent Health* 47, no. 5 (November 2010): 523- 525, https://doi.org/10.1016/j.jadohealth.2010.03.005.

[76] Cari Gillen-O'Neel, Virginia W. Huynh, and Andrew J. Fuligni, "To Study or to Sleep? The Academic Costs of Extra Studying at the Expense of Sleep," *Child Development* 84, no. 1 (2013): 133-142, https://doi.org/10.1111/j.1467-8624.2012.01834.x.

[77] *Ibid.*

[78] Giuseppe Curcio, Michele Ferrara, and Luigi De Gennaro, "Sleep Loss, Learning Capacity and Academic Performance," *Sleep Medicine Review* 10, no. 5 (November 2006): 323–337, https://doi.org/10.1016/j.smrv.2005.11.001.

[79] Amy R. Wolfson and Mary A. Carskadon, "Understanding Adolescents' Sleep Patterns and School Performance: A Critical Appraisal," *Sleep Medicine Review* 7, no. 6 (2003): 491–506, https://doi.org/I0.1053/smrv.2002.0258; Kyla Wahlstrom, "Changing Times: Findings from the First Longitudinal Study of Later High School Start Times," *NASSP Bulletin* 286, no. 633 (December 2002): 3–21, https://www.spps.org/cms/lib010/MN01910242/Centricity/Domain/7352/bulletin_12_02_wahlstrom_2.pdf; "Impact of School Start Time on Student Learning," Hanover Research, last modified February 2013, accessed September 11, 2019, https://www.dist50.net/cms/lib/IL02213585/Centricity/Domain/232/StartTime3.pdf; Finley Edwards and Janice B. Ridell, "School Start Times Found to Affect Student Achievement," External Relations, *Education Next*, last modified May 2012, accessed September 11, 2019, https://www.educationnext.org/school-start-times-found-to-affect-student-achievement/; Scott E. Carrell, Teny Maghakian, and James E. West, "A's from Zzzz's? The Causal Effect of School Start Time on the Academic Achievement of Adolescents," *American Economic Journal: Economic Policy* (August 2011): 62–81, https://doi.org/10.1257/pol.3.3.62.

tests.[80] Evidence suggests that later school start times are associated with a two to three percent increase in standardized test scores, with even stronger effects observed among the most disadvantaged students. The magnitude of this effect is equivalent to reducing class size by one-third, suggesting that delayed school start times could be a cost-effective strategy to reduce the achievement gap.[81]

Sleep loss that contributes to inattentiveness in school, comprehension issues, and failure to complete assignments all are associated with lower graduation rates, absenteeism, and tardiness.

Graduation Rates

Delaying school start times has a positive impact on graduation and attendance rates. A 2017 study involving 30,000 high school students enrolled in 29 high schools scattered across seven states examined the impact of an 8:30 AM or later start time on graduation and attendance rates. Two years after a delayed start was implemented, average graduation rates had increased from 79 percent to 88 percent.[82] Another study, conducted with over 9,000 students in eight public high schools in three states, found significant improvement with later start times of 8:35 AM or later in academic performance outcomes, including grades earned in core subject areas of math, English, science and social studies, plus performance on state and national achievement tests.[83]

Attendance and Tardiness

Attendance and tardiness are contingent on multiple factors such as household schedules, student extracurricular activities, and even student health conditions. Despite other confounding factors, adolescents with shorter sleep duration, sleep deficiency, large weekday–weekend bedtime discrepancy, and insomnia have been found to have significantly higher odds of substantial school absence.[84]

Evidence suggests, however, that increasing adolescent sleep might provide the benefit of increasing attendance and mitigating tardiness among students. Students who

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[80] Kyla Wahlstrom, Beverly J. Dretzke, Molly F. Gordon, et al., "Examining the Impact of Later School Start Times on the Health and Academic Performance of High School Students: A Multi-Site Study," Center for Applied Research and Educational Improvement (St Paul, MN: University of Minnesota, 2014), retrieved from: http://www.cehd.umn.edu/CAREI/sleepresources.html.

[81] Finley Edwards, "Early to rise? The effect of daily start times on academic performance," *Economics of Education Review* 31 (2012) 970–983.

[82] Pamela M. McKeever, EdD and Linda Clark, PhD, "Delayed high school start times later than 8:30 AM and impact on graduation rates and attendance rates. *Sleep Health,* April 2017, Vol.3, Issue 2, 119-125. https:/doil.org/10.106/j.sleh.2017.01.002.

[83]Kyla Wahlstrom, Beverly J. Dretzke, Molly F. Gordon, et al., *Examining the Impact of Later School Start Times on the Health and Academic Performance of High School Students: A Multi-Site Study*, Center for Applied Research and Educational Improvement (St Paul, MN: University of Minnesota, 2014), retrieved from: http://www.cehd.umn.edu/CAREI/sleepresources.html.

[84] Mary Hysing, Siren Haugland, Kjell M. Stormark, et al., "Sleep and School Attendance in Adolescence: Results from a Large Population-Based Study," *Scandinavian Journal of Public Health* 43, no. 1 (November 2014): 2–9, https://doi.org/10.1177/1403494814556647.

get sufficient sleep have been shown to attend school more. In an early (2002) study researchers analyzed a one-hour delay in start time and found that attendance rates for all students in grades 9, 10, and 11 improved in the years from 1995 to 2000, with the greatest rate of improvement for grade 9 students.[85]

The previously cited studies on academic performance and graduation rates also found that that attendance rates and reduced tardiness show significant positive improvement with later start times.[86]

Insufficient Sleep and Demographic Factors

Adequate restorative sleep is necessary for optimal health, school functioning, and well-being, but U.S. adolescents are not routinely obtaining adequate sleep.[87]

Students of high socioeconomic status tend to academically outperform their lower socioeconomic peers. In addition, there are known socioeconomic and racial/ethnic disparities in sleep, with adolescents from low socioeconomic backgrounds as well as African-American and Hispanic youth having higher rates of insufficient sleep as compared to their higher socioeconomic or non-Hispanic white counterparts. [88] However, there is emerging evidence that adjusting school start times can mitigate this "achievement gap" which exists between upper and lower middle class students.

A sleep study from Seattle[89] examined the effects of a 55-minute-later school start time on two high schools, one of which had many more economically disadvantaged students (86 percent) and ethnic minorities (68 percent) than the other (31 percent and 7 percent respectively).[90] With the later school start time, the less advantaged school demonstrated lower rates of tardiness and absenteeism, while there was no change in either category at the other school.[91]

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[85] Kyla Wahlstrom, "Changing Times: Findings from the First Longitudinal Study of Later High School Start Times," *NASSP Bulletin* 286, no. 633 (December 2002): 3–21, https://www.spps.org/cms/lib010/MN01910242/Centricity/Domain/7352/bulletin_12_02_wahlstrom_2.pdf.
[86] *Supra* notes 83 and 84.
[87] Katherine M. Keyes, PhD, Julie Maslowsky, PhD, Ava Hamilton, BA, and John Schulenberg, PhD, "The great sleep recession: changes in sleep duration among US adolescents," *Pediatrics* 2015 Mar; 135(3): 460–468. doi: 10.1542/peds.2014-2707 . *See also,* Gopal K. Singh and Mary Kay Kenney, "Rising prevalence and neighborhood, social, and behavioral determinants of sleep problems in US children and adolescents," *Sleep Disorders* 2013: 394320.Published online 2013 May 30. doi: 10.1155/2013/394320.
[88] Dana Guglielmo, MPH, Julie A. Gazmararian, PhD, MPH, Joon Chung, Ann E. Rogers, PhD, RN, and Lauren Hale, PhD "Racial/ethnic sleep disparities in US school-aged children and adolescents: a review of the literature" *Sleep Health* 4 (2018) 68–80. doi: 10.1016/j.sleh.2017.09.005. Epub 2017 Oct 15.
[89] Gideon P. Dunster, Luciano de la Iglesia, et al. "Sleep*more* in Seattle: Later school start times are associated with more sleep and better performance in high school students." *Science Advances* vol 4 (2018): 1-7. Accessed June 6, 2019. https://advances.sciencemag.org/content/advances/4/12/eaau6200.full.pdf.
[90] *Ibid.*
[91] *Ibid.*

Economic Benefits of Sufficient Sleep for Adolescents

Despite an active public debate for and against the potential benefits of later school start times (SST), to date, there have been only two attempts to quantify some of the potential economic benefits of later start times and compare them against potential costs. The Brookings Institution found a benefit–cost ratio of 9:1 for a one hour later start time among middle and upper grades, meaning that for every $1 spent, the return is $9.[92] Based on that ratio, the study estimated an average gain of $17,500 per student in terms of lifetime earnings compared to a cost of $1,950 per student over the school career. However, these findings were based on a single school district in North Carolina.

An analysis by the RAND Corporation expands on the work performed by the Brookings Institution with a hypothetical macroeconomic modeling approach involving a state-wide shift in school start times to at least 8:30 AM and compared changes in the economic performance of 47 U.S. states. The model forecasted the economic gain of each state from a start time shift in terms of higher academic performance (*e.g.* higher likelihood to graduate from high school or college) and reduced car crash mortality. For a calculation of the benefit-cost ratios associated with a delay in SST, the following two types of potential costs were taken into account: (1) those associated with changing school busing schedules using data provided in the Brookings study; and (2) infrastructure related costs that may be needed to accommodate delayed school start times in some districts (*e.g.*, additional athletic field lighting).

The findings suggest that in many states, the predicted economic benefits for delaying school start times would outweigh the costs within 5 years after the change. For example, after 5 years of the shift to at least 8:30 AM, the U.S. average predicted benefit-cost ratio is between 1.7 (based on costs associated with changes in school bus schedules and additions to school infrastructure, such as additional lighting equipment) and 2.1 (based on costs associated with changes in school bus schedules), meaning that for every $1 spent, the return is between $1.70 and $2.10.

The predicted benefit-cost ratio for Pennsylvania is slightly lower than the U.S. average throughout most of the years, but the Commonwealth also sees its economic benefits outweigh the costs after 5 years under both cost assumptions.

Using a macroeconomic modeling approach, the authors conclude that delaying school start times to at least 8:30 AM could lead to profound economic gains in the form of increased overall economic performance. The findings of this study, as well as the Brookings Institution findings, suggest that the benefits of later start times may outweigh the immediate costs.

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[92] Marco Hafner, Martin Stepanek, and Wendy M. Troxel, *Later school start times in the U.S.: An economic analysis*. Santa Monica, CA: RAND Corporation, 2017. https://www.rand.org/pubs/research_reports/RR2109.html.

POLICY STATEMENTS BY NATIONAL EDUCATIONAL, MEDICAL, AND PSYCHOLOGICAL ORGANIZATIONS

In 2014, the American Academy of Pediatrics (AAP) issued a statement calling for a revision of secondary school start times to no earlier than 8:30 AM to ensure that adolescents receive sufficient, age-appropriate amounts of sleep. The AAP was quickly joined by the American Psychological Association, the National Association of School Nurses, and the Society of Pediatric Nurses. The following year, the CDC issued a report on school start times among middle and high school students across the country during the 2011-2012 school year. The report declared that insufficient sleep had been associated with adverse risk behaviors, poor health outcomes, and poor academic performance. "In view of these negative outcomes, the high prevalence of insufficient sleep among high school students is of substantial public health concern."[93] The CDC further declared that "[A]mong the possible public health interventions for increasing sufficient sleep among adolescents, delaying school start times has the potential for the greatest population impact by changing the environmental context for students in entire school districts."[94] The following year, the American Medical Association released a policy statement encouraging school districts to establish later school start times. Following these releases, a variety of national organizations, including health associations, educational organizations, and government agencies have published position statements with regard to a later school start.

The American Academy of Pediatrics

In its 2014 policy statement, the AAP recognized "insufficient sleep in adolescents as an important public health issue that significantly affects the health and safety, as well as the academic success, of our nation's middle and high school students."[95] While pointing out that a number of factors, including biological changes in sleep associated with puberty, lifestyle choices, and academic demands, negatively affect middle and high school students' ability to obtain sufficient sleep, the Adolescent Sleep Working Group, the Committee on Adolescence, and the Council on School Health of the AAP maintain that "the evidence strongly implicates earlier school start times (*i.e.* before 8:30 AM) as a key modifiable contributor to insufficient sleep, as well as circadian rhythm disruption, in this

[93]Anita G. Wheaton, PhD, Gabrielle A. Ferro, PhD, and Janet B. Croft, Ph.D. United States Centers for Disease Control and Prevention, "School Start Times for Middle School and High School Students – United States, 2011-2012 School Year," *Morbidity and Mortality Weekly Report,* Vol. 64, No.30, 810-813, 811, August 7, 2015. https://www.cdc.gov/mmwr/pdf/wk/mm6430.pdf.
[94] *Ibid.* at 812-813.
[95]American Academy of Pediatrics, "School Start Times for Adolescents." *Pediatrics* Vol. 134, No. 3, September 2014, doi: 10.1542/peds.2014-1697.
https://pediatrics.aappublications.org/content/pediatrics/134/3/642.full.pdf.

population."[96] The statement invokes a substantial body of research which has demonstrated that "delaying school start times is an effective countermeasure to chronic sleep loss and has a wide range of potential benefits to students with regard to physical and mental health, safety, and academic achievement."[97] Consequently, the AAP "strongly supports the efforts of school districts to optimize sleep in students and urges high schools and middle schools to aim for start times that allow students the opportunity to achieve optimal levels of sleep (8.5-9.5 hours)" and to improve physical and mental health, safety, academic performance, and quality of life.[98] Potential improvements in physical and mental health include reduced obesity risk, lower rates of depression, and fewer driving crashes.

AAP describes insufficient sleep as one of the most common, important, and potentially remediable health risks in children, particularly in adolescents. Pediatricians are well aware of the complex and interrelated reasons behind the current epidemic of insufficient sleep. The AAP article describes two principal biological changes in sleep regulation that are responsible for a sleep-wake "phase delay" experienced by adolescents and traces the extent and effects of adolescent sleep loss. Though multiple factors can affect the quality and quantity of adolescents' sleep, school start time appears to be the most salient and most malleable factor. Recent research shows that delaying school start times for middle school students is accompanied by positive outcomes similar to those found in high schools. AAP buttresses its policy statement by alluding to a number of students who have "clearly demonstrated that delaying school start times not only results in a substantive increase in average sleep duration but also has a significant positive effect on a variety of key outcomes," ranging from decreased levels of self-reported sleepiness and fatigue to improvements in academic measures; additional health-related and other benefits can also be anticipated.[99] AAP addresses perceived barriers to changing school schedules and possible solutions.

Acknowledging that additional research is needed "to further document the effects of changes in school start times over time, to examine specific factors that increase or decrease the likelihood of positive outcomes, and to assess the effect on families, the community, other stakeholders, and the educational system in general," AAP, however, finds "both the urgency and the magnitude of the problem of sleep loss in adolescents and the availability of an intervention that has the potential to have broad and immediate effects … highly compelling."[100]

AAP encourages "concomitant attention to other contributing and potentially remediable factors, such as excessive demands on students' time because of homework, extracurricular activities, afterschool employment, social networking, and electronic media use" and emphasizes the importance of educating communities about the scientific

[96] *Ibid.*
[97] *Ibid.*
[98] *Ibid.*
[99] *Ibid.*
[100] *Ibid.*

rationale underpinning the merits of delaying school start times.[101] AAP endorses the scientific rationale for later school start times, "lends its strong support to school districts contemplating delaying school start times as a means of optimizing sleep and alertness in the learning environment and encourages all school administrators and other stakeholders in communities around the country to review the scientific evidence regarding school start times, to initiate discussions on this issue, and to systematically evaluate the community-wide impact of these changes" (for example, academic performance, school budget, traffic patterns, and teacher retention).[102]

AAP offers specific recommendations for pediatricians and other health care professionals regarding optimal sleep, potential risks of chronic sleep loss in adolescents, and the potential utility of taking systemic countermeasures such as later school start times in mitigating these effects.

The American Psychological Association

The American Psychological Association (APA) issued a fact sheet supporting the idea that "moving high school start times can improve student performance and general well-being."[103] Based on studies done in several states, with urban, suburban, and rural schools included, APA offered a list of benefits observed from later high school start times, such as:

- increased attendance rates;
- decrease in disciplinary action;
- decrease in student-involved car accidents;
- increase in student GPA;
- increase in state assessment scores;
- increase in college admissions test scores;
- increase in student attention;
- decrease in student sleeping during instruction; and
- increase in quality of student-family interaction.[104]

APA noted that concerns about delayed start times had generally "focused less on academic/social/cognitive outcomes and more on logistical complications." In APA's view, these complications are "surmountable, and, with adequate planning, can be

[101] *Ibid.*
[102] *Ibid.*
[103] American Psychological Association, "Later School Start Times Promote Adolescent Well-Being," 2014 https://www.apa.org/pi/families/resources/school-start-times.pdf.
[104] *Ibid.*

minimized or completely eliminated" while delaying school start for adolescents "provides numerous benefits to the students and their broader community alike."[105]

The National Association of School Nurses/Society of Pediatric Nurses

The Society of Pediatric Nurses (SPN) and the National Association of School Nurses (NASN) released a joint statement strongly asserting that "optimal sleep during growth and development is critical for the health, safety and academic success of our nation's youth."[106] They highlight an early school start time as a "significant modifiable factor contributing to insufficient sleep during adolescence" and express their support for delaying school start times for middle school and high school students as proposed in the policy statement "School Start Time for Adolescents" by the American Academy of Pediatrics.[107]

NASN and SPN express their belief that the registered professional school nurse is "in a pivotal position to collaborate with students, families, teachers, pediatric nurses, school administration officials, and other health professionals to address factors contributing to insufficient sleep."[108]

SPN and NASN acknowledge the challenges of alterations in afterschool activities, along with adjustments to parental schedules. They indicate other modifiable factors such as the need for families to:

- self-regulate sleep habits;
- set bedtime limits;
- set limits on social networking; and
- discuss the use of electronic media in the bedroom.[109]

NASN and SPN like actions they can take "to collaborate with administrators, teachers, parents, school boards, and communities to address this public health issue, which include:

- Working with parents to understand developmental changes in sleep/wake patterns during adolescence.
- Educating parents on the importance of setting bedtime limits.
- Identifying adolescents at risk.

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[105] *Ibid.*
[106] The National Association of School Nurses and Society of Pediatric Nurses, *Consensus Statement: Early School Start Times*, 2014, https://www.startschoollater.net/uploads/9/7/9/6/9796500/position_statement_2016.10_society_of_pediatric_nurses.pdf.
[107] *Ibid.*
[108] *Ibid.*
[109] *Ibid.*

- Working with teachers and parents to monitor academic course loads ad extracurricular activities.

- Identifying strategies to promote optimal sleep.
- Recommending limits on the use of caffeine and other stimulants.
- Recommending limits on the use of electronic media and social networking.[110]

The American Medical Association

The American Medical Association's (AMA) policy on insufficient sleep in adolescents was developed by its Council on Science and Public Policy. The policy statement:

- Identifies 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.
- Encourages school districts to aim for the start of middle schools and high schools to be no earlier than 8:30 AM, in order to allow adolescents time for adequate sleep;
- Encourages physicians, especially those who work closely with school districts, to become actively involved in the education of parents, school administrators, teachers, and other members of the community to stress the importance of sleep deprivation among adolescents, and to encourage school districts to structure school start times to accommodate the biologic sleep needs of adolescents; and
- Encourages continued research on the impact of sleep on adolescent health and academic performance.[111]

American Academy of Sleep Medicine

The American Academy of Sleep Medicine, is the national professional society dedicated exclusively to the medical subspecialty of sleep medicine. In its 2017 position statement the AASM asserted that that middle school and high school start times should be 8:30 AM or later to support:

- An adequate opportunity for adolescents to obtain sufficient sleep on school nights.
- Optimal alertness in the classroom environment to facilitate peak academic performance.

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[110] *Ibid.*

[111] American Medical Association, *Insufficient Sleep in Adolescents*, 2016. https://policysearch.ama-assn.org/policyfinder/detail/school%20start%20time?uri=%2FAMADoc%2FHOD.xml-0-5024.xml.

- Reduced tardiness and school absences to foster improved opportunities for learning.
- Adolescent mental health and psychological well-being.
- Adolescent driving safety.[112]

The Society of Behavioral Medicine

The Society of Behavioral Medicine (SBM) issued a position statement: "Start middle and high schools at 8:30 AM to promote student health and learning."[113] Citing various studies, SBM contends that such a schedule promotes students' sleep, resulting in improvements in physical health, psychological well-being, attention and concentration, academic performance, and driving safely.

SBM concisely lists barriers that school districts mention when discussing changing school start times:

- conflicts with afterschool programs, sports activities, and afterschool student jobs;
- teacher concerns regarding scheduling and total work hours;
- transportation costs for busing children to school;
- difficulties in changing family patterns of daily life; and
- lack of awareness among school community stakeholders (i.e., school administrators, faculty, students, families) regarding the importance of sleep.[114]

Nonetheless, SBM reasons that objections and barriers can be mitigated and are surmountable.

- Teachers' arrivals and departures from school do not need to change. Teachers may use the period before instruction each morning for preparation, grading, meetings, and professional development.
- Bus schedules may be staggered to allow younger students to be transported to school before middle and high school students.
- Schools that start between 8:30 AM and 9:00 AM would typically finish between 3:00 PM and 3:30 PM, allowing daylight time for sports and

[112] Nathaniel M. Watson, MD, MS et al. "Delaying middle school and high school start times promotes student health and performance: an American Academy of Sleep Medicine position statement." *Journal of Clinic Sleep Medicine,* 2017;13(4):623–625. http://dx.doi.org/10.5664/jcsm.6558
[113] Society of Behavioral Medicine, *Position Statement: Start Middle and High Schools at 8:30 AM or Later to Promote Student Health and Learning*, November 2017. https://www.sbm.org/UserFiles/file/late-school-start-statement-FINAL.pdf.
[114] *Ibid.*

afterschool activities. Coaches often need the afternoon practices and game times due to their daily jobs.

- Families' morning routines may be less chaotic when teen students are rested.
- Students are less likely to have unsupervised time when school finishes later in the day.[115]

SBM further states that a national trend to delay high school start times may be not only possible but also welcomed as school administrators and school communities appreciate the related benefits to students' health and well-being.

SBM advocates for a four-tier approach to promote later start times for middle and high schools:

1. School board members must enact an 8:30 AM or later school start time policy for their school districts.
2. State departments of education and state legislators, particularly those on education committees, should advocate for later school start times for middle and high schools.
3. SBM encourages lobbying of the U.S. Department of Education through congressional representatives.
4. To increase awareness, SBM suggests school-level promotion of education about the importance of sleep through in-services, workshops, curriculum changes, and family and community events.[116]

SBM concludes its position statement with an unequivocal affirmation: "It is no longer a question of whether policies promoting later school start times should be adopted, but rather how they should be implemented."[117]

The detailed SBM statement was endorsed by the National Education Association, the National Parent Teacher Association (PTA), the Sleep Research Society, Parents for Public Schools, and Start Schools Later.

[115] *Ibid.*
[116] *Ibid.*
[117] *Ibid.*

The American Sleep Association

The American Sleep Association's (ASA) position on school start times is that "middle school and high school time should not start before 08:00. A time closer to 09:00 would be preferable."[118] ASA position statement maintains that "early school start times and sleep deprivation are associated with weight gain, depression, mood problems, higher blood glucose levels and increased motor vehicle accidents" while "later school times are associated with higher attendance rates, lower depression scores, and more even temperament at home."[119]

The National Parent Teacher Association

The National Parent Teacher Association (PTA) adopted the resolution "Healthy Sleep for Adolescents" at its convention of delegates in 2017.[120]

Based on the existing scientific research into the adolescent sleep requirements and the changing sleep patterns in adolescence as well as the impact of the duration of sleep on academic outcomes for secondary schools students, the resolution highlights the establishment of school policies which support healthy sleep habits as "effective means of addressing problems that result from sleep deprivation that hamper students' progress and development, including absenteeism, tardiness and inattentiveness, and thereby improving student performance."[121] The resolution also cites the research by the CDC and AAP demonstrating that "inadequate sleep imperils adolescents by heightening risks for a multiplicity of threats to their health, safety and well-being."[122] Evidence strongly indicates that "earlier school start times are a key but modifiable contributor to insufficient sleep, as well as to natural sleep rhythm disruption" and proves that "implementation of later school start times for adolescents affords students the opportunity to obtain optimal levels of sleep, thereby improving physical and mental health, safety, academic performance, and quality of life," the resolution calls upon the National PTA and its constituent associations

- to educate youth, parents, educators, school personnel, school boards, athletic coaches, athletic organizations, state board of education members, and communities about the positive impact that sufficient quality sleep has for teens' health, safety, academic success, and future earnings;
- to urge local stakeholders, policymakers, and appropriate national organizations to collaborate in order to develop solutions and policies which provide

[118] The American Sleep Association. *Healthy School Start Times*, February 7, 2018 https://www.sleepassociation.org/blog-post/healthy-school-start-times/.
[119] *Ibid.*
[120] The National Parent Teacher Association, *Resolution: Healthy Sleep for Adolescents*, https://www.pta.org/docs/default-source/files/advocacy/2017-approved-convention-resolutions/healthy-sleep-for-adolescents-r.pdf.
[121] *Ibid.*
[122] *Ibid.*

opportunities for sufficient, quality sleep for teens reflective of their local community; and

- to work with the U.S. Department of Education to encourage states and school districts to incorporate standards regarding sleep need and patterns, potential risks of insufficient sleep, signs of sleep-related difficulties, and healthy sleep habits into existing health, science, physical education, and other appropriate curricula.[123]

The National PTA and its constituent associations expressed their strong support for the efforts of schools districts to optimize sleep for students and "urge high schools and middle schools to aim for start times that allow students the opportunity to achieve optimal levels of sleep and to improve their physical and mental health, safety, academic performance, and quality of life."[124]

National Education Association

The National Education Association adopted a resolution in 2014 supporting school schedules that follow "research-based recommendations regarding the sleep patterns of age groups" that promote adequate rest on a regular basis.[125]

[123] *Ibid.*
[124] *Ibid.*
[125] National Education Association, 2013-2014 Handbook at 250, Washington DC: 2014. Accessed August 16, 2019.

THE CURRENT STATUS OF SECONDARY SCHOOL START TIMES IN PENNSYLVANIA

Pennsylvania provides a secondary education to its 1.7 million students in a variety of ways. In addition to its 500 school districts,[126] there are 84 stand-alone career and technical centers, as well as career and technical education programs embedded in 110 school district high schools and one charter school, [127] over 160 brick-and-mortar charter schools, and 14 cyber charter schools. Regionally, 29 intermediate units provide special education, professional development, and technical assistance to school districts, charter schools, and private schools.[128] Additionally, 37 approved private schools provide educational services to students with exceptionalities, including autism, pervasive developmental disorder, blindness, cerebral palsy, deafness, muscular dystrophy, intellectual disability, neurological impairment, and serious emotional disturbance.[129] Other nonpublic schools also provide education to Pennsylvania's youth, including 101 private independent schools[130] There are also 210 private Christian schools, which includes 122 schools offering high school curriculum,[131] and eight Catholic dioceses that provide parochial school education through 355 schools, including 59 Catholic high schools.[132] Other religiously affiliated schools such as Amish and Quaker schools, and other non-traditional schools also provide secondary education in Pennsylvania.

In the CDC's 2015 evaluation of secondary student start times during the 2011-2012 academic year, the report noted that the average start time of Pennsylvania public schools is 7:48 AM.[133] This is consistent with reported school start times in the 2019-2020

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[126] Department of Education. "Types of Schools." http:www.education.pa.gov/Schools/Pages/Types-of-Schools.aspx. Website accessed June 13, 2018.

[127] Pennsylvania Department of Education. "Career and Technical Education." 2018. https://www.education.pa.gov/Documents/K-12/Career%20and%20Technical%20Education/PA%20CTE%202019%20Brochure.pdf.

[128] *Supra* note 94.

[129] Pennsylvania Department of Education. "Directory of Approved Private Schools & Chartered Schools for the Deaf and the Blind Pennsylvania". May 2019. https://www.education.pa.gov/Documents/K-12/Special%20Education/APS%20Directory.pdf .
Department of Education. "Types of Schools." http:www.education.pa.gov/Schools/Pages/Types-of-Schools.aspx. Website accessed June 13, 2018.

[130] Independent schools are independently governed by a board of trustees and they are funded primarily through tuition, charitable contributions, and endowment revenue. https://www.paispa.org/page.cfm?p=14.

[131] Association of Christian Schools International, "Top Christian Private High Schools in Pennsylvania. https://www.privateschoolreview.com/pennsylvania/christian-religious-affiliation/high

[132] High-Schools.com. "Pennsylvania Catholic High Schools". https://high-schools.com/directory/pa/reports/catholic/.

[133]Anita G. Wheaton, PhD, Gabrielle A. Ferro, PhD, and Janet B. Croft, Ph.D. United States Centers for Disease Control and Prevention, "School Start Times for Middle School and High School Students – United States, 2011-2012 School Year," *Morbidity and Mortality Weekly Report,* Vol. 64, No.30, 810-813. August

school year, as the majority of Pennsylvania's public school students start school between 7:30 AM and 7:59 AM. Additionally, it should be noted that 98.3 percent of Pennsylvania's school districts outside of the cities of Pittsburgh and Philadelphia have secondary school start times before 8:30 AM.

The Joint State Government Commission examined secondary school start times in Pennsylvania's 500 school districts, which contain over 600 secondary schools. Secondary start times were found for 495 districts. Five school districts were not included because the district does not house a high school; all high school level students in these districts attend neighboring school districts. For these reasons, the individual secondary schools in the district were not included in this portion of the study. Of the 495 districts identified by Commission staff, 474 school districts have one secondary school. Another 15 districts have two secondary schools, three have three secondary schools, and one has four secondary schools. With two exceptions,[134] these additional 19 districts with multiple secondary schools start all of the high schools in the same half-hour time frame.

Looking at only those districts with uniform start times across the district (491), the following breakdown can be seen:

- 77 school districts with secondary start times between 7:00 AM and 7:29 AM (15.7 percent);
- 307 school districts starting between 7:30 AM and 7:59 AM (62.5 percent);
- 99 school districts starting between 8:00 AM and 8:29 AM (20.1 percent); and
- 8 school districts starting at 8:30 AM or later (1.6 percent).

Pittsburgh School District and Philadelphia School District have been reviewed separately, so that inconsistent start times across both districts and Philadelphia's large size, number of public secondary schools, and number of brick-and-mortar secondary charter schools would not skew the percentages of the foregoing breakdown.

Pittsburgh School District is the second largest school district in Pennsylvania in terms of enrollment, has nine secondary schools, one of which starts its school day at 8:26 AM. Seven of its secondary schools start in the 7:30 AM to 7:59 AM time frame and one starts at 7:00 AM. Unlike the Philadelphia School District, which encompasses all of Philadelphia County, Pittsburgh School District, though by far the largest, is only one of 43 districts in Allegheny County. Six brick-and-mortar charter schools serve Allegheny County, three of which start between 8:00 AM and 8:29 AM, and three of which start at 8:30 AM or later.

7, 2015. https://www.cdc.gov/mmwr/pdf/wk/mm6430.pdf. Erratum: Vol. 64, No. 30, August 14, 2015, Vol. 64, No. 31, 859-860.

[134] Pocono Mountain School District has two high schools – one that starts at 7:13 AM and one that starts at 7:30 AM. Central Crawford District also has two secondary schools – one that starts at 7:40 AM and one that starts at 8:30 AM.

Philadelphia, the largest school district in Pennsylvania in terms of enrollment, has 57 district secondary schools and 31 brick-and-mortar secondary charter schools. Start times vary across the district. Given that so many students attend charter schools in Philadelphia, a truly representative picture of start times affecting secondary students in the city requires looking at both traditional public schools and brick-and-mortar charter schools together. Start times for three of the district schools were not available on the district's website, and three were identified as an "educational options program" (EOP or Twilight School) that are operated in the late afternoon to allow persons over age 18 to complete graduation requirements. Additionally, start times could not be found for two of the brick-and-mortar charter schools. A review of the start times of the 51 public secondary schools and 29 brick-and-mortar charter schools that remain after eliminating those schools where times were not found or were not relevant (the EOPs), results in the following analysis of secondary school start times in the City and County of Philadelphia:

- 5 school districts with secondary start times between 7:00 AM and 7:29 AM (6 percent);
- 29 school districts starting between 7:30 AM and 7:59 AM (36 percent);
- 36 school districts starting between 8:00 AM and 8:29 AM (45 percent); and
- 10 school districts starting at 8:30 AM or later (12.5 percent).

It should be noted that the district does not usually provide school bus runs for students in grades 7-12 but instead provides the students with public transportation.[135]

While charter schools do not generally have an impact as significant on other districts as they do on Philadelphia, several districts in the suburban Philadelphia counties also have a number of students enrolled in charter schools. This issue is discussed further in the chapter entitled, "Common Perceived Challenges and Potential Solutions."

Recent School Start Time Changes

During the period 2011-2019, 26 school districts were identified as districts that delayed their secondary school start times. This number is believed to be accurate as of mid-October 2019. A number of schools in the process of delaying secondary school start times may implement changes for the 2020-2021 school year. Table 1 provides a snapshot of the school districts cited, followed by a short narrative of the implementation where possible.

[135] It should be noted that Pittsburgh and Erie City school districts also offer some public transportation to some of their students. Other urban districts may also do so but were not identified in the Commission's research.

Table 1 Pennsylvania Public School Districts That Delayed Secondary School Start Times 2011-2019					
School District (County)	**Year**	**Current Bell Time**	**No. of Students & No. of Schools**	**Geographic Size in Square Miles**	**Comments**
Antietam (Berks)	2020-2021	K-1: 8:30-3:15 2-6: 8:25-3:10 7-12: 7:45-3:00	1,144 3	5.2	7-12 start time changing to 7:57 AM.
Avonworth (Allegheny)	2018-2019	K-2: 8:55-3:25 3-6: 8:50-3:20 7-8: 8:00-2:55 9-12: 8:00-2:55	1,685 4	10.8	HS moved from 7:15 AM to 8:00 AM.
Blue Ridge (Susquehanna)	2013	K-5: 8:15-3:10 6-8: 8:07-3:00 9-12: 8:07-3:00	995 3	110.5.	See detailed narrative below.
Burrell (Westmoreland)	2018-2019	K-5: 9:10-3:40 6-8: 8:30-3:18 9-12: 8:10-2:42	1,806 4	26.7	See detailed narrative below.
Downingtown Area (Chester)	2014-2015	K-5: 8:50-3:30 6: 8:50-3:30 7-12: 7:40-2:40	12,794 16	80	HS moved 15 minutes later and MS moved 10 minutes earlier to create a single start and end time for HS/MS. Is undergoing study in 2019 to determine if further delays appropriate.
Erie (Erie)	2018-2019	PrK-5: 8:00-2:30 6-8: 8:00-2:45 9-12: 8:40-2:45	11,020 15	28.5	See detailed narrative below.
Homer Center (Indiana)	2018	K-6: 8:57-3:30 7-12: 8:40-2:58	873 2	41.2	Noted fewer student absences and tardiness of students and employees.
Keystone Oaks (Allegheny)		K-5: 8:25-3:15 K-5: 8:15-3:05 6-8: 7:40-2:28 9-12: 7:40-2:28	1,867 5	4.4	Moved HS and MS start time from 7:30 AM - 7:40 AM to accommodate professional development time in the mornings.

Lake-Lehman (Luzerne)	2018-2019	K-6: 8:55 -3:40 7-12: 8:00-2:50	1,789 4	142.1.	See detailed narrative below.
Mechanicsburg (Cumberland)	2018-2019	K: 7:50-2:20 1-5: 7:40-2:35 6-8: 8:30-3:30 9-12: 8:20-3:20	4,122 8	16	See detailed narrative below.
Penncrest (Crawford)	2016	K-6: 8:05-2:50 K-6: 8:10-2:45 7-12: 8:25-3:00	2,834 6	407.8.	HS time changed to accommodate professional learning community time increase in the morning: was able to coordinate with career and technical center.
Phoenixville Area (Chester)	2019-2020	K-5: 8:55-3:35 6-12: 8:05-2:53	3,924 6	21.5	See detailed narrative below.
Pine-Richland (Allegheny)	2019-2020	K-3: 9:20-3:40 4-6: 8:35-3:10 7-12: 7:45-2:36	4,607 6	31.6	K-6 arrive 5 minutes; 7-12 arrive 15 minutes later than previously to improve transportation efficiencies: achieved by reduced home room and transition time for HS/MS students.
Pittsburgh Milliones, University Preparatory School (Allegheny)	2016-2017	6-12: 8:38 – 3:28	384 1	N/A	See detailed narrative below.
Quaker Valley (Allegheny)	2017-2018	K-5: 9:00-3:40 6-12: 8:00-3:00	1,923 4	24.2	See detailed narrative below.
Radnor Township (Delaware)	2019-2020	K-5: 9:07-3:40 6-8:7:50-2:40 9-12: 8:30-3:10	3,664 5	13.8	See detailed narrative below.
Seneca Valley (Butler)		K-6: 8:55-3:25 7-12: 8:09-2:41	7,170 8	95.4	See detailed narrative below.
South Middleton (Cumberland)	2019-2020	K-2: 8:50-3:30 3-5: 8:50-3:30 6-8: 7:45-2:45 9-12: 7:45-2:45	2,122 4	49.1	ES arrival/departure moved back 5 minutes; MS/HS moved back 30 minutes.

Spring Cove (Blair)	2017-2018	K-5: 8:55-3:15 6-12: 7:50-3:05	1,811 4	98.1.	Reduced transition times.
State College Area (Centre)	2018-2019	K-5: 8:10-3:00 6-8: 8:40-3:42 9-12: 8:40-3:40	6,808 11	151.1.	See detailed narrative below.
Tredyffrin-Easttown (Chester)	2019-2020	K-4: 9:10-3:45 5-8: 8:27-3:10 9-12: 7:50-2:15	6,900 8	28.1	See detailed narrative below.
Troy Area (Bradford)	2018-2019	K-12: 8:15-2:40	1,443 3	276.4.	All schools delayed 15 minutes to coordinate with career and technical center and private schools.
Unionville-Chadds Ford (Chester)	2017-2018	K-5: 9:10-3:40 6-12: 8:00-2:43	3,993 6	77	See detailed narrative below.
Westmont Hilltop (Cambria)	2018	K-6: 8:35-3:40 7-12: 8:00-3:00	1,421 2	15.6	MS students delayed 25 minutes; HS delayed 20 minutes; to make bus runs more efficient and save on transportation costs.
Woodland Hills (Allegheny)	2018-2019	PrK-5: 8:55-4:05 6-8: 7:55-3:05 9-12: 7:05	3,529 5	13.4	See detailed narrative below.

Source: Information in this table and the following narrative compiled from JSGC survey of school districts, Start School Later website, various media reports, the Pennsylvania Department of Education's Educational Names and Addresses database (EDNA), the PaFutureReady Index, individual school websites and communications with school staff.

Blue Ridge School District

Beginning in the 2013-2014 school year, both middle and high school start times were delayed by 30 minutes, changing the start times from 7:45 AM to 8:15 AM. This change eliminated 6:00 bus pick-ups and increased the district's transportation reimbursement due to fewer "unloaded" miles. This change did not affect elementary school start times.

Burrell School District

At the request of the district superintendent, the school board changed the high school starting time from 7:45 AM to 8:10 AM in 2018 for the 2018-2019 school year. This change did not affect the starting time for middle and elementary schools; furthermore, it did not affect dismissal time for high school, middle school or elementary school. The additional time for the high school came from removing the morning homeroom period - when the first bell rings, students go to their first period class. Additionally, one minute is taken from each of the 7 class periods. In terms of busses, the first bus for high school students will arrive at 7:35 AM.

Erie School District

In 2018, the school district conducted a month-long study requesting feedback from parents, students, and staff as well as assessing the impact of later school start times. Resultantly, the school district altered the bell times. Previously, the district used the following schedules: high school started at 7:45 AM and ended at 2:55 PM; East middle school started at 7:45 AM and ended at 2:45 PM; Strong Vincent and Wilson middle schools started at 8:00 AM and ended at 2:55 PM; and the elementary schools started at 9:20 AM and ended at 3:40 PM. The new schedules are the following: high school starts at 8:40 AM and ends at 3:30 PM; middle school starts at 8:00 AM and ends at 2:45 PM; elementary starts at 8:00 AM and ends at 2:30. The predominant outlet for feedback was the school district's Facebook page, where community members could post their thoughts about the start time change. District administration also studied information from the Erie Metropolitan Transit authority.

The district expanded its transportation plan in the 2017-2018 academic year after merging 3 of its 4 high schools. The merger created greater distances for many high school students to get to school. Furthermore, the district expanded free bus service to all high school students who live more than 2 miles from school. Previously, the district only provided passes to a limited number of students with financial difficulties.

The district created the before-school program in 2017 at its 10 elementary schools to allow parents to drop off children before work. One of the primary concerns facing the decision to delay the start of school was the before-school program for PreK-5. With the earlier start times for elementary students, the before-school program, with 235 enrolled

students, is still free and runs from 7:40 AM - 8:40 AM. The district spends $250,000 on these before-school programs.[136]

Lake-Lehman School District

In the 2018-2019 school year, the district changed the start times for the junior-senior high school from 7:30 AM to 8:00 AM. The district also changed the start time for the elementary school to 8:55 AM - about an hour later than it previously started.

Mechanicsburg School District

In the 2018-2019 school year, the district changed the start times for all levels of schooling to coincide with a broader plan of expansion and building renovation. The previous start times were the following: high school started at 7:55 AM and ended at 2:57 PM; middle school started at 8:20 AM and ended at 3:20 PM; elementary school started at 7:45 AM and ended at 2:25 PM; and kindergarten started at 8:00 AM and ended at 2:00 PM. Under the new schedules, the district uses the following bell times: middle and high school starts at 8:05 AM and ends at 2:53 PM; elementary school starts at 8:55 AM and ends at 3:35 PM; and kindergarten starts at 7:50 AM and ends at 2:20 PM. This solution allowed the district to establish its "Kindergarten Academy" which cost $16 million.

In terms of transportation, the district now operates a two-tier transportation system in which Kindergarten and grade 4/5 students are transported together to the 4/5 Academy and then to the Kindergarten Academy. Each 1-3 building is assigned a separate set of buses to transport these students from their respective attendance areas. After a bus completes its elementary assignment, it proceeds to the middle school or high school for a secondary assignment. There are two shuttles which account for non-public schools in the area. Additionally, with these changes, secondary students have a much smaller gap between when they arrive at school and the start of classes.

Phoenixville Area School District

On January 17, 2019 the Phoenixville Board of School Directors voted to push their school start time from 7:24 AM for high school and 7:28 AM for middle school to 8:05 AM for both levels for the 2019-2020 academic year. The end times for both high school and middle school changed from 2:35 PM to 2:53 PM. In addition, elementary school times changed from an 8:30 AM to 3:15 PM school day to a 9:55 AM to 3:35 PM school day. This decision comes as a result of the board's 18-month "sleep exploration" in which it held three public forums and hosted Dr. Wendy Troxel, a behavioral scientist at the University of Pittsburgh.

During the 2018-2019 school year, the Board of School Directors commissioned an advisory group to study adolescent sleep and school start times before making

[136] Ed Palattella, "Erie School District explores time changes." *Go Erie.com*. Last modified April 20, 2018. Accessed June 7, 2019. https://www.goerie.com/news/20180420/erie-school-district-explores-time-changes

recommendations to the Board of School Directors. This advisory group, known as the Sleep Advisory Group, consisted of students and community members who met monthly to deliberate the benefits and shortcomings of a later start time. In addition to this Sleep Advisory Group, the 12-person Steering Committee formed during the 2018-2019 school year. This committee, comprised of representatives from administration, the transportation department, community members, and the Board, met monthly to "operationalize the various scenarios" associated with altering school start times. The Phoenixville Area Education Association (PAEA) also presented its position to the Board in October 2018.

Throughout deliberations, the board considered four options. The first option can be described as concurrent: high school and middle school would have started at 8:20 AM and ended at 3:30 PM. The board rejected this proposal because it would have accrued an additional $1.25 million in busing costs. The second option is considered a "flip" in which the high school and middle school would have started at 8:35 AM and ended at 3:45 PM. The third option was to maintain the current start and end times. The final option—which the board ultimately chose—can be described as a "push." This option was expected to incur an additional $300,000 in busing costs and would shorten both high school and middle school days by about 5 minutes.

The board described their final decision as a compromise of the steering committee's recommended 8:10 AM start time and the PAEA's 8:00 AM recommendation.

Pittsburgh Public School District (Milliones-University Preparatory)

In the 2016-2017 school year, Milliones University Preparatory School changed its start times from 7:42 AM to 8:38 AM for its high school students. This school includes grades 6-12; however, only the high school students had delayed the start times. Overall, the school's attendance rate improved from 81 percent in 2015-16 to 84 percent last school year in the first year after the change. According to the school's improvement plan, the school cut its chronic absence rate by 10 percent from the prior year.

Quaker Valley School District

In the 2017-2018 school year, the district moved the start time back for students in grades 6-12. This action followed a survey the board conducted, asking parents about a later start time. The survey ultimately found support in the community for a later start time; therefore, the school day was delayed from starting at 7:45 AM to starting at 8:00 AM.

Radnor Township School District

On April 23, 2019 the Radnor Township school board voted to change Radnor High School's start time from 7:35 AM to 8:30 AM and its end time from 2:27 PM to 3:10 PM. Radnor Middle School - which previously started at 8:00 AM and ended at 3 PM now begins at 7:50 AM and ends at 2:40 PM. Ithan, Radnor, and Wayne Elementary Schools - which previously started at 9:00 AM and ended at 3:30 PM, start at 9:07 AM and end at 3:40 PM. These changes went into effect in the 2019-2020 school year.

Before making this decision, and over the course of a few years, the District hosted six formal presentations, distributed two surveys (one for community members on adolescent sleep and school start time and one for Radnor High School students on their sleep habits), and hosted 21 meetings of various formats for discussion of this topic. These presentations, discussions, and surveys resulted in a final recommendation by the Sleep and School Start Times Committee to the School Board on April 23, 2019 to alter its school start times as part of a multipronged effort to address adolescent sleep. The District formed a study committee comprised of students, parents, community members, and district employees to assess the benefits of a later school start time. The district also created a comprehensive page dedicated to this study on its website that was (and continues to be) updated regularly.

With the changes to the schedule, the board will keep the three-tier busing system in place despite changes in routes. These changes to the busing model are expected to cost the school district $120,000 for the 2019-2020 school year and subsequent years to hire and retain two additional bus drivers. "More Sleep for a Healthier Student," the report detailing the start time changes and rationales, notes that there will be no major changes to sports and extracurricular activities aside from the fact that optional morning swim practice will be delayed an hour.

Seneca Valley School District

In the 2018-2019 school year, the district changed their start times for all grade levels. Previously, the start times were as follows: 7-12 started at 7:34 AM and ended at 2:30 PM and K-6 started at 8:40 AM and ended at 3:10 PM. The new bell times are as follows: 7-12 starts at 8:09 AM and ends at 2:41 PM and K-6 starts at 8:55 AM and ends at 3:25 PM. This change came through the school board. These changes do not impact the vo-tech school in the area or the private and parochial schools in the area. The district does not use double bus runs for elementary students under these new changes. The district eliminated an activity period to accommodate the new start times.

State College Area School District

In the 2018-2019 school year, the district changed start times at all grade levels. The previous start and end times were as follows: high school started at 8:10 AM and ended at 3:16 PM; middle school started at 8:10 AM and ended at 3:12 PM; and elementary school started at 8:44 AM and ended at 2:50 PM. The new bell times are as follows: high school starts at 8:40 AM and ends at 3:40 PM; middle school starts at 8:40 AM and ends at 3:42 PM; and elementary school starts at 8:10 AM and ends at 3:00 PM. This change adds 24 minutes to the elementary school day, a primary goal of this overall initiative. With this additional time, the elementary schools will offer an additional special subject within STEM curriculum as well as an additional 10 minutes per day per special subject. The changes will cost the district about $2 million in the first year and about $1.5 million annually thereafter. The addition of the fifth special subject requires the district to hire 10 elementary-level faculty members, which accounts for the largest impact on the budget. The 2016-17 budget projection included $1.4 million and in the summer of 2016 the district

received an increase of about $645,000 per year in general state education funds, which has been dedicated toward the annual cost of the proposal.

Southwestern School District

Southwestern, in York County, delayed its school start times in 2006. Initiated by concerns that the elementary day was too short and the secondary day too long, a teacher's committee was appointed to study the matter in consultation with the athletic director. The school's collective bargaining agreement did not specify start and end times, so no collective bargaining agreement negotiations were needed in that area. Presentations were made to the board and the community. Many families found the earlier elementary school start time attractive as it eliminated the need for before-school childcare. In order to ensure that no student was picked up by bus before 7 AM, the district transportation budget was increased by $50,000 for three additional bus runs. Elementary school days ran from 8:55 AM to 2:30 PM and secondary days lasted from 7:30 AM to 3:10 PM under the previous schedule. The new schedule has elementary student days running from 7:45 AM to 2:30 PM, while secondary students attend school from 8:15 AM to 3:15 PM.

Tredyffrin-Easttown School District

On April 22, 2019, the Tredyffrin-Easttown school board voted to change their start times for the high school, middle school, and elementary schools in the district beginning with the 2019-2020 school year. At the time of the board vote, the start and end times were the following: high school started at 7:20 AM and ended at 2:20 PM; middle schools started at 7:50 AM and ended at 2:33 PM; and elementary schools started at 8:45 AM and ended at 3:20 PM. With the revised bell times for the 2019-2020 school year, the schools have the following schedules: high school starts at 7:50 AM and end at 2:50 PM; middle schools start at 8:27 AM and end at 3:10 PM; and elementary schools start at 9:10 AM and end at 3:45 PM.

The board began assessing the benefits and drawbacks of later school start times in the 2016-2017 school year when it began reviewing adolescent sleep literature. In September 2018, the board approved a goal to assess strategies to address adolescent sleep needs—one of these strategies included adjusting school start times. The committee agreed on several assumptions for later school start times before creating new schedules. Under the new school start times, the school district would maintain the current number of instructional minutes each day, continue to use three tiers for busing, maintain current start time order, keep the start and end time the same for each grade level, and use a defined start and end time range with 7:45 AM as the earliest start and 3:45 PM as the latest end. Before moving forward, the committee encouraged parent, student, and staff input at subsequent school board meetings by using presentations, facilitating discussion, and distributing a survey on March 8, 2019. Once the school district gathered and analyzed the survey results - of which there were more than 7,000 - the education committee recommended the start and end times which were implemented in the 2019-2020 school year.

Unionville-Chadds Ford School District

In the 2015-2016 school year, a Student Forum throughout Chester County found and presented evidence to support a later start time to their respective school districts. This student forum consisted of students from ten Chester County High Schools. Prompted by the student movement, the Unionville-Chadds Ford School Board created a committee to evaluate the student findings. The board ultimately moved both Patton Middle School and Unionville High School from a 7:35 AM start to an 8:00 AM start for the 2017-2018 school year. These changes accrued $40,000 of transportation expenditures. Additionally, students in the district miss more class time traveling to away games because many of their surrounding schools still start earlier.

At the end of the 2017-2018 school year, the board conducted a follow-up study to assess how the new times impacted the district. This follow up study found that both middle and high school students get more sleep with the later start times.

Woodland Hills School District

In the 2018-2019 school year, the district changed start times for all grade levels. The junior/senior high school start times was moved 20 minutes later to 7:05 AM for the safety of students traveling to school at the earlier time; the intermediate schools and elementary school times were moved 15 minutes later to accommodate bus schedules. At the end of the 2018-2019 school year, the district underwent a grade reconfiguration, but retained the start times for the 2019-2020 academic year.

Public Schools Considering Later School Start Times - Regional Approaches

The Bucks County Intermediate Unit (Bucks IU) is one of the 29 educational service agencies providing support to local families, schools, and school districts. The Bucks IU serves 13 school districts, three Career and Technical Centers, and dozens of nonpublic schools in Bucks County. In 2016-2017, at the request of the local school district superintendents, the Bucks IU launched a collaborative, countywide approach to studying the topic of school start times. In addition to facilitating conversations amongst the local districts, the Bucks IU has also invited school leaders from other districts that have studied the issue extensively in to local meetings to share their stories. The Bucks IU has also contracted with Hanover Research of Arlington, Virginia to prepare a series of research briefs that articulate the current research, logistics considerations, and lessons learned from similar districts across the country. The Bucks IU continues to facilitate ongoing forums on this topic for the benefit of local districts interested in continuing their exploration of this topic.

The Chester County Intermediate Unit approved a student-based project to study delayed secondary school start times in 2015. The Student Forum Delayed Start Time Committee was created to assess the potential benefits of and obstacles to delaying high school start times. The Committee was comprised of students from a dozen high schools

(including a charter high school). The committee surveyed Chester County high school students, who overwhelmingly supported the concept, and felt that a delayed start time would have positive impacts on their academic, emotional, and physical well-being.[137] At the time of this report, of Chester County's twelve school districts, three had delayed school start times, and three were formally studying the issue. Among the school districts engaged in a study, Downingtown had previously moved its secondary start times 15 minutes later during the 2014-2015 school year, and began a new study looking at even later start times in 2019.

In 2018, the Montgomery County Office of Public Health's (OPH) administrator recommended that the OPH assist in coordinating a validated student sleep assessment with interested school districts/administrators in Montgomery County through the Montgomery County Intermediate Unit. OPH's role is to gather and analyze the data from the surveys and prepare a report of the findings. The schools will decide whether they want to host a dialogue with their families and consider a new policy.

The superintendents of the six school districts in Adams County conducted a survey in 2017 to gauge knowledge and interest in secondary school start times. Respondents included over 6,000 students, parents, community members, teachers, school board members, business owners and others. Perceived potential negative impacts on afterschool athletics and extracurricular activities, transportation supervision of younger children, and an overall lack of community support or desire for change resulted in no districts changing their start times.

Public Schools Considering Later School Start Times - Under Formal Study

At least 28 public school districts have been identified as engaging in some type of publicly acknowledged review of delaying secondary school start times in response to student sleep needs. This number is believed to be accurate as of mid-October 2019. This list is not exclusive - school districts were identified via posts on the districts' websites, press releases, media reports, and the Start School Later website, and there may be other unidentified studies.

Bensalem School District

The school board heard a presentation on later start times in August 2019, a community forum was held in October 2019, and the district will continue to explore options.

Brandywine Heights Area School District

Delaying school start times is under consideration as part of the district's strategic plan.

[137] Delayed Start Time Committee, Student Forum of Chester County, "Delayed High School Start Time: Recommendation to the Chester County Intermediate Unit Board."

Bristol Township School District

The district been studying the possibility of pushing back middle and high school start times for the past two years.

Centennial School District

The district formed a Secondary School Start Time Committee to explore the feasibility of a later high school start time in 2018, and was looking at issues such as implications to other schools' start times and shared transportation needs with non-Centennial schools.

Central Bucks School District

The district began discussing later school start times in 2018. A survey of 11,000 individuals, including 4,000 parents and 5,000 students was completed in the spring of 2019 and research continues.

Central York School District

The district announced that it is considering later start times as part of its 3-year comprehensive planning, beginning in 2019.

Council Rock School District

At the end of the 2016-2017 academic year the district sent its Director of Special Services to the first national Adolescent Sleep, Health, and School Start Times Conference in Washington, D.C. School start times were then addressed at a November 2017 Academic Standards Committee meeting. Current high school start and end times are 7:33 AM to 2:15 PM.

Derry Township School District

It was announced in September 2019 that a steering committee would be formed to create a plan to implement a later start time for Hershey High School students. The committee will include administrators, board members, teachers, and community members. It is expected that the new start time would be in place for the 2021-2022 school year.

East Penn School District

In February, 2019 the school board members voted to direct district administrators to study the possibility of changing start times.

Ellwood City School District

The school board requested proposals from the school administrators in April 2019; no decisions have been made.

Ephrata Area School District

The district initiated a study in 2019.

Fox Chapel School District

It was reported in January 2018 that the district was in the initial stages of research.

Greencastle-Antrim School District

School start times became a topic of discussion among the school board in 2015. The School Start Time Committee was formed to look at the research, and is comprised of staff members, parents, students, and board members. A parent-teacher-community survey and a student survey were conducted, an information session was held in February 2019, and recommendations expected in spring of 2019.

Hampton Township School District

Research on later start times in Hampton Township began in the 2017-2018 school year with a presentation to the school board by the district superintendent on the topic. In January of 2018, University of Pittsburgh Assistant Professor of Psychiatry Peter Franzen presented the research to district officials. The district then formed a committee to determine whether or not there are academic benefits to delaying school start times for high school students. The process included student input. The study committee was expected to continue its research into 2019, with any recommendation expected to emerge slowly and deliberately. The secondary school day for 2019-2020 runs from 7:30 AM to 2:19 PM.

Hatboro-Horsham School District

The district is reviewing its start and end times and bus routes to determine the impact of any changes to the transportation process.

Lower Merion School District

Since 2017, the district has been researching the issue and has undertaken a transportation study. The Sleep Health and School Schedules Advisory Committee will present its recommendation to the School Board on October 24, 2019.

Moshannon Valley School District

The district is conducting a feasibility study looking at a unified start time after 8:00 AM for all schools for the 2020-2021 school year.

Moon Area School District

In January 2018, the board viewed presentations by sleep experts on adolescent sleep and delaying school start times. No further study efforts have been identified.

North Allegheny School District

Over the 2017-2018 academic year, the district held two public forums addressing student stress. Furthermore, the district superintendent gave a presentation on grade weighting and school start times at the first of these public forums. After the forums, the district sent an electronic survey to parents, staff, and students. The survey results prompted the board to dismiss the prospect of switching elementary and high school start times as an option for later start times. The school board invited three sleep professionals including a clinical psychologist and two researchers from the University of Pittsburgh to make presentations. North Allegheny had planned to move its 7:25 AM start time later but encountered a transportation obstacle that would require the hiring of between 29 and 46 drivers, at a cost of between $1.8 million and $2.8 million. The school district reported that this proposal has been tabled for the 2019-2020 academic year.

Owen J. Roberts School District

In 2016, Owen J. Roberts began a study of later school starts times, but ultimately declined to change start times in 2017. Following parental requests for further study into the matter, a new task force was formed in 2018, and multiple options to address adolescent sleep needs, including delaying school start times, were under consideration as of fall 2019.

Pennsbury School District

The school board has made the issue an ongoing discussion item at the board's monthly education committee meeting.

Perkiomen Valley School District

The School Start Times Review Committee met in early October 2019 to begin the process of formal discussions and study of the issue.

Quakertown Community School District

In June 2019 the "2019-2020 Superintendent/District Goals" were approved, and included creating a parent committee to analyze school start times and costs and make recommendations to the school board by February 1, 2020.

Springfield Township School District

In May 2019 the district conducted a student survey. The superintendent announced that the intent of the district would be consider all relevant factors involved in delaying school start times and that, beginning in the 2019-2020 school year, a full-fledged community conversation and investigation as to whether starting school later, and by how much, is something that should be considered in Springfield Township.

Upper Dublin School District

The district conducted a student survey in early 2019. The Education Committee reviewed preliminary data from the survey at its March 11, 2019 meeting. Information sessions and focus groups were planned for April 2019.

Upper Merion School District

In June 2019, the district announced that a Sleep and School Start Time Advisory Committee was being formed to study sleep deprivation in adolescents, educate the community on the topic, evaluate the impact on the district, and present a report and initial recommendation to district administration and, ultimately, the school board.

Wallingford Swarthmore School District

The school board voted in May 2019 to initiate a study of adolescent sleep needs and school start times in the district. At the beginning of the 2019-2020 academic year, a task force was to be convened to address the issue. If a recommendation to change school start times is produced, it is the goal of the district to implement any proposed change in the 2020-2021 school year.

West Chester Area School District

West Chester originally considered shifting to later secondary school start times in 2012, but private school transportation coordination and costs were considered a formidable barrier. The district has 10 elementary schools, three middle schools and three high schools. It enrolls 11,923 students in a 74 square mile area, with 610 West Chester students enrolled in charter schools and another 230 attending a career and technical center. A new study began in fall 2019, but transportation costs remain a concern.

Public Schools Considering Later School Start Times - Informal Discussions Only

Fifteen additional school districts have shared with the Commission that delaying school start times has been informally discussed among administrators and school board members, but no formal studies have been initiated. These schools are not individually identified in this report, as survey responses did not indicate whether these discussions were public information.

Public Schools with Long-Standing Later School Start Times

Several Pennsylvania school districts have always had start times that match or exceed the AAP recommended start time of 8:30 AM for secondary students. Geography and enrollment are likely a factor in these schedules, as buses need to travel long distances to gather a few students at each stop, resulting in earlier bus pickup times.

Forest City Regional School District

The district is one of six school districts in Susquehanna County. It is a rural district in northern Pennsylvania covering 96.6 square miles. It has an elementary school (K-6) and a secondary school (7-12) to serve its 789 students. The daily schedule at both schools is 8:30 AM to 3:30 PM.

Juniata County School District

The district is the only school district in Juniata County. In rural central Pennsylvania, it encompasses 374.1 square miles. Its 2,807 students attend two elementary schools (K-5 and K-6), one middle school (6-8), one junior/senior high (7-12) and one high school (9-12). The daily schedule at all schools is 8:30 AM to 3:15 PM.

Sullivan County School District

The district is the only school district in Sullivan County. Located in northeastern Pennsylvania, it covers 452.5 square miles, making it the 5th largest school district in the Commonwealth in terms of area. (Keystone Central, the largest in terms of land area, covers 970.8 square miles.) Sullivan County's two schools, elementary (K-6) and secondary (7-12), serve 620 students. The school day at the secondary school runs from 8:40 AM to 3:30 PM, and the elementary is on an 8:45 AM to 3:20 PM schedule. The single-tier bus run results in an average bus ride for students of one hour.

Public Schools Deciding Against Later School Start Times

Twenty school districts reported that changing school start times had been considered, but ultimately decided against. Parental opposition was frequently cited, followed by transportation expenses, coordination of extracurricular activities, coordination with sports schedules, and coordination with career and technical centers.

Public Schools Moving Start Times Earlier

Nineteen school districts responding to the Commission's survey reported that high school start times were changed to an earlier time in recent years. Reasons are usually related to transportation costs and logistics, as can be seen in the following three school districts that have provided public information as to the earlier start time decision.

Connellsville Area School District

The district changed its high school start from 7:20 AM to 7:05 AM, with a 2:17 PM dismissal time for the 2015-2016 school year. Junior high start times moved from 7:30 AM to 7:15 AM, with a 2:30 PM dismissal time. The changes were to reduce the number of bus runs and address low numbers of riders on one run.

Milton Area School District

In 2017-2018, middle school and high school start and end times were shifted from 8:07 AM to 3:25 PM and 8:04 AM to 3:28 PM respectively to a combined start and end time of 8:00 AM to 3:00 PM. The change was prompted by the loss of instructional time due to the scheduling of start and travel time for athletic events, which was causing stress among the students.

North Hills School District

In December 2012, the district superintendent proposed new school schedules to reduce transportation expenses. Middle school start times would be delayed by 10 minutes to 7:50 AM, elementary school students would start at 8:30 AM and 9:15 AM, and high school students would see their start time advanced by 20 minutes to 7:20 AM. The high school day in 2019-2020 runs from 7:20 AM to 2:00 PM.

Charter Schools

Pennsylvania's 180-plus charter schools are found in 34 of its 67 counties. They are concentrated in Philadelphia County (87 schools) and Allegheny County (23 schools), with eight each in Chester and Lehigh Counties. Twelve counties have one charter school each. Additionally, many only serve elementary students, usually in the K-6 or K-8 ranges. Secondary education programs were identified at 89 charter schools (76 brick-and-mortar, 13 cyber) with 19 brick-and-mortar schools beginning before 8:00 AM and 13 beginning 8:30 AM or later. To the extent cyber charter schools have a fixed schedule, login times for secondary students range between 8:00 AM and 9:00 AM. See Tables 2 and 3.

Table 2

Start Times at Pennsylvania Brick-and-mortar Charter Schools Serving Secondary Students

School Name	Home County	Grade Range	Start Times
City Charter High School	Allegheny	8-12	8:00
Passport Academy Charter School – blended 3 hours a day on campus (morning or afternoon session) and 2 hours online M-F)	Allegheny	9-12	8:30
Spectrum Charter School	Allegheny	9-12	8:30
The New Academy Charter School	Allegheny	8-12	8:30
Urban Pathways 6-12 Charter School	Allegheny	6-12	8:15
Westinghouse Arts Academy Charter School	Allegheny	9-12	8:10
Lincoln Park Performing Arts Charter School	Beaver	7-12	8:45
HOPE for Hyndman Charter School	Bedford	K-12	7:50
I-LEAD Charter School	Berks	9-12	
Center for Student Learning Charter School at Pennsbury	Bucks	6-12	9:15
School Lane Charter School	Bucks	K-12	8:00
Collegium Charter School	Chester	K-12	7:30
Renaissance Academy Charter School	Chester	K-12	8:00
Sugar Valley Rural Charter School	Clinton	K-12	7:40
Capital Area School for the Arts Charter School	Dauphin	9-12	7:45
Chester Charter Scholars Academy Charter School	Delaware	K-12	9:00

Perseus House Charter School of Excellence	Erie	6-12	8:15
New Day Charter School	Huntingdon	K-12	8:00
La Academia Partnership Charter School	Lancaster	6-12	7:45
Executive Education Academy Charter School	Lehigh	K-12	8:00
Innovative Arts Academy Charter School	Lehigh	6-12	7:20
Roberto Clemente Charter School	Lehigh	K-5 6-12	8:30 8:00
Keystone Education Center Charter School	Mercer	HS 9-12 MS 7-8	8:00 7:45
Evergreen Community Charter School	Monroe	6-12	8:00
Lehigh Valley Academy Regional Charter School	Northampton	K-12	8:00
Lehigh Valley Charter High School for the Arts	Northampton	9-12	7:40
Belmont Charter School	Philadelphia	K-11	8:00
Boys Latin of Philadelphia Charter School	Philadelphia	6-12	8:00
Charter High School for Architecture and Design	Philadelphia	9-12	8:15
Community Academy of Philadelphia Charter School	Philadelphia	6-12	8:00
Esperanza Academy Charter School	Philadelphia	K-12	
Franklin Towne Charter High School	Philadelphia	9-12	7:45
Freire Charter School	Philadelphia	5-12	7:50
Imhotep Institute Charter High School	Philadelphia	9-12	8:30
KIPP Dubois Collegiate Academy	Philadelphia	9-12	
Mariana Bracetti Academy Charter School	Philadelphia	K 1-5 6-12	9:00 8:45 8:10
Maritime Academy Charter School	Philadelphia	1-12 MS HS	 8:45 7:30
MAST Community Charter School	Philadelphia	K-8 9-12	8:15 7:40
Mastery Charter School – Gratz Campus	Philadelphia	7-12	8:00
Mastery Charter School - Hardy Williams	Philadelphia	7-12	8:00
Mastery Charter High School – Lenfest Campus	Philadelphia	7-12	8:00
Mastery Charter School – Pickett Campus	Philadelphia	6-12	8:00
Mastery Charter School – Shoemaker Campus	Philadelphia	7-12	8:00

Mastery Charter School – Thomas Campus	Philadelphia	7-12	8:00
Math Civics and Sciences Charter School	Philadelphia	1-5 6-12	8:30 8:15
Multicultural Academy Charter School	Philadelphia	9-12	7:55
New Foundations Charter School	Philadelphia	K-8 9-12	8:15 7:00
Olney Charter High School (Aspira)	Philadelphia	9-12	8:20
People for People Charter School	Philadelphia	K-12	8:00
Philadelphia Electrical and Technical Charter High School	Philadelphia	9-12	7:50
Philadelphia Performing Arts Charter School	Philadelphia	5-8 9-12	7:45 8:00
Preparatory Charter School of Mathematics Science Tech and Careers	Philadelphia	9-12	8:00
Sankofa Freedom Academy Charter School	Philadelphia	K-8 9-12	8:10 8:30
Tacony Academy Charter School	Philadelphia	9-12	8:30
TECH Freire Charter School	Philadelphia	9-12	7:50 9:50 W
Universal Audenreid Charter School	Philadelphia	9-12	8:00
Youth Build Philadelphia Charter School	Philadelphia	12	9:00
Gillingham Charter School	Schuylkill	K-12	8:30
Tidioute Community Charter School	Warren	K-12	8:00
Dr. Robert Ketterer Charter School, Inc.	Westmoreland	6-12	7:40
Crispus Attucks Charter School	York	12	8:00
York Academy Regional Charter School	York	K-7 8-9	8:00 8:15

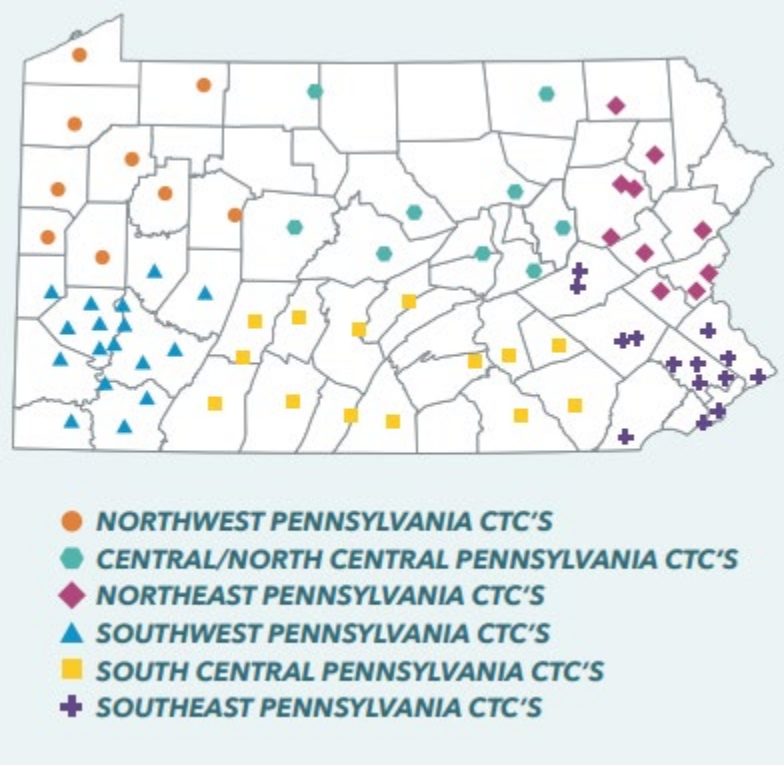
Source: Information compiled by Joint State Government Commission staff.

Table 3			
Start Times at Pennsylvania Cyber Charter Schools Serving Secondary Students			
School Name	**Home County**	**Grade Range**	**Start Times**
Pennsylvania Distance Learning Charter School	Allegheny	K-12	Asynchronous
Pennsylvania Cyber Charter School	Beaver	K-5 6-12	8:30 8:00
Central Pennsylvania Digital Learning Foundation Charter School	Blair	K-12	Asynchronous
21st Century Cyber Charter School	Chester	6-12	Asynchronous
Achievement House Charter School	Chester	7-12	Asynchronous
SusQ-Cyber Charter School	Columbia	9-12	9:00
Commonwealth Charter Academy Charter School	Dauphin	K-12	9-12 is flexible
Reach Cyber Charter School	Dauphin	K-12	9-12 is flexible
Agora Cyber Charter School	Montgomery	K-12	8:00; 9-12 has asynchronous option
Pennsylvania Virtual Charter School	Montgomery	9-12	8:15
ACT Academy Cyber Charter School 9-12	Philadelphia	9-12	
ASPIRA Bilingual Cyber Charter School K-12	Philadelphia	K-12	8:20
Esperanza Cyber Charter School – K-12	Philadelphia	K-12	

Source: Information compiled by Joint State Government Commission staff.

Career and Technical Centers

Consistent with the Commonwealth's population distribution, most career and technical schools (CTC) are located in the Southeast and Southwest regions of the state. Determining start times is a complex manoeuver for many school districts. In the Southeast, CTCs tend to be geographically closer to the schools they serve, but they also have more students to transport to the schools. In the more rural regions of the state, a CTC could have a dozen or more sending school districts, which makes coordinating start times more complicated and requires a higher level of cooperation among sending districts. The map below shows the distribution of CTCs across the state.



Source: Pennsylvania Department of Education brochure "Pennsylvania Department of Education. Career and Technical Education." 2018. https://www.education.pa.gov/Documents/K-12/Career%20and%20Technical%20Education/PA%20CTE%202019%20Brochure.pdf

Career and technical centers are as varied as the communities they serve. Nearly two-thirds of the 84 identified by the Pennsylvania Department of Education are attended by students on a part-time basis. The CTC student will spend half a day at their home school, and half a day at the CTC. In a few CTCs, three two-hour sessions are held daily and students from participating schools spend the rest of the day in their home schools. Many CTCs offer both high school programs and adult education programs. About 10 of these programs offer both full- and part-time attendance. The number of participating school districts in any given CTC can range from 16 districts sending students to the CTC

to CTCs sponsored by one school district alone. Five CTCs are in this category, although only one, Connellsville Area Career and Technical Center, offers a full time program that runs from 7:30 AM - 2:07 PM.

There are 18 CTCs where students spend the entire day at the CTC and receive both career and technical training as well as the standard academic classes offered by regular high schools that do not also offer a part-time option. Six of these schools are in the Philadelphia School District. Table 4 below identifies the start and end times for the remaining 12 CTCs that offer full-time programming only.

Table 4

Start Times at Pennsylvania Career and Technical Centers Offering Full-Time Programming Only

CTC Name	No. of Sending Districts	Start and End Times	Notes
Bucks County Technical High School	6	7:10-1:54	
Columbia Montour AVTS	7	8:15-3:11	
Connellsville Area CTC	1	7:30-2:07	Fayette County
Dauphin County Technical School	7	7:55-2:50	
Franklin County CTC	6	8:00	Start times vary based on sending district schedule
Jefferson County Dubois AVTS	4	8:13	
Lancaster County CTC – three campuses	16	8:00	Full time for seniors; juniors attend part time
Lawrence County CTC	8	8:10-2:40	
Mifflin County Academy of Science and Technology	3	8:15-2:55	
Schuylkill Technology Centers- two campuses	12	8:00-2:30	
SUN Area Technical Institute	5	8:05-2:45	Union County - Seniors only
West Side CTC	5	7:55-2:30	Luzerne County
York County School of Technology	14	8:10	

Source: Information compiled by Joint State Government Commission Staff

Non-Public Schools

An informal survey of 50 of Pennsylvania's 101 private independent schools indicated that most senior (i.e. secondary) schools begin between 8:00 AM and 8:30 AM. One school's daily schedule is 10:00 AM to 4:00 PM. It should be noted that many

nonpublic schools are dependent on public busing schedules. Several of the schools participating in the informal study provided additional information on their start times.

The Haverford School

The school day begins at 8:30 AM (Monday, Tuesday, Thursday, Friday) and 9:00 AM on Wednesdays to accommodate faculty and department meetings. This start schedule began almost 10 years ago when the administration first encountered the research about sleep and teenage circadian rhythms. The school found that its students are more awake, less tardy, and that our first period runs much smoother.

Linden Hall

Based on comments from students, parents, and employees, as well as considerable research, three school years ago the school moved its start time from 8:00 AM to 8:30 AM. The school found, without exception, that the change has been very positive for the students and faculty/staff.

Springside Chestnut Hill Academy

The Upper School (secondary) was changed from 8:00 AM to 8:15 AM three years ago.

YSC Academy

The school day begins at 10:00 AM and ends at 4:00 PM. The school fully supports later school start times, and reports that it has have always had a later start to the school day. [138]

The Solebury School

In the 2016-2017 school year, Solebury School, a private school, changed its school start time to 8:30 AM. By the spring of 2017, the school reported that almost 75 percent of students reported they were able to sleep later and/or eat breakfast more often than the previous year. Additionally, over half of the students reported that they felt less stressed. The school day still ends at 3:30 PM because the school shifted its academic schedule to a college model.

Parochial and approved private schools for persons with exceptionalities were not surveyed for this report.

[138] Emails from Linda Phelps, Retired Executive Director, Pennsylvania Association of Independent Schools. Received September 12, 2019 and October 4, 2019.

COMMON PERCEIVED CHALLENGES AND POTENTIAL SOLUTIONS

A nationwide study of school start time changes identified the salient perceived challenges faced by school districts delaying their start times as traffic flow at school, changes in parents' work schedules, afterschool extracurricular program attendance, changes in teachers' work schedules, and before-school athletic practice schedules. When all athletic-related items were combined, athletics was the most common perceived challenge reported by school districts. Other perceived challenges identified in this study were costs to school districts, loss of community support, limitations on student after school employment, financial costs to families, and safety concerns for elementary students.[139]

Similar challenges have been identified by the National Sleep Foundation, including: transportation; after school activities, including athletics; impacts on younger students; coordination with programs such as special education, and career and technical centers; reduced time to access public resources by students (*e.g.*, public libraries, etc.); teachers' family time; stress for families; a lack of information about sleep science within the community; and resistance of students to change.[140]

For the purpose of this report the Commission, in cooperation with the Pennsylvania Department of Education, conducted a qualitative survey of Pennsylvania school start times. Surveys were sent to superintendents/administrators of the 754 local education agencies (LEA) in the Commonwealth, which included 500 school districts, 170 charter schools, and 84 career and technical schools. Survey questions were as follows:

- Has your school district changed secondary school start times within the last five years?
- Did your district encounter barriers that needed to be addressed to accomplish this change? If so, please list and prioritize the top five barriers encountered.
- Has your district conducted any reviews or evaluations of the impact of the start time changes? If so, please share any findings or data you have collected.
- Has your district considered and rejected changing secondary school start times? If so, please list and prioritize the top five reasons the district chose not to change start times.

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[139] Judith Owens, Darrel Drobnich, Allison Baylor, et al., "School Start Time Change: An In-Depth Examination of School Districts in the United States," *Mind, Brain, and Education* 8, no.4 (November 2014): 182-213, https://doi.org/10.1111/mbe.12059.

[140] National Sleep Foundation, "Eight Major Obstacles to Changing School Start Times". http:www.sleepfoundation.org/sleep-topics/school-start-time-and-sleep. This does not appear to be a formal scientific survey but rather based on anecdotal information.

- If your district were to consider delaying school start times, what do you perceive to be the top five barriers that your district would likely encounter?

Surveys were emailed on April 3, 2019 and a reminder email sent June 12, 2019. Of Pennsylvania's 500 school districts, 219 responded to the survey. Twenty-six school districts indicated that they had changed secondary school start times within the past five years, and nine of them identified challenges that were encountered. Seven of those nine districts identified transportation logistics as a perceived challenge; most of the districts also identified one or two of the other common challenges identified in this chapter. Some respondents listed perceived challenges in order of priority, while others did not.

145 of the responding districts out of 219 (66.2 percent) indicated that they had not changed secondary school start times within the past five years and doing so had not been considered within the school district. Of the 219 survey respondents, 182 (83.1 percent) identified multiple perceived challenges should their school district attempt to change secondary times. This chapter reviews the most common challenges identified in the surveys, many of which are similar to the concerns identified nationally and offers potential solutions.

Instructional School Day Requirements

Any change in school start times must take into consideration the directives of the Public School Code of 1949 regarding the minimum number of hours in the school year. Efforts to delay start times that concomitantly shorten the school day must ensure that the School Code mandates are met. Under the Code, students are required to attend school 180 days per year, or 990 hours of instruction for secondary students as the equivalent (defined as grades 7-12). This equates to 5.5 hours of instruction per day. School boards may set the start and end times of each session day, but if the board does not set a different time the school day is statutorily mandated to start at 9:00 AM and end at 4:00 PM.[141]

The 990 hours of instruction time for secondary students is defined as time in the school day devoted to instruction and instructional activities provided as an integral part of the school program under the direction of certified school employees.[142] Instructional activities may include:

- classroom instruction and instructional activities provided under the direction of certified school employees;
- student services, such as guidance and counseling services, psychological services, speech pathology and audiology services and student health services;
- opening exercises;

[141] §1504(a) of the act of March. 10, 1949 (P.L. 30, No. 14), known as the Public School Code of 1949. 24 P.S. 15-1504(a). 22 Pa.Code §§11.1 and 11.3.
[142] 22 Pa.Code § 11.2.

- homeroom periods;
- supervised study halls;
- assemblies;
- clubs, student councils and similar activities conducted during school hours;
- school, group or class educational trips, to which admission is not charged to students or parents and a certified school employee accompanies the students;
- civil defense, fire, bus evacuation and similar drills;
- up to three days for graduation preparation by students in graduating classes, so long as the preparation occurs within 60 days of the commencement ceremony and under the supervision of certified school employees; and
- Early dismissal and delayed opening due to inclement weather.[143]

Concerns

Many concerns about delaying secondary school start times revolve around the assumption that a later start time by necessity dictates an equivalent later dismissal time. This does not have to be the case.

Information

Pennsylvania's mandatory instruction hours leave room for some flexibility in the daily schedule that could allow a district to "compress" the school day, so that a later start does not result in a later equivalent dismissal.

Strategies

Some school districts have used the following strategies:

- Shortened "passing" time between classes in the daily schedule.
- Allowed flexible student schedules (some schools offer online/cyber options in some topics so that students do not necessarily need to be at school at the first bell).
- Made first hour (Period 1) a study hall and allow students to use "flex" time to start day at Period 2.
- Initiated an eight period schedule and put athletes into free periods/study hall/physical education for the last period of the day.
- Eliminated zero hour/periods at start of day that begin before the official school start time.

[143] 22 Pa.Code § 11.8.

- Increased the number of school days in order to reduce the number of minutes that students are required to be in school each day.

The Pennsylvania Department of Education (PDE) could increase Act 80 flexibility for districts that are exploring changing school start times so that teachers could have additional time for activities such as lesson planning, professional development, curriculum review, and other similar activities. Sort, daily allocations of Act 80 time could provide districts with crucial minutes to overcome potential obstacles in regards to transportation, staffing and athletics.

Transportation in General

Concerns about transportation encompass many issues, most centered on cost and coordination. Approximately one-quarter of the respondents to the Commission's survey listed transportation generally; transportation costs; transportation logistics; and busing or bus schedules as the principal challenges they would anticipate encountering in delaying secondary school start times. Most specific transportation challenges identified included:

- contractual commitments to bus contractors;
- lack of pool of bus drivers generally; bus driver shortages;
- driver availability for later runs because drivers "moonlight" as drivers and have full-time commitments to day jobs;
- size (square mileage) of some rural districts require close alignment of elementary and secondary start times to maximize uses of buses and resources;
- length of bus rides;
- districts that have one K-12 run; change would impact all students;
- traffic patterns and rush hour traffic;
- sharing both public and private school runs with neighboring school districts that use the same bus company;
- combining elementary and secondary students on the same bus;
- potential impact on after school activities bus runs;
- potential impact on ability to bus students to athletic events; and
- coordination with career and technology centers, and parochial, charter and independent (non-public) school schedules.

Concerns

A common objection to delaying secondary school start times is that it will increase transportation costs in terms of either additional buses, additional drivers, or additional bus runs.

Information

The transportation cost impact of changing school start times varies greatly from district to district. Some districts have experienced cost savings, while others have incurred no or minimal cost increases. Districts with more complex transportation systems may face significant costs depending on how school start times are reconceived in each district. Each school district will need to be innovative in navigating a district's transportation needs and rethinking its approach to transporting students with new school schedules. In the method employed, there are some basic approaches that can be used as a foundation for an individual school entity's program.

School bus systems can operate in a variety of ways and that is why a third-party analysis of transportation and route efficiency is often conducted by districts and can be helpful to find creative and cost-effective solutions. In a one-tier system, a single fleet of buses may make one run that picks up all students at the same time. This arrangement is usually found in schools that are small in pupil numbers but encompass large geographic areas. Other districts may operate a two-, three-, or even four- or more tier system. A two-tier system usually has buses making two trips, one to collect and deliver secondary school students to school and a second to collect and deliver elementary school students to school. A three-tier system employs separate bus runs for elementary, middle, and high school students. Oftentimes in school start time studies, districts explore changing their tier system, sometimes for arrival or dismissal, or both. Four-tier and larger systems frequently employ a shuttle system to deliver students to charter schools, career and technical centers, and non-public schools.

Other nuances in school busing include whether or not districts own their own buses and hire their own drivers or contract with a third-party for their transportation needs. Transportation bargaining agreements, whether they are in house or outsourced, may need to be reviewed as part of any district school start time study.

In addition, urban districts typically have more access to and use public transportation for student transport. The Erie City School District worked with the city's public transportation system to assist with their recent school start time change.

Strategies

The 2014 nationwide study[144] recognized several new approaches used by school districts to meet transportation concerns. Some approaches that districts might want to consider are:

[144] *Supra* note 139.

- Changing tier-systems, either for the AM or PM runs, or both.
- Encouraging creative tiers bus runs where same levels do not have to be on the same tier.
- Encouraging car pools.
- Encouraging students to use personal transportation.[145]
- Providing incentives for using public transportation, or other modes of transport.
- Creating bus depots for special program and centers.
- Allowing middle and high school students to ride on the same buses.
- Charging parents who have sufficient financial resources a flat-rate fee for special activities.

Bus Driver Shortages

Several survey respondents identified a shortage of bus drivers as a potential challenge to changing school start times.

Concern

Districts struggle to find bus drivers already; any move that would result in the need for more bus drivers to make additional runs or drive additional buses would be a significant important hurdle.

Information

Bus driver shortages have been reported in both western Pennsylvania,[146] the Lehigh Valley region[147] and everywhere in between.[148] The State of Maine recently enacted a law directing the state's Departments of Education and Labor to comprehensively

[145] The American School Bus Council does not recommend students driving to school. *Safety Features of the School Bus* brochure. "Students are about 70 times more likely to get to school safely if they take the school bus instead of traveling by car." http://schoolbusfacts.com/wp-content/uploads/2017/01/SafetyFeatures.pdf

[146] *WPXI Pittsburgh*, "11 Investigates school bus driver shortage in Western Pennsylvania," December 14, 2018. https://www.wpxi.com/news/top-stories/11-investigates-school-bus-driver-shortage-in-western-Pennsylvania/888288378.

[147] Sarah M. Wojcik, "With Start of school days away, Lehigh Valley districts grapple with bus driver shortage," *The Morning Call,* August 23, 2019. https://www.mcall.com/news/education/mc-nws-education-bus-driver-shortage-20190823-dleq4sgxrndllldzitevs333t4-story.html.

[148] Shannon Murphy, *WGAL8 Lancaster*, "Dauphin County company aims to help with bus driver shortage," May 25, 2019. https://www.wgal.com/article/dauphin-county-company-aims-to-help-with-bus-driver-shortage/27591327.

examine issues related to the school transportation workforce, including the determination of the best strategies for hiring, training, and retaining school transportation personnel.[149]

The National Association for Pupil Transportation (NAPT) conducted a study in 2016 of bus driver shortages nationwide. There were 1,053 respondents – a mixture of representatives of school bus contractors and school districts that own their own school bus fleets. The smallest 20 percent of companies and school districts surveyed and the largest 20 percent reported having limitations in finding drivers. Forty-five percent of the smallest NAPT respondents and 47 percent of the largest NAPT respondents identified the problem as severe. Fifty-nine percent of all NAPT survey respondents indicated that driver retention is becoming much more difficult. Fifty-six percent indicated that not only was the shortage severe, but that is was getting worse.

Many factors were cited as reasons for the driver shortage, but varied across regions. Respondents in the Northwest and Midwest indicated employee benefits are a major factor in recruitment and retention, while respondents in the South and West felt that the pay is a major factor. Other potential major factors include hours available to work and obtaining a CDL (commercial driver's license).

NAPT respondents ranked their preferred methods of recruiting drivers by advertising as:

- Internet;
- newspaper ads;
- bulletin boards in the local community;
- other;
- flyers; and
- Billboards.

Most NAPT respondents accept online applications (73 percent) as well as paper applications (59 percent). The overall average hiring process (number of days from submission of application until a new hire is informed of a decision) is 23 days.

Financial incentives to retain drivers, in order of the popularity among NAPT respondents, were: retirement plan (64 percent); medical insurance (61 percent); dental insurance (51 percent); vision insurance (44 percent); attendance bonus (29 percent); referral bonus (20 percent); safety bonus (14 percent); and other (19 percent).[150]

Other factors believed to play a role in the bus driver shortage include: fewer retirees (the traditional work pool for bus drivers) are less interested in the work; the

[149] State of Maine, Chapter 59, Resolves (formerly L.D. 1641), approved June 7. 2019.
[150] National Association for Pupil Transportation, "Driver Shortage Study," Fall 2016 https://www.napt.org/files/driver_shortage_presentation__keyfindings.pdf.

country's current low unemployment rate; the part-time nature of the job with a split schedule for mornings and afternoons; training; and the willingness to take on the responsibility for a bus-full of children every day. Additionally, in some regions, public school districts compete with private bus contractors to hire drivers and normally cannot compete with the private contractors from a compensation perspective.[151]

Strategies

Strategies being used by school districts and bus companies include higher pay, more benefits, reimbursing drivers for costs of training and licensing fees, providing potential drivers opportunities to "test drive" empty buses to get a feel for what it takes to drive such a large vehicle, supplemental pay to existing district workforce in all categories for those who earn needed credentials, and more aggressive marketing, including through social media. It has been reported that the superintendents and other staff at two school districts in western Pennsylvania have received their commercial driver's license in order to help with driver needs in their respective districts. Other school districts around the country are reportedly training teachers to serve as bus drivers. [152] Newer buses are equipped with more mirrors, cameras, internal microphones, and additional safety features which are touted to potential drivers to assuage some of the concerns about driving a school bus.[153]

Transportation Mandates, Coordination, and Logistics

Coordinating multiple bus runs among a district's various educational entities encompasses a large subset of the transportation issue in general.

Concern

The Pennsylvania mandate that school districts providing transportation to their resident pupils must also provide transportation to career and technical centers, charter schools, parochial schools, and other private schools within a 10-mile radius of the student's home district is a major challenge to delaying secondary school start times. Many of the respondents to the Commission's survey who identified multiple hurdles to school start time changes, identified coordinating start times with regional career and technical centers as a major hurdle. Other educational entities that were identified as sources of conflicts were co-operative programs, intermediate units, and dual enrollment programs. Charter schools, parochial, and private schools were also potential sources of coordination issues.

Additionally, members of the Advisory Committee have raised concerns about the adequacy of the state transportation subsidy to accommodate changes.

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[151] *Supra* note 147.
[152] Corey Mitchell, "Teacher-Drivers Keep Wheels on the Bus Going Round" *Education Week,* October 3, 2019. https://www.edweek.org/ew/articles/2019/09/03/teacher-drivers-keep-wheels-on-the-bus-going.html.
[153] *Supra,* note 147.

Information

Pennsylvania's 1949 public school law does not require school districts to provide transportation to students. School boards of any district may provide for free transportation for resident pupils to and from any non-profit school the student is lawfully enrolled in that is within the district boundaries or no more than 10 miles from the nearest highway outside the district boundaries. The ten-mile limit does not apply to area vocational technical schools (also referred to as career and technical centers) or special schools or programs approved by the Pennsylvania Department of Education.[154] Transportation to charter schools is also mandated with a similar 10 mile requirement and, in addition, is required to occur on days the charter school is open, even if the transportation-providing school district is closed that day.[155]

School districts finance student transportation, but receive a subsidy from PDE.[156] The subsidy is based on a complex formula that, according to PDE, averages approximately half of a subsidized district's annual transportation costs.[157] The state formula applies uniformly to all school districts, regardless of geography, topography, the number students in the district, and the number of runs needed to minimize the length of bus rides, among other factors. Additionally, the annual subsidy is adjusted based on the Consumer Price Index,[158] and not other factors that may more closely affect transportation costs such as fuel or the increasing use of more costly vans to transport smaller groups of students to programs off-campus, charter schools, or nonpublic schools. Since the 2001-2002 school, each school district has been paid $385 for each nonpublic school student transported.[159] According to the Pennsylvania Association of School Business Officials (PASBO), "vans used for special education students or private school students being transported more than 10 miles from the district's boundaries are typically reimbursed well below – usually less than one-half – the actual cost to operate or contract the van."[160]

Coordination concerns vary across the Commonwealth. In school districts outside of Allegheny County and the Philadelphia area, aligning start times with other school districts and the regional career and technical center is the larger concern. Within the southeast region of the Commonwealth, coordinating with charter schools is the bigger hurdle, where 91 of the Commonwealth's 182 charter schools are located in Philadelphia County alone. Chester, Lehigh, Delaware, Northampton, Bucks, and Montgomery Counties (all in the Philadelphia area) have multiple charter schools, as do Dauphin and York Counties in the South Central region. Allegheny County has coordination issues with both career and technical centers (6) and charter schools (23). Forty-nine percent of

[154] PSC § 1361; 24 P.S. § 13-1361.
[155] PSC § 1726-A; 24 P.S. § 17-1726-A.
[156] PSC § 2541; 24 P.S. § 25-2541.
[157] Pennsylvania Department of Education, Pupil Transportation Frequently Asked Questions. Accessed August 29, 2019. https://www.education.pa.gov/Teachers%20-%20Administrators/Pupil%20Transportation/Pages/Pupil-Transportation-FAQs.aspx.
[158] 22 Pa. Code § 23.39.
[159] PSC § 2509.3; 24 P.S. § 25-2509.3.
[160] Dr. Wayne McCullough Director of Leadership and Development, PASBO, "Testimony to the Senate Education Committee's Subcommittee on Transportation and Support Services", May 15, 2017 .

Pennsylvania's counties have no charter schools located within the county and another 18 percent report only one charter school per county.

As noted above, there is no mileage limit on how far a school district must transport special education students or career and technical school students. The "10-mile beyond the district boundaries" requirement comes in to play where charter schools, parochial, schools and nonpublic/private/independent schools are involved. Based on an informal survey of the Pennsylvania Association of Independent Schools, whose membership totaled 101 schools in 2018-2019, most school start times already are between 8:00 AM and 8:30 AM. [161] Catholic education in Pennsylvania is administered under eight dioceses with 355 schools, including 59 high schools.[162] If parochial, private, and charter schools were evenly distributed across the Commonwealth, transportation of these students would be a small part of school districts' budgets. Due to the concentration of charter schools in the Southeast Pennsylvania region, this requirement can be especially cumbersome for these districts. Lower Merion Township School District in Montgomery County reported that it transports students to 84 independent schools. West Chester School District in Chester County reported runs to more than 160 schools daily. There are many more districts in that region who cite similar experiences.

According to information provided by School Bus Consultants, a national school transportation consulting service, Pennsylvania's 1949 requirement to provide free transportation to charter school students is replicated in only six other states in the country.[163] Most of those states require transportation to be provided on the same terms and conditions as for students attending district schools. In perhaps the least restrictive free charter school transportation mandate, Kansas only requires transportation be provided to students who qualify for the federal free lunch program and live 2.5 miles or more from the charter school. School districts may also provide transportation for other charter school students.[164]

Strategies

The General Assembly could rewrite the transportation subsidy to simplify and modernize the formula to take into account other variables. Additionally, some members of the Advisory Committee have advocated for a revision to the 10-mile nonpublic school rule. Legislation has been introduced in the 2019-2020 session to amend this requirement for charter schools to a 5-mile limit. Senate Bill 591, Printer's No. 647, was referred to the Senate Education Committee, where it currently rests.

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[161] *Supra*, note 138.
[162] National Catholic Education Association, School Locator, accessed August 27, 2019. https://www.ncea.org/NCEA/School-Locator/School-Locator.aspx?WebsiteKey=60819b28-9432-4c46-a76a-a2e20ac11cfd&hkey=ddf4fdd5-6144-44b4-a381-17b31cd6e3d3&New_ContentCollectionOrganizerCommon=2#New_ContentCollectionOrganizerCommon
[163] Those states are Connecticut, Kansas, Massachusetts, New Hampshire, New Jersey and Ohio.
[164] Kans. Stat. § 72-4210.

Suggestions have also been made that costs to implement delayed school start times should be considered an exemption to the limitations on school district property tax increases under the Taxpayer Relief Act (Act 1 of 2006).[165]

Athletics and Other Extracurricular Activities

The potential of later school start times to negatively impact afterschool activities is another perceived challenge identified by the Commission survey. Concerns about students losing homework and family time because of activities such as band, chorus, theatre, and clubs running later in the day were cited, and as well as losing time for participation in community and religious activities. Less time for private lessons and tutoring were also mentioned. By far the largest extracurricular activity that concerned people was athletics. Over half of the respondents referred to athletics in particular in some form or another as a potential source of conflict with later school start times. Two school districts responding to the Commission survey indicated potential challenges to delaying school start time could be summed up in one word: "athletics."

Concerns

Concerns expressed about negative impacts on sports included the following:

- Athletes missing too much instructional time for early dismissals to sporting events (this was the principal concern of most respondents identifying athletics as a barrier).
- Shortened practice times or practices that run into the evening.
- Lack of lighted fields if practices/games start later.
- Ability for student athletes to attend away games, tournaments, and Pennsylvania Interscholastic Athletic Association (PIAA) - scheduled events on time.
- Loss of participants in athletics and other extracurriculars.
- Loss of time to complete homework; pushing back of other evening activities; as well as loss of family time.
- Coaching staff availability.
- Transportation availability.
- Available gym or field time – some schools have one gymnasium used by the school and the community while others "borrow" neighboring district lighted fields for practice.

[165] Act of June 27, 2006 (Sp.Sess. 1, P.L. 1873, No.1), § 333.

Information

Research has shown that insufficient sleep among athletics negatively impacts both performance and health. On the other hand, increased sleep duration and improved sleep quality reduce injuries, enhance performance and competitive success. Proper sleep makes for better athletes all-around.[166] For working parents, later start times for athletics could increase the likelihood that they could see their children participate. Furthermore, evidence from across school districts in Pennsylvania as well as across the country that have delayed start times do not suggest an adverse effect of later start times on extracurricular engagement.[167]

Strategies

It is important to remember that a later start time does not have to equate to an equivalent later end time, or a later end time at all. Districts have "passing time" between periods, provided opportunities for online or hybrid learning, as well as eliminating or shortening early morning "zero periods" in order to keep end times as early as possible. Keeping the end of day dismissal time close to pre-change times eliminates many of the concerns regarding reduced time for extracurriculars and loss of instructional time. Some school districts have exercised flexibility with PE requirements and reconceived how students satisfy those. Radnor High School hand-scheduled athletes to have physical education as the last period of the day, so that when they are dismissed early for athletic competitions they lose minimal instructional time on core academic subjects. Phoenixville Area High School has declared that "participation and completion of a PIAA sport or Marching Band season at the high school level (grades 9-12) will count as .25 physical education credit."[168]

Coordination and negotiation among coaches, partners in athletic leagues, and assigners may be necessary to address some issues. It is important to recognize that not all athletes in each district have an afterschool schedule that could be impacted by a change in school start times. For coaches who are also teachers within the district, consideration should be given during the scheduling process to ensure the least conflict for potential early dismissal where possible. Some of the issues, such as coaching availability, is a contract issue and can be addressed through contract renegotiations. Community groups who use district facilities can be consulted to ascertain if their activities might be impacted by later school start times.

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[166] *Supra* notes 71-73.

[167] Karl E. Minges and Nancy Redeker, "Delayed school start times and adolescent sleep: A systematic review of the experimental evidence." *Sleep Medicine Review,* 2016 Aug; 28:86-95. doi:10.1016/j.smrv.2015.06.002Minges KE1, Redeker NS2.

[168] Phoenixville Area High School Program of Studies 2019 – 2020, p. 7. http://pahs.pasd.com/userfiles/servers/server_435325/file/highschool/department/bhalla%20counseling/2019%20pos/updated%202019-2020%20final%20pos.pdf.

Impact on Elementary School Students and Families

Many of the concerns raised regarding later secondary school start times are based on an assumption that in order to move secondary start times, elementary times would need to be earlier, or "flip." Delaying secondary school start times does not necessarily require a change in elementary school start times and if it does, it does not necessarily need to result in drastic changes nor an exact swap of times with the secondary level.

Concerns

Some survey respondents expressed concern that delaying secondary school start times would require elementary students to start and end school earlier, with negative impacts on their safety and school performance. Any proposal that would involve elementary students arriving home before their older siblings is a particular concern, as is the possibility that earlier start times will require younger children to wait at bus stops in the dark. Needing to potentially adjust child care is seen as both a before- and afterschool challenge. If changes affect elementary students, parental work schedules may be disrupted as well.

Information

There is limited research on the effects of earlier school start times on elementary students, and that which exists is inconsistent. For the 1997-1998 academic year, the Minneapolis Public Schools middle and high schools moved to a later school start time, with elementary schools spread among 7:40 AM, 8:40 AM, and 9:40 AM start times. Researchers gathered data from a written teacher survey and on-site focus groups in the schools. The responses indicated that the 8:40 AM start time had the most positive benefits for elementary students. The response to the 9:40 AM start time was generally negative, as teaching and learning were considered to be significantly compromised by the shortened morning. Concerns were also raised about student fatigue and disengagement in the morning. The 7:40 AM start was found to be positive in the sense that students were alert and ready to work and had fewer transitions from home to school as they were able to come directly to school as opposed to going to a childcare facility first. The 7:40 AM start saw an increase in tardiness and absenteeism, however. Overall, the 8:40 AM start was felt to be a positive benefit in the morning and afternoon.[169]

A study of the effect of early school start times on school performance among elementary students suggests that early start times can be detrimental to school performance for elementary students as well as secondary students. The study found this to be a greater impact among schools serving middle and upper class students.[170] The lead

[169] Kyla Wahlstrom, PhD, "Elementary Feedback on Changed Start Times," Center for Applied Research and Educational Improvement, University of Minnesota, 1998. https://www.spps.org/cms/lib/MN01910242/Centricity/Domain/7352/elementary_feedback_on_changed_start_times.pdf.

[170] Peggy S. Keller, Olivia A. Smith, Lauren R. Gilbert, Shuang Hu, Eric A. Haak, and Joseph A. Buckhalt. "Earlier School Start Times as a Risk Factor for Poor School Performance: An Examination of Public

researcher and most of the team from the foregoing study conducted a study of the association between earlier school start times and behavior problems in elementary schools. Both studies looked at a public elementary schools in Kentucky. The second study found that a one hour earlier start time was associated with increased behavioral incidents and increased disciplinary actions in elementary school students. Like the first study, the authors noted a greater risk among higher income students, for whom changing school start times is the most significant challenge they have encountered in life. Conversely, students enduring poverty may not be significantly impacted by school start time change because it is but one of a number of challenges those children face.[171]

A study of elementary school students in grades 3-5 at a public northeastern elementary school was undertaken to determine if a move to earlier elementary school start times in order to accommodate a shift to later start times for secondary students had an impact on the sleep patterns of the elementary students. Pre- and post-change surveys were conducted. The third grade students experienced a change from 9:10 AM to 7:45 AM, while the fourth and fifth grade students moved from 8:20 AM to 7:45 AM. The study results indicated that the earlier start times did not decrease the total amount of sleep the students experienced. While the fourth and fifth graders reported minor decreases of 4 and 9 minutes respectively, the third graders reported an overall 24 minute increase in sleep time.[172]

In terms of the concern of having trouble completing homework, students and parents whose secondary school start times have shifted report that students are not finding completing homework to be an issue and in fact, sometimes students save some homework for the morning when they are better rested and more alert. In addition, any change in school start times, as part of a multi-pronged approach to better sleep outcomes for students, should be accompanied by a review of a district's approach to assigning homework through policy and implementation. Regarding the concern of missing family/meal times, students and parents whose secondary school start times have been delayed report that more students are taking the time to eat breakfast before school and have more time to interact with family in the morning.[173]

Elementary Schools in the Commonwealth of Kentucky." *Journal of Educational Psychology,* Vol. 107 No. 1, 236-245 (2015).

[171] Peggy S. Keller, PhD Lauren R. Gilbert, PhD, Erik A. Hassk, MS, Shuang Bi, MS, and Olivia A. Smith, BS, "Earlier schools start times are associated with higher rates of behavioral problems in elementary schools." *Sleep Health: Journal of the National Sleep Foundation,* Vol. 3, 113-118 (2017).

[172] Erica R. Appleman, MA, Karina Stavitsky Gilbert, PhD, and Rhoda Au, PhD, "School start time changes and sleep patterns in elementary school students." *Sleep Health: Journal of the National Sleep Foundation,* Vol. 1, 109-114 (2015).

[173] Lisa J Meltzer, Janise McNally, Kyla L Wahlstrom, and Amy E. Plog, "Impact of Changing Middle and High School Start Times on Sleep, Extracurricular Activities, Homework, and Academic Engagement," *Sleep*, Volume 42, Issue Supplement_1, April 2019, Pages A328–A329, https://doi.org/10.1093/sleep/zsz067.817

Strategies

Earlier elementary school start times are not a requirement for delayed secondary starts. To the extent they are necessary, workable solutions exist. Community organizations and school districts can work together to create before and after school programs. Districts can revisit current before and after-care arrangements to determine if accommodations can be made to address some of the concerns regarding childcare. Earlier elementary start times may save parents money on childcare, as they may be able to see their children off to school before they leave for work.

Efforts to shift secondary school start times must be sensitive to the learning needs of elementary school students as well, and simply "flipping" elementary school and secondary school start times, while seemingly a simple solution from a secondary school student perspective, needs to be nuanced to assure it does not significantly and negatively affect elementary school students.

Impact on Teachers and Staff

Secondary school start time changes not only impact the students and their families, but all district employees who provide educational and support services, from teachers and aides to food service personnel and maintenance staff.

Concerns

Teachers may be concerned about implications of later school start times on their own childcare needs, time needed for class preparation and professional development requirements. Other staff, including administrative staff, food service, and custodial service staff may have concerns about shifting schedules. Other concerns involve the impact of extending the school day on the availability of staff to monitor students at the end of the day and the ability of faculty who are also coaches or lead other afterschool activities to be available for practices and club meetings.

Information

Collective bargaining agreements (CBAs) vary from district to district. Some CBAs may specify school day start and end times for teachers and support staff. In these cases, renegotiation may be necessary. Additionally, later start times may impact the timing of school breakfast and lunch breaks, and may result in changes in the number of students receiving breakfast. Custodial and food service staff may encounter workdays that end later in the day, and may need to readjust personal schedules as well.

Strategies

In some areas, renegotiation of CBAs may be necessary. Some schools have addressed concerns about professional development time and class preparation time by staggering start times for employees, switching afternoon faculty meetings and training to mornings, or adding an earlier, teacher/staff only start time to allow for these activities. As noted before, planning of a secondary school start time delay that does not result in an end of the day extension can obviate many of these concerns. Involving key staff representatives to the start time discussion can add another source of creative ideas and more clearly identify challenges that district personnel perceive.

Other Perceived Challenges

A number of perceived potential consequences can flow from delaying secondary school start times, including adjustment to secondary students' and their families' personal lives.

Concerns

Later secondary school start times will result in later dismissal times, impacting the ability of secondary students to obtain afterschool employment, participate in other community activities such as Scouts, private arts and sports lessons, tutoring, and religious activities. Less time after school may also impair student's ability to complete homework assignments, share in family/meal time, and access community resources such as public libraries.

Information

Afterschool job opportunities exist and are filled based on student availability. A later dismissal time will simply result in a later work start time. Businesses, however, are not likely to expand their closing times in order to create more work hours for students. Additionally, for families that rely on income from all family members for essential needs, the loss of that potential five hours of income, even at minimum wage, can have a significant impact on the family's welfare. Pennsylvania has over 53,000 farms, and even Philadelphia County, the Commonwealth's most urban county, reported 43 small farms in 2017.[174] Agribusiness accounts for approximately 10 percent of Pennsylvania's employment and is one of the Commonwealth's four key industries.[175] Students in rural areas may have part-time jobs on farms and students living on family farms are often needed to assist in working the farm; the loss of daylight hours of labor can have a negative impact on farming families.

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[174] United States Department of Agriculture, National Agricultural Statistics Service, 2017. https://www.nass.usda.gov/Quick_Stats/CDQT/chapter/2/table/1/state/PA.

[175] Pennsylvania Department of Community and Economic Development, Agribusiness, https://dced.pa.gov/key-industries/agribusiness/. Accessed September 11, 2019.

Strategies

To help ensure that afterschool employment opportunities continue to exist, involving businesses that employ students in the discussions of the school start time changes may be useful. Other non-school-related afternoon and evening activities can be rescheduled to reflect the new student hours. Efforts to delay start times may also need to make sure that the end of the school day is not delayed significantly.

Community Support

Ultimately, one of the biggest challenge facing schools that intend to adjust their school start times to be consistent with the recommendation that secondary school students should not start school before 8:30 AM, in order to optimize the benefits of appropriate and adequate sleep, is resistance to change. Suggestions to change school start times are frequently met with concerns about negative or costly impacts on a variety of school-related and family issues. A commitment to proactive communication, transparency, and inclusion when having conversations about this initiative is very helpful towards effective consensus building. Several members of the Advisory Committee who have had the experience of adopting later school start times for secondary school students in their home districts have prepared a guidance document to assist individuals in initiating the process of change, which can be found in Appendix A.

A number of states have studied the possibility of establishing later secondary school start times. While there are several studies that have shown the positive benefits of later secondary school start times, there is a lack of longitudinal data on the persistence of the effects on sleep of later school start times. A few studies have examined the effects over time, with results varying among length of effect and sustained benefits.

Studies on the Impact of Delaying School Start Times

A study of school start time changes conducted in 2014 identified at least 70 school districts, representing approximately 1,000 schools that have successfully implemented a delay in high school start times in the United States. The study examined process challenges faced by schools implementing bell schedule changes, and identified school districts that had been successful in 20 states, including Arkansas, California, Colorado, Connecticut, Delaware, Florida, Idaho, Kentucky, Maine, Massachusetts, Minnesota, Mississippi, New York, North Carolina, Ohio, Oregon, Rhode Island, South Carolina, Virginia, and Wisconsin.[176] A few of the schools in these locales have participated in follow-up studies that evaluated the longevity of the benefits of delaying secondary school start times.

Minnesota Study (Minnesota, Colorado, and Wyoming)[177]

In a three-year study conducted at the University of Minnesota's College of Education and Human Development, researchers analyzed the impact of a later school start time on over 9,000 students across eight high schools and five school districts. The study population included both city and suburban communities with varying incomes, diverse races and ethnicities, and a range of graduation rates. These students attended schools in Minnesota, Colorado, and Wyoming.

The team created a three-part study. In Part One, researchers collected survey data in which students responded to questions about their daily activities, substance use, and sleep habits. The team also juxtaposed health factors before and after start time delay and compared this data with national average data. In Part Two of the study, researchers collected data on students' academic performance such as grades, attendance, tardiness, and performance on standardized tests. Furthermore, the team examined car crash data for the communities involved in this study. In Part Three of the study, the team analyzed the

[176] Judith Owens, Darrel Drobnich, Allison Baylor, et al., "School Start Time Change: An In-Depth Examination of School Districts in the United States," *Mind, Brain, and Education* 8, no.4 (November 2014): 182-213, https://doi.org/10.1111/mbe.12059.
[177] *Supra,* note 80.

processes in which local school districts switched to later start times by interviewing "key players" in each district.

With all data collected, the researchers reached several conclusions about later school start time for the report published in 2014. First, the team found that high schools which start at 8:30 AM or later allow for more than 60 percent of students to obtain at least eight hours of sleep per night. In light of this, the study also found that teens getting less than eight hours of sleep reported significantly higher depression symptoms, greater use of caffeine, and signs that they are at greater risk for making poor choices for substance use. On the academic plane, students with start times of 8:35 AM or later showed significantly positive improvement in performance on state and national achievement tests, attendance and tardiness, and grades in the core subject areas - math, English, science, and social studies. Finally, with respect to drivers aged 16 to 18 years old, the number of car crashes reduced by 70 percent when a school shifted start times from 7:35 AM to 8:55 AM.

In a follow-up study, the University of Minnesota's researchers found that attendance rates for students in grades 9, 10, and 11 improved significantly over the period 1995-2000, with the highest improvement for the 9th graders. Additionally, the students reported that they continue to get one hour's more sleep each school night compared to students whose school day starts an hour earlier.[178]

Seattle, Washington[179]

The Seattle School District delayed start times for secondary schools from 7:50 AM to 8:45 AM for the 2016-2017 academic year. A pre-/post-study was conducted in which students were studied before this change in the spring of 2016 and after this change in the spring of 2017.

The study populations include sophomores of two public high schools in Seattle - Franklin High School and Roosevelt High School. Students were monitored with Philips wristwatches which tracked, among other things, their sleep-wake cycles. Additionally, students were asked to keep a sleep journal, complete a one-time survey, and fill out a demographics survey at the start of the study. In each year at the same time of the year, experimenters studied an independent sample of students taking the same biology class. The study was implemented as a science laboratory practice in which the students could test predictions about their own sleep patterns. At the end of the study, the data were returned to the students for an in-class learning exercise on research methods, data interpretation, and the relationship between sleep and their lifestyles.

Once the data was collected, the researchers found that the change from 7:50 AM to 8:45 AM resulted in significant lengthening of daily sleep of more than 30 minutes, increased punctuality, and better alignment of sleep timing with circadian system with sub-benefits of reduced social jet lag, reduced sleepiness, and an increase in academic performance of 4.5 percent higher grades.

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[178] *Supra,* note 80.
[179] *Supra,* note 89.

New York

A study of a high school in Glen Falls, New York found that after one year, total sleep time returned to baseline (i.e., the students were not sleeping any longer) after an initial increase of 20 minutes, but that the timing of sleep was significantly and persistently delayed. The study authors found that the delay in the sleep period resulted in a lasting reduction in tardiness and disciplinary incidents.[180]

Colorado

A study released in the spring of 2019 examined the effect of changing school start times in the Cherry Creek School District in Greenwood Village, Colorado. In the fall of 2017, middle school start times were delayed from 8:00 AM to 8:50 AM while high school start times were delayed from 7:10 AM to 8:20 AM. Students in grades 6-11 were surveyed pre-change in spring of 2017 and post-change in the spring of 2018 regarding changes to student sleep, extracurricular activities, homework, and academic engagement. The students reported increased sleep duration, less sleepiness while doing homework, minimal changes to extracurricular participation, and improved academic engagement.[181] Another abstract from this study indicated that teachers and staff reported increased sleep duration and improvements in daytime functioning.[182]

Legislative Proposals, Studies, and Recent Enactments

A number of states have recently considered legislating later secondary school start times.

California

In August 2018, the California Legislature passed a bill requiring middle and high schools to begin no earlier than 8:30 AM. However, outgoing Governor Jerry Brown vetoed the legislation. On February 14, 2019, Senator Anthony Portantino reintroduced the proposal as Senate Bill 328, which was signed by Governor Gavin Newsom on October 13, 2019. Thus, California became the first state to mandate later secondary start times statewide. Under the new law, middle school students will start school at 8:00 AM or later, while high school students will start no earlier than 8:30 AM, including middle and high school students at charter schools. The law does not apply to optional earlier classes

[180] Pamela V. Thacher, PhD and Serge V. Onyper, PhD, "Longitudinal Outcomes of Start Time Delay on Sleep, Behavior, and Achievement in High School," *Sleep*, Vol. 39, No.2, 271-281 (2016). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4712391/

[181] Lisa J Meltzer, Janise McNally, Kyla L Wahlstrom, and Amy E. Plog, "Impact of Changing Middle and High School Start Times on Sleep, Extracurricular Activities, Homework, and Academic Engagement," *Sleep*, Volume 42, Issue Supplement_1, April 2019, Pages A328–A329, https://doi.org/10.1093/sleep/zsz067.817

[182] Amy E Plog, Janise McNally, Kyla L Wahlstrom, and Lisa J Meltzer, "Impact of Changing School Start Times on Teachers/Staff," *Sleep*, Volume 42, Issue Supplement 1, April 2019, Pages A85–A86, https://doi.org/10.1093/sleep/zsz067.206

(referred to as zero periods) nor rural school districts. The change must be implemented by January 1, 2022, or when the collective bargaining agreement that is operative on January 1, 2020 expires, whichever is later.[183] In an op-ed in support of the introduction of his proposed legislation, Senator Anthony Portantino stated

> Establishing a time before which schools should not begin mandated instruction is as fundamental as requiring schools to turn on the heat when the temperature falls below a certain level. Local districts would still set their own hours; they need only meet the minimum "no earlier than" start time that's proven to be essential to students' well-being.
>
> It's time for an evidence-based, sound policy discussion that prioritizes student health and achievement. Teaching adolescents at a time they cannot effectively learn is an ineffective use of public funds and undermines our children's health and their chances for success today and in the future.[184]

Connecticut

In Connecticut, four House bills addressing a later school start were introduced in January of 2019 and referred to the Joint Committee on Education: HB6626 proposes an amendment to prohibit any public high school instructional classes to begin before 8:30 AM to increase educational outcomes of high school students; HB6206 supports later school starts for middle and high school students "to establish safe, healthy and developmentally appropriate school hours"; HB5976 establishes a task force to conduct a study concerning school start times; and HB6222 permits school districts to establish later middle and high school start times which are appropriate to the needs of the school district and its students. The Connecticut General Assembly adjourned on June 5, 2019 with no further action on these bills.

Hawaii

Hawaii House Bill 318 was introduced in January 2019 and required the Department of Education to convene a Staggered School Start Times Task Force to study and evaluate the issues and implications, including effects on school bus schedules, of later school start times. The bill passed the House on March 1, 2019, and the Senate, with amendments, on April 9, 2019. The bill was sent to conference committee, but was not moved further before the Hawaii State Legislature adjourned *sine die* on May 2, 2019.

[183] California Education Code, §46148 (2019).
[184] Op-ed, "Time for healthier start times for our schools: Anthony Portantino," *The San Gabriel Valley Tribune (California,)* published: March 10, 2017, updated: August 30, 2017. https://www.sgvtribune.com/2017/03/10/time-for-healthier-start-times-for-our-schools-anthony-portantino/.

Maine

In April 2019, Maine passed a LD770 to require all secondary schools to start no earlier than 8:30 AM; the Senate, however, denied the bill.

Maryland

In 2014, the Maryland Task Force to Study Safe and Healthy School Hours for Maryland Public Schools, recommended that the Maryland Department of Health and Mental Hygiene advise local school systems of the benefits of later school start time policies and encourage them to conduct feasibility studies regarding implementation of school start times of 8:00 AM or later.[185] In 2016, Maryland established its Orange Ribbon for Health School Hours program that recognizes school district that implement no earlier than 8:00 AM start times for elementary school students and no earlier than 8:30 AM start times for middle and high school students. Additionally, students may not board the school bus any earlier than one hour prior to the start of school.[186]

New Jersey

On August 8, 2019, the New Jersey Governor Phil Murphy signed bill S3160/A4865 (2019) establishing a pilot program involving five high schools (grades 9-12) for a four year period to study, educate, and inform the public about the benefits of moving school start times to 8:30 AM or later.[187] While the law is unclear when the pilot programs will begin, schools are instructed to voluntarily apply to the New Jersey Department of Education. In addition to requiring at least one urban, suburban, and rural high school to be selected, the legislation mandates the schools be selected from different regions. Moreover, the Department of Education has been instructed to collaborate with the pilot programs to study both the positive and negative consequences of the change, including the impact on transportation, extracurricular activities, and family life. Specifically, the Department of Education is requested to collect the following data and present an official report at the end of the pilot period: number of students participating in the pilot program; before and after start times; impact the program had on reducing tardiness and absenteeism; an assessment of the health, academic, and safety benefits associated with establishing later start times; an evaluation of any potential negative impacts on school districts and families that may be associated with the change; and lastly a recommendation by the Department of Education.

Previously, in 2017, the New Jersey Department of Education surveyed its school districts with a 93 percent response rate by 428 targeted school district and charter school administrators; approximately 14 percent had middle schools or high schools with start

[185] State of Maryland, Department of Health and Mental Hygiene. Study of Safe and Healthy School Hours for Maryland Public Schools (December 22, 2014)
https://www.startschoollater.net/uploads/9/7/9/6/9796500/maryland_dhmh_school_start_time_report_123114.pdf
[186] Maryland Education Code, §7-122.
[187] https://www.njleg.state.nj.us/bills/BillView.asp

times of 8:30 AM or later. Of the remaining districts with earlier start times, 91 percent reported not considering a change; six percent had previously considered a change but decided against a change; and nine schools starting before 8:30 AM were considering a change. The reasons preventing a delayed start included: transportation coordination/cost; athletic event conflicts; and child care issues and other parental concerns. For schools that recently changed start times, principals reported the most positive result included increased teacher satisfaction followed by improved student engagement and attentiveness.

The New Jersey Study made three recommendations: 1) supporting local school board authority, the study did not mandate either the New Jersey Legislature or the New Jersey Department of Education to direct school start times. Acknowledging "one size" does not fit all, the study recommended school districts to individually review and consider the delayed school start issue. 2) determining that a sufficient number of New Jersey schools have implemented later school start times, the study discouraged conducting a formal pilot study and encouraged the New Jersey Department of Education to collect and share information about existing implementations. and 3) the New Jersey Department of Education should not only publicize the study and supporting research on its website to benefit the public but also directly share this vital information with all school districts.

South Carolina

In January 2019, South Carolina introduced a bill (H3394) to create a Public School Start Time Study committee "to determine the benefits of requiring public schools to extend current daily start times by one hour, and to make recommendations to the General Assembly regarding proposed changes to state laws necessary to implement such later start times for public schools." The bill remained in the Committee on Education and Public Works until the South Carolina General Assembly adjourned on May 21, 2019.

Texas

In February 2019, Texas introduced HB1602, which seeks to prohibit school districts from beginning academic instruction before 8:00 AM. In addition, the bill appropriates the amount of over $755 million from the general revenue fund to the Texas Education Agency to distribute to school districts to offset any additional transportation costs. The bill was left pending in the House Public Education Committee when the Texas Legislature adjourned on May 27, 2019.

United States Congress

Nationally, in March 2019, United States Representative Zoe Lofgren reintroduced a version of the "ZZZ's to A's Act" (A version of which was first proposed in 1998.) directing the U.S. Secretary of Education to conduct a study to determine the relationship between school start times and adolescent health, well-being, and performance. HR 1861 currently sits in the House Committee on Education and Labor.

APPENDIX A

Guidance for Pennsylvania School Districts
Wishing to Explore School Start Time Changes

The movement for school districts to address the medically identified urgent public health issue of chronic adolescent sleep deprivation and its relationship to US secondary school start times can come from a variety of sources in any given community – students, parents, health professionals, educators, legislators - and often some combination among them.

Exploring any organizational change, particularly one that has been a matter of policy and practice for a long time, can take time. Investigating in a specific district the advisability of changing school hours to comply with the national medical community's calls to do so can meet meaningful resistance because of the many structural changes involved. School districts that have considered start time changes report some apprehension about the pre-conceived impact of changing school schedules on families, schools, staff, transportation, sports, extracurriculars and economics.

A meaningful community-engaged process is necessary. Many school districts across the US have successfully altered their school start times, but not all who have considered moving later have made the change. Often what makes the difference is process that revolves around some common themes - coordination, collaboration, comprehensiveness and communication - just to name a few. Here are some suggestions from districts who have successfully made the change:

Make a coordinated and public decision as school leadership to spearhead this investigation.

School boards often work with their superintendents to set annual goals. Setting the exploration of student sleep needs and its connection to existing school start times as a district goal at a public meeting of your school board will help facilitate the community's awareness of the district's intentions and the necessary deployment of the personnel and time resources to conduct this comprehensive study.

Set a defined timeline with milestones to evaluate this opportunity that includes benchmarks such as annual operational, budgeting and scheduling cycles of the district.

The phases of this study – from the initial district goal setting to the final school board vote - can typically be completed within 18-24 months. Time for multiple individual stakeholder and task force meetings support an iterative and consensus-driven process, whereby initial recommendations can be reviewed and redesigned based on feedback. If a

school board does ultimately vote to approve a change in school start times, the implementation of that change is typically an extension of some sort to this timeline extending the time to the next milestone and given annual cyclical demands on the district's resources and capacity for this investigation.

Assign a project leader or leaders from the administrative team to lead the study effort.

The person who is the designated leader of the study effort needs to have excellent facilitation skills to promote consensus and be viewed as neutral about the outcome of the group's recommendation. The leader of the group must be skilled at building consensus among a diverse committee of stakeholders. The leader must also be skilled at leading the group through a problem-solving activity. Figuring out how to move a school start time is a large puzzle. The committee or community advisory group needs a leader that encourages constructive brainstorming debate and problem solving. These structured activities will lead to new solutions or ideas. In short, a true consensus process will lead to a solution that everyone can live with and is best for the students.

Create a community advisory group and establish the level of authority, tasks, meeting schedule and work timeline for the advisory group.

Any potential change in school hours can impact a wide variety of stakeholders, not just at the secondary school level, nor strictly internally. It is therefore critical to invite and recruit members of various groups so that they are a part of the conversation from the beginning. Those stakeholders can include: students, teachers, support staff, parents, union leadership, athletics and extracurricular booster club leaders, parent organizations, local employers, district and community health personnel, central office and school building administrators, school board members, special education and other subgroup representatives, intermediate unit and career and technical education representatives and more. This community advisory group should be limited to a size that is manageable for meetings. This group can work in subcommittees or short-term working groups to help problem solve logistical challenges, provide feedback as recommendations evolve, and also serve as ambassadors/liaisons to their respective constituencies.

Continually educate the entire community on the WHY - science of sleep.

Whether or not a community agrees on changing school start times, understanding why the school district is undertaking this study is critical. Providing ongoing education to the community on the science of sleep and the consequences of chronic adolescent sleep deprivation can increase the likelihood that any feedback solicited from the community on changing school hours is grounded in and informed by a common understanding of the research and district goals. While there are nationally recognized sleep experts available to speak who have made presentations at various school districts across Pennsylvania, there are often local sleep experts in each community who can provide this education, sometimes at a lower or no cost option.

Consider baseline metrics that can be used to illustrate the current state of wellness among students and measure the impact of any potential changes that are made.

A primary baseline metric to establish is the current state of sleep among secondary students in the school district. There are several validated student sleep survey instruments available that administrators can administer to secondary students prior to a change in school start times and then again afterwards. Other baseline metrics to establish can include, attendance, tardiness, athletic injuries and concussions, nurse visits, mental health referrals, and discipline referrals. The Pennsylvania Youth Survey (PAYS) includes good metrics to consider. Assure your community that you will track the impact of any changes made, including gathering feedback from teachers, parents and students.

Communication is critical.

From the time school leadership sets this prospective study as a district goal to the time that there is potentially an implementation, proactive communication with the entire community is critical. Someone on the district team should be responsible for overseeing this very important aspect of the study. Effective means of communication include establishing a prominent place on a school district website to house all related study information, regular updates by email to all stakeholders, regular study status reports during board business and/or committee meetings, strategic appearances by the project leader and/or designated members of the advisory team at various gatherings of stakeholders including faculty, parents, students and others. Rapid responses to misinformation and disinformation, and addressing social media communications may also be useful.

Project leaders should ideally know their community and remain as objective as possible throughout the process.

Understand from the beginning that no endeavor of any kind always garners 100 percent support. Divergent opinions are inevitable and need to be heard. In fact, school districts who have successfully changed their times attest that it is often the concerns raised that can produce some of the most innovative and helpful solutions to the challenges. Problem solve with the community collaboratively and thoughtfully.

Work with other districts who might make or have made changes to leverage previous experience and opportunities to collectively problem solve.

Many school districts throughout Pennsylvania have successfully changed their school hours and many more are currently considering doing so. Those school districts may be willing to lend guidance sand 'lessons learned' and support other districts at any stage of this process. Since there are a variety of potential challenges to work through that involve other districts and partnering institutions, seek other districts as partners for joint problem solving.

Don't let the perfect be the enemy of the good.

There will never be universal agreement on what works best for each community. Trying to find an optimal outcome can be elusive and stymy progress. School leaders and members of the advisory committee need to be patient throughout the process. Focus on the established health and wellbeing benefits of sleep, which may generate responses that could include a later school start time, and not allow the process to get derailed by a vocal minority. Schools need to make decisions around what is in the best interest of their students, even if that is in direct conflict with existing schedules that have been built around the convenience of adults.

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THE GENERAL ASSEMBLY OF PENNSYLVANIA

SENATE RESOLUTION

No. 417 Session of 2018

INTRODUCED BY DINNIMAN, EICHELBERGER, FOLMER, TARTAGLIONE, SCHWANK, LEACH, BREWSTER AND RAFFERTY, SEPTEMBER 10, 2018

SENATOR EICHELBERGER, EDUCATION, AS AMENDED, SEPTEMBER 25, 2018

A RESOLUTION

Directing the Joint State Government Commission to establish an advisory committee to conduct a study on secondary school start time in this Commonwealth.

WHEREAS, The American Academy of Pediatrics recognizes insufficient sleep in adolescents as an important public health issue that significantly affects the health and safety, as well as the academic success, of our nation's middle school and high school students; and

WHEREAS, A recent poll conducted by the National Sleep Foundation found that 60% of children under 18 years of age are tired during the day and 15% said they fell asleep at school during the year; and

WHEREAS, A February 2014 study by the Center for Applied Research and Educational Improvement found academic performance outcomes, including grades earned in core subject areas of math, English, science and social studies, in addition to performance on national and State achievement tests, attendance rates and reduced tardiness, show significantly positive improvement with

school start times of 8:35 a.m. or later; therefore be it

RESOLVED, That the Senate direct the Joint State Government Commission to establish an advisory committee to conduct a comprehensive study of issues, benefits and options related to instituting a later start time to the school day at secondary schools in this Commonwealth. The advisory committee shall be comprised of the following:

(1) the Secretary of Education or a designee;

(2) a representative of the Pennsylvania Association of School Nurses and Practitioners;

(3) a representative of the Pennsylvania Chapter of the American Academy of Pediatrics;

(4) A REPRESENTATIVE OF THE PENNSYLVANIA PSYCHOLOGICAL ASSOCIATION; <--

~~(4)~~ (5) a representative of the Association of School Psychologists of Pennsylvania; <--

~~(5)~~ (6) a representative of the Pennsylvania School Boards Association; <--

~~(6)~~ (7) a representative of the Pennsylvania Association of School Administrators; <--

~~(7)~~ (8) a representative of the Pennsylvania Principals Association; <--

~~(8)~~ (9) a Pennsylvania certified teacher; <--

~~(9)~~ (10) a representative of a school bus transportation organization; <--

~~(10)~~ (11) an individual representing the interests of students of disabilities; <--

~~(11)~~ (12) a parent of a child attending a public school in this Commonwealth; and <--

~~(12)~~ (13) other individuals and organizations selected <--

by the Joint State Government Commission;

and be it further

RESOLVED, That the Joint State Government Commission, in conducting the study, do all of the following:

(1) Conduct a thorough and comprehensive study of secondary school start times in this Commonwealth.

(2) Evaluate studies or initiatives promoted by national education advocacy organizations relating to secondary school start times.

(3) Prepare an assessment on the effect of establishing a later school start time on the health, safety and academics of students.

(4) Evaluate any potential negative impacts on both public and private school entities and families that may be associated with an altered school start time and consider strategies for addressing potential problems.

(5) Review all available literature on the experiences of public and private school entities in other states that have instituted later school start times.

(6) Include any recommendations relating to the advisability of establishing a pilot program to test later school start times at select secondary schools in this Commonwealth that are interested in participating in the program;

and be it further

RESOLVED, That the Joint State Government Commission issue a report of its findings and recommendations to the Senate no later than ~~18~~ 12 months from the adoption of this resolution. <--

APPENDIX C

Organizations Endorsing Delayed Secondary School Start Times and Providing Research

American Academy of Pediatrics www.aap.org
School Start Times for Adolescents
https://pediatrics.aappublications.org/content/134/3/642

American Academy of Sleep Medicine www.aasm.org
Delaying Middle School and High School Start Times Promotes Student Health and Performance: An American Academy of Sleep Medicine Position Statement
https://aasm.org/aasm-position-delaying-middle-school-high-school-start-times-is-beneficial-to-students/

American Medical Association www.ama-assn.org
AMA Supports Delayed School Start Times to Improve Adolescent Wellness
https://www.ama-assn.org/press-center/press-releases/ama-supports-delayed-school-start-times-improve-adolescent-wellness

American Psychological Association www.apa.org
Later School Start Times Promote Adolescent Well-Being
https://www.apa.org/pi/families/resources/school-start-times.pdf

Society of Behavioral Medicine www.sbm.org
Start Middle and High Schools at 8:30 a.m. or Later to Promote Student Health and Learning
https://www.sbm.org/UserFiles/file/late-school-start-statement-FINAL.pdf

National Center on Sleep Disorders Research: (National Heart, Lung, and Blood Institute, National Institutes of Health):
https://www.nhlbi.nih.gov/about/org/ncsdr/External

U.S. Centers for Disease Control and Prevention
https://www.cdc.gov/features/school-start-times/index.html;
https://www.cdc.gov/healthyschools/sleep.html;
https://www.cdc.gov/features/students-sleep/index.html

Sleep Organizations

American Sleep Association: www.sleepassociation.org

Minnesota Sleep Society https://www.mnsleep.net/

National Sleep Foundation www.sleepfoundation.org

Pennsylvania Start School Later www.startschoollater.net/pa---statewide.html
* In addition to a statewide chapter, there are nine local Start School Later chapters throughout Pennsylvania. Links to each chapter can be found within the statewide website:

- Berks County
- Bucks County
- Chester County and Unionville District Student Chapter
- Delaware County
- Lower Merion
- Montgomery County
- Southeastern
- Phoenixville
- Western Region

Sleep Research Society: www.sleepresearchsociety.org

Sleep For Success Westport: https://sleepforsuccesswestport.org

Start School Later (national organization) www.startschoollater.net