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Later School Start Times for Adolescents in Baltimore City Public Schools:

Opportunities and Recommendations

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Executive Summary

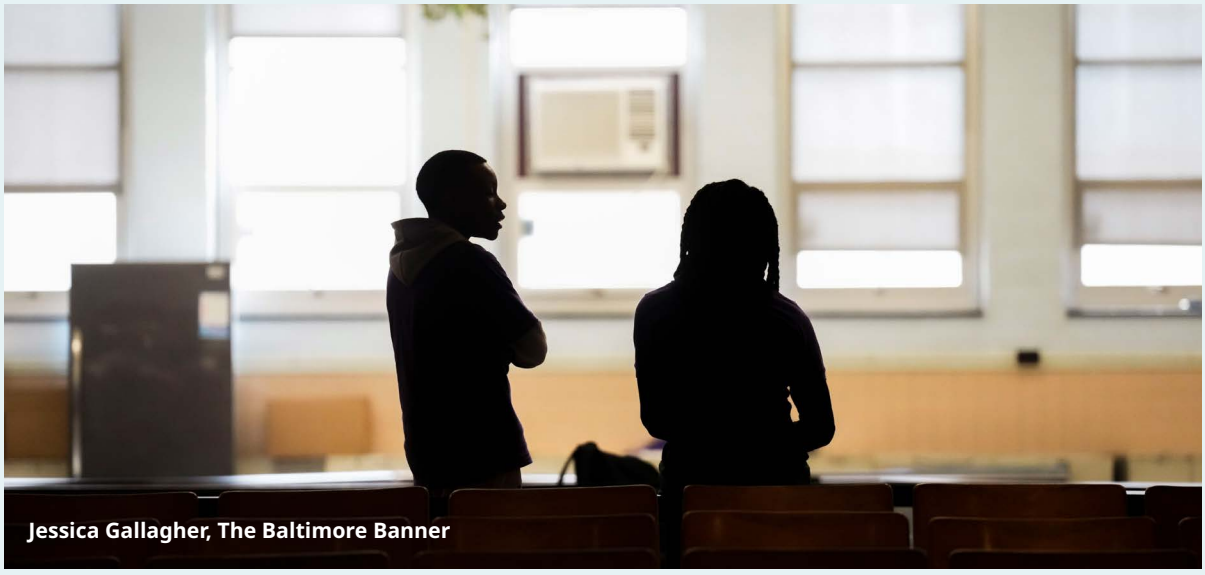
Primarily in response to the national school bus driver shortage and other student transportation challenges, Baltimore City Public School System (City Schools) pushed start times for many schools earlier for the 2022-2023 school year, affecting most adolescents in the district. As a result, in the 2023-24 school year, 81% of high schools started before 8:30 a.m., with many starting as early as 7:30 a.m. While this decision was made after discussions with stakeholders on the benefits and challenges of both earlier and later school start times, it is counter to policy statements from major health, medical, and education organizations recommending that secondary schools start classes no earlier than 8:30 a.m.

These recommendations are based on nearly three decades of research on adolescent sleep, circadian rhythms, and health. Well established research shows that because of changes to sleep regulatory systems during adolescence, secondary students with later school start times not only get better sleep but also have improved school performance and fewer absences, tardies, discipline challenges, symptoms of depression and anxiety, substance misuse, and even automobile crashes. Importantly, too, students living in urban communities like Baltimore, who disproportionately experience poverty, housing instability, and other challenging life circumstances, show greater improvements from later school start times than their peers.

The strong evidence base supporting later start times suggests that delaying, instead of advancing, City Schools' school start times will significantly help improve the school performance, safety, and lives of Baltimore's youth. Prior to this shift to earlier start times, there were already many adolescent-serving schools that started before 8:30 a.m., with the most recent available data on Baltimore City showing that 62% of middle school students (2021-22) and 81% of high school students (2018-19) were obtaining fewer than 8 hours of sleep on average on school nights. Due to biological changes to sleep and circadian rhythms that occur in adolescence, this shift to even earlier start times compounds these high rates of

insufficient sleep and means that thousands of City Schools teenagers cannot arrive at school on time ready to learn and are at increased risk for anxiety, depression, problematic substance use, conduct problems, and other poor health, safety, and behavioral consequences.

In this report, we discuss the significance of later school start times for the health and safety of youth in middle and high school in Baltimore City Schools. We review the science on adolescent sleep and circadian rhythms, the consequences of insufficient, ill-timed, and poor-quality sleep, sleep health disparities, and research on outcomes associated with later school start times. We then provide an overview of the City Schools context and recommendations for prioritizing healthy school start times for adolescent students.



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Adolescent Sleep Needs and Circadian Timing

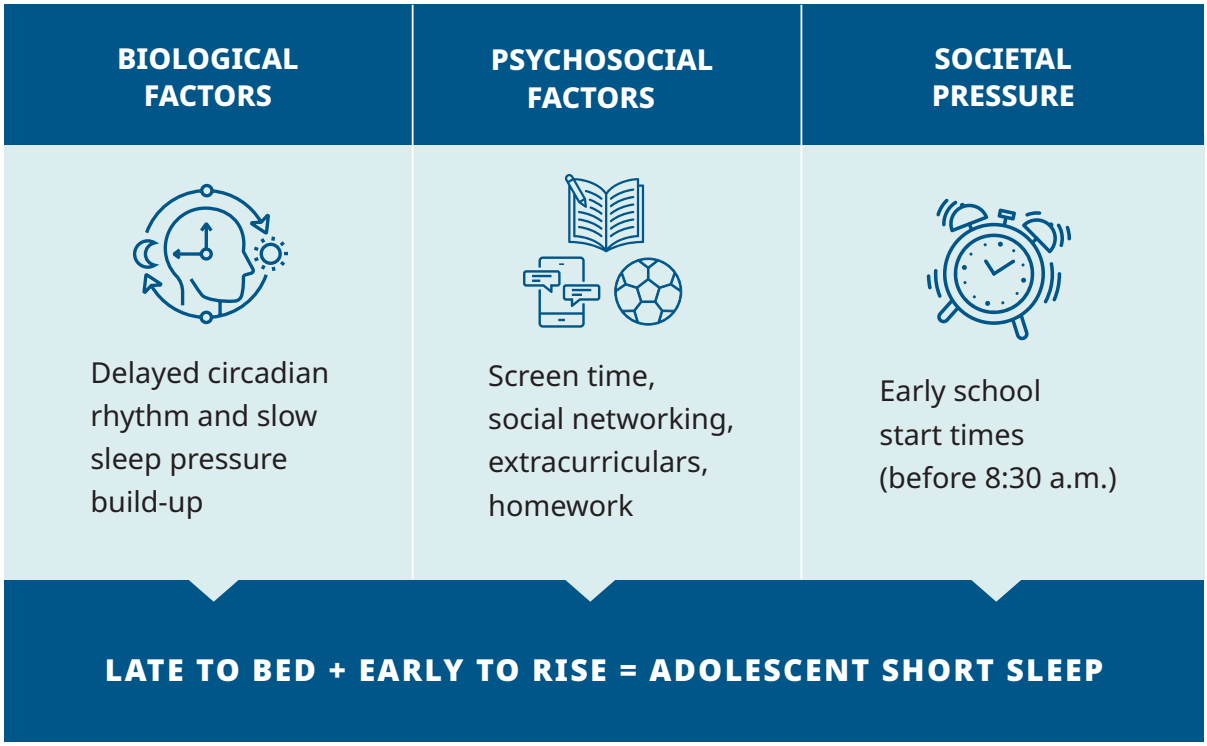
The American Academy of Pediatrics (AAP),[1] the National Sleep Foundation,[2] the American Academy of Sleep Medicine,[3] and other health organizations recommend that most adolescents need somewhere in the range of 8-10 hours of sleep per night, with several studies documenting that adolescents need an average of at least 9 hours for optimal mood and cognitive functioning.[4,5] Strikingly, the 2024 National Sleep Foundation's Sleep in America Poll found that 80% of teenagers ages 13-17 reported obtaining fewer than 8 hours of sleep on both school nights and weekends,[6,7] an alarming increase from the 45% reported in the 2006 poll.[6] The most recent available data on Baltimore specifically, from the Centers for Disease Control's (CDCs) Youth Risk Behavior Surveillance System, shows that 81% of high school students (2018-2019) and 62% of middle school students (2021-2022) report getting insufficient sleep.[8] To understand why early school start times are a uniquely important contributor to these concerning statistics, we must first understand the biological and psychosocial factors at play during adolescence.

Several developmental changes in sleep and the circadian timing system take place during the transition to adolescence. The circadian timing system refers to our internal "clocks" or timekeepers (aka circadian rhythms) responsible for regulating physiological processes that cycle approximately every 24 hours with the light/dark cycle. While there are clocks in every cell and tissue in the body, the "master" clock that synchronizes and regulates them all is in the hypothalamus in the brain. One of the physiological processes regulated by the circadian timing system is sleep, with alternating levels of alertness and sleepiness across the day.[9,10] In early adolescence, circadian rhythms, and thus sleepiness, begin to shift to a later clock time—that is, the times the adolescent naturally feels ready to sleep or to wake up are delayed by 2-3 hours compared to younger children or older adults.[11] The other process besides the circadian timing system that regulates sleep and wake is the homeostatic sleep system, which tracks sleep pressure depending on previous sleep and wake history. Starting at waketime, sleep pressure builds across the day and then begins to dissipate at sleep onset, decreasing across the night during sleep.[9,10] In adolescents, this sleep pressure builds more slowly across the day[12] but does not dissipate more quickly during sleep.[13,14] These changes in both the circadian timing and homeostatic systems mean that adolescents have a biological need to go to bed later so that their sleep-wake schedules are consistent with their biological clocks. These delays are seen in other mammals, including some primates and rodents, at puberty, and so appear to be largely biological rather than the result

of rebelliousness, bad parenting, or electronic distractions.[15–17]

Paired with this biological delay in sleep timing, several psychosocial factors contribute to shortened and misaligned sleep in adolescents. Screen time, specifically in the hour before bedtime and during the night, has been linked to *more* delayed bedtimes or sleep onset among adolescents, particularly time spent on social media, although causal relationships and mechanism involved remain to be established.[18,19] Adolescents also identify homework and extracurricular demands and late-night and early-morning athletic and other school activities as major barriers to getting sufficient sleep.[20] Early school start times, which in turn require early wake times, are in direct conflict with their naturally occurring later bedtimes and lifestyle factors (e.g., screen time) and contribute to a "perfect storm" of increased risk for chronic insufficient sleep among adolescents (**Figure 1**).[21,22] As a result, suffering from chronic sleep insufficiency is unfortunately the norm for adolescents today.[23] In the next section, we review the staggering public health implications of early school start times and sleep insufficiency among adolescents.

Figure 1. Factors Associated with Insufficient Sleep in Adolescents. Adapted from Carskadon, 2011 & Crowley et al., 2018.



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School Start Times and Adolescent Sleep, School Engagement, Health, Risky Behavior, and Safety

The evidence is abundantly clear: healthy sleep is essential for adolescent brain functioning and behavior across several areas, including emotion regulation, learning and memory, intellectual abilities, reward and motivation, and impulse control.[24] When these areas are impaired, adolescent health, safety, and performance, both in and out of school, suffer. When classes begin too early in the morning—which for most adolescents is before about 8:30 a.m.—many adolescents do not obtain healthy sleep regardless of their bedtimes, given the delay in their biological sleep and wake rhythm. This has serious consequences for their physical and mental health, safety, and school performance. Here we highlight relevant research on the connections between sleep and a variety of related outcomes, including mental and physical health, substance use, injury, and school engagement and success. Lastly, we summarize research findings on how some of these outcomes have changed over time for students whose schools shifted to later start times.

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School Engagement and Performance

The duration and timing of sleep are linked to a variety of outcomes relevant to school engagement and behavior, including learning, memory, cognition, daytime sleepiness, irritability, impulsivity, attention, psychomotor response, and motivation.[24–28] Sufficient, regular sleep is required for optimal school performance and engaging with the learning process. Likewise, healthy sleep is necessary for paying attention and acquiring new information and concepts, consolidating and strengthening, filtering out what is important to retain, and ultimately retrieving acquired information, etc.[24,29,30] Healthy sleep also helps teens grapple with complex problems or work on creative projects. For example, during a middle or high school day, students who are sleep-deprived will struggle to concentrate, have difficulty participating in class, find it challenging to absorb or analyze new information, and struggle to get along with peers when working in groups. Likewise, students might not be able to stay alert or even awake during class, leading to missed information, incomplete notes, and disengagement with the subject. Furthermore, students who consistently get enough and consistent sleep tend to have higher grades, less absenteeism, and decreased tardiness compared to their sleep-deprived peers.[31–35] Finally, extended sleep in adolescents is particularly beneficial for those who may already face challenges with school engagement, behavior, and learning. In a study of adolescents with ADHD, extended sleep was associated with less daytime sleepiness and fewer attention problems and oppositional behaviors.[36] These findings suggest that ensuring sleep health may also promote cognitive performance and functioning for students with existing struggles with executive dysfunction and learning.

Mental Health

Insufficient sleep during adolescence contributes to or exacerbates many of the mental health challenges that commonly emerge in adolescence.[37] Disruptions in emotion regulation associated with insufficient sleep,[24] for example, mean that adolescents may have a hard time coping with numerous stressors, from academic pressures to social challenges. In particular, insufficient and irregular sleep is associated with increased risk for depression, self-harm, suicidal ideation, suicide attempts, and suicide completion in teens.[38–43] This is exceedingly important for Baltimore teens, as they exhibit high rates of clinically significant depressive symptoms, suicidal ideation, and suicide attempts, with an astounding 17% of Baltimore City middle school students reporting that they had ever attempted suicide in the 2021-22 school year,[8] which is almost twice as high as the national average.[44] Using the CDC's Youth Risk Behavior Survey Analysis Tool available on their website and the most recent available data on sleep, we found that the rates of insufficient sleep (<8 hours on

average school nights) were substantially higher among middle (2021-22) and high school (2018-19) students in Maryland who endorsed these mental health issues compared to those who did not.[44] For example, the prevalence of insufficient sleep among Maryland middle school students was 74.3% among those who reported ever having attempted suicide and 51.1% among those who did not.

Physical Health

Sleep is interconnected with the immune system, and healthy sleep reduces risk for illness, supports recovery, and even boosts vaccine effectiveness.[45] Relatedly, adolescents who experience a sleep debt, where they don't get enough sleep during the school week, are more likely to have elevated inflammation in the body,[46] and those who sleep longer have been shown to report fewer bouts of illness.[47] Insufficient and poorly timed sleep can also affect an adolescent's growth, weight regulation/obesity risk, and heart health (e.g., high blood pressure); the latter connection recently prompting the American Heart Association to add sleep as a key health behavior in its "Life's Essential 8" framework for cardiovascular health.[48] Sleep deprivation in adolescents is associated with eating more unhealthy types of foods and larger amounts of them, which can then alter the regulation of hormones related to growth and appetite, and increase the risk for weight gain, overweight, and obesity.[49] Greater social jet lag (i.e., the discrepancy between the biological timing of sleep/wake and the actual timing of sleep/wake enforced by social demands, such as school start times) is also associated with increased obesity risk, especially in those who already have a high BMI (body mass index).[50] Even students who get enough sleep have been shown to overeat if the *timing* of their sleep is mismatched to their circadian clock (e.g., waking up too early).[51]

Risky Behavior and Public Safety

Conduct Problems

Delaying school start times may also offer a relatively simple strategy to prevent conduct problems and enhance public safety. This is because the sleep and health benefits of later school start times can enhance adolescents' ability to control their impulses and avoid engagement in conduct problems (e.g., theft, assault, disorderly conduct, problematic substance use). After years of research, we now know that adolescents with healthier sleep patterns are less likely to engage in acts of misconduct, which holds true across race and ethnicity, and socioeconomic status.[52–56] The lower levels of misconduct among adolescents with healthier sleep patterns are mostly due to the emotional, mental, and cognitive benefits afforded by consistent healthy sleep patterns.[57–59] These benefits help enhance

adolescents' ability to regulate their behavior and avoid engaging in misconduct.[60,61] Because of the known improvements in behavior that can result from enhanced sleep quantity and quality,[62,63] it seems prudent to implement policies that safeguard youths' sleep to minimize challenges with adolescent misconduct that schools and communities may face. In this way, policies that promote youth sleep health have excellent potential to yield more diffuse benefits for public safety and even minimize burdens on the legal system in maintaining public safety.

As outlined so far, delaying school start times is a universal approach. This means it is an approach applied to all (not just some) adolescents in the school environment. In this case, the aim of achieving healthier adolescent sleep profiles can support healthier behavioral profiles. This approach to promoting adolescent sleep health aligns with the AAP recommendation (noted earlier) to begin middle and high schools no earlier than 8:30 a.m. This policy is particularly well suited as an adolescent misconduct prevention strategy, as it targets many of the factors known to increase youths' risk of conduct problems.[64] Decades of evidence reveal that policies and programs that promote early self-control (such as executive functioning, self-regulation, and attention) in youth are some of the best "bang-for-your-buck," evidence-based strategies to prevent conduct problems from the earliest stages of life.[65,66] Because delayed school start times have been shown to improve youths' sleep health,[67] and sleep is one of the most important factors in supporting healthy impulse control levels among youth,[68,69] this policy should be a central feature of any school or community effort to reduce misconduct among youth. Improving self-control also supports better school performance and engagement, which are themselves important deterrents to misconduct.[64]

Best of all, a strategy to preventing adolescent misconduct that focuses on delayed school start times is decidedly proactive, not reactionary and/or punitive; it stops young people engaging in problem behaviors – including illicit behaviors - before they start or, at a minimum, keeps these behaviors from rising to the level where formal invention from the criminal legal system becomes a real possibility. This means that starting school later could have the added benefit of reducing racial and ethnic disparities in experiences of serious forms of punishment from schools (e.g., suspension, expulsion) or the criminal legal system (e.g., arrest, conviction, or even incarceration) that can jeopardize their chances for future success and well-being.

In some cases, later school start times also hold the potential to reduce adolescent conduct problems not just by improving sleep and self-control but also by reducing situational risk factors and opportunities for peer-involved misconduct in the after-school hours.[64,70,71] Delaying school start times to accommodate youths' biologically driven "night owl" sleep patterns often (though not always) means that school dismissal/release times are also delayed to some degree. For example, this year, City Schools that began before 8 a.m. had dismissal times ranging from 2:10-3:25 p.m. (mean=2:22 p.m.; median=2:25 p.m.), schools with start times from 8-8:29 a.m. had dismissal times

ranging from 2:40-4 p.m. (mean=2:50 p.m.; median=2:40 p.m.), and schools with dismissal times of 8:30 a.m. or later had dismissal times ranging from 3:09-4 p.m. (mean=3:40 p.m.; median=3:40 p.m.).

Criminologists have long understood that the hours immediately following school release are windows of opportunity for youth engagement in misconduct, especially alongside their peers.[72,73] A national report on adolescents shows that youth-involved violence peaks between 3 and 4 p.m. on school days.[74] This is because these are the hours when youth are most likely to engage in "unstructured socializing," or spending time with peers unsupervised by guardians/parents (since most have yet to clock out at work) without any planned pro-social activity with a clear structure (like a school club or sport).[75,76] This phenomenon is a well-known, potent situational risk factor for misconduct because it creates the conditions under which peer-involved acts of misconduct become most likely. Critically, unstructured socializing has been documented as one of the most important explanations of youth misconduct patterns (and changes over time) since the 1990s.[70,71] In cases where youth are left to their own devices in peer groups in those minutes and hours immediately

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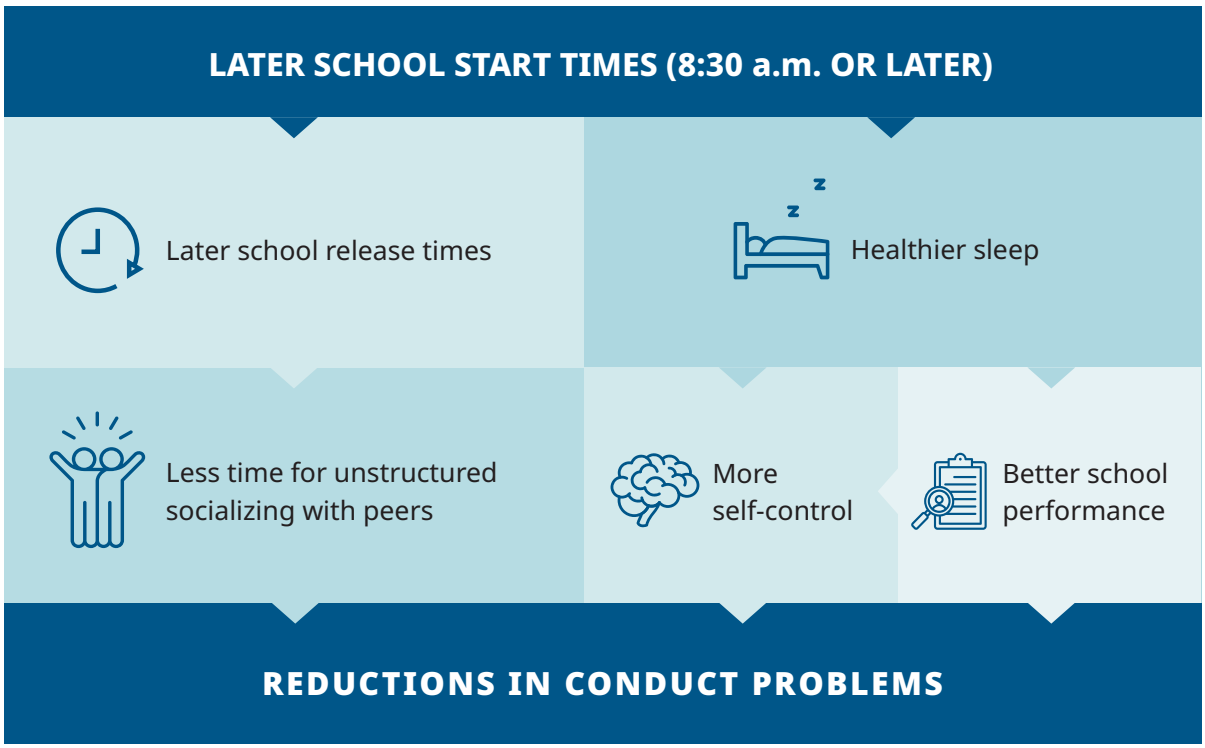
after school, opportunities for misconduct—including group-based or peer-involved acts—abound and become more likely as peer socialization (and peer pressure) increase.[73] It is thus possible that a later school dismissal (due to a later start time) will reduce the opportunity for misconduct by decreasing the total amount of time available to engage in unstructured socializing with peers on school days.[64] This may be particularly true for youth who are most vulnerable to engaging in conduct problems due to lower academic and school engagement (e.g., lack of involvement in after-school academic and social clubs, sports, and other structured after-school activities).

In summary, there are multiple ways that delaying school start times can minimize youths' risk of involvement in misconduct, including by boosting sleep health (via alignment with youths' late circadian rhythms) and the resulting benefits for self-control and school performance, as well as by potentially reducing opportunities for misconduct after school by minimizing the time available for unstructured socializing with peers (see **Figure 2**).

Figure 2. Pathways from Later School Start Times to Reduced Delinquency and Misconduct. Adapted from Semenza et al., 2020.



Substance Use

Sleep problems are a major risk factor for substance use behaviors and disorders in adolescents.[77] For example, shorter average sleep duration is associated with greater odds of subsequent marijuana and binge alcohol use,[78] and alcohol-related interpersonal problems.[79] These connections between adolescent sleep problems and substance use patterns are in part due to sleep-disturbance-related changes in areas of the brain related to emotion regulation, reward functioning, risk-taking, and impulsivity.[77] This is relevant for Baltimore City students who have relatively higher rates of substance use among middle schoolers than other Maryland students and higher rates of smoking cigarettes, cigars, or smokeless tobacco among high school students compared to Maryland and national estimates.[8] CDC data also show that Maryland high school students who use each substance are more likely to have insufficient sleep (<8 hours on average school nights) compared to those who do not.[44] Adolescents have also reported using substances like caffeine (e.g., coffee and energy drinks) and other stimulants to fight daytime sleepiness, and alcohol to help them fall asleep, potentially worsening sleep problems and overall health.[77]

Risk Behaviors and Injury

Adolescents who get insufficient sleep are at greater risk for injuries in sports[80] and at work,[81] and for motor vehicle crashes,[82,83] the latter of which are among the leading causes of death in this age group.[84] This increased risk may in part be due to the association between sleep deprivation and slower reaction times, more attention lapses, problems with judgment and emotion regulation like aggression, and more risk-taking behavior.[25–27] For example, findings from the CDC on data from over 50,000 U.S. teenagers showed that those who reported sleeping 7 or fewer hours per school night were also more likely to report texting while driving, drinking while driving, riding with a drinking driver, infrequent seatbelt use, and using bicycle helmets only infrequently.[85] Drowsy driving and fall-asleep-at-the wheel accidents are also commonly reported among adolescents,[86,87] who are typically inexperienced drivers, compounding risk for accidents and injury.

Effects of Delaying School Start Times

From a public health perspective, early school start times, generally defined as required classes before 8:30 a.m., are a major contributor to sleep insufficiency in adolescents and are the only contributor demonstrated to be modifiable at a population level.[88] Sleep scientists, partnered with other key stakeholders, have been advocating for school start times to be pushed later for adolescents for decades now. A large, broad, and consistent body of evidence supports potential benefits of later school start times for adolescents across multiple domains of functioning, including sleep, mental health, safety, and school performance,[88–94] including numerous studies associating later school start times with better school engagement, performance, and behavior (e.g., fewer tardies and absences, higher graduation rates, fewer disciplinary referrals).[95–100]

When Minneapolis, one of the first public school districts to shift high school start times, moved its high schools from 7:15 to 8:40 a.m., students got more sleep on school nights—a notable finding given common predictions that later start times would result in teens going to bed even later and thus still not obtaining more sleep.[101] Many subsequent studies of schools delaying start times also find that students with later start times may slightly delay their bedtimes if at all, but *significantly* delay their wake-up times and as a result obtain more and better-timed sleep.[94,102–105] For example, a study of 28,000 students in Denver, another large, urban school district, showed that school start time shifts of 40-60 minutes later for middle schoolers and 70 minutes later for high school students were associated, on average, with 29 minutes more sleep for middle school students and 45 minutes more sleep duration for high school students.[102]

After Minneapolis delayed its start times, researchers also documented better attendance rates, fewer tardies, less falling asleep in class, and fewer depressive symptoms.[101] These same benefits, as well as reduced use of caffeine and energy drinks, illegal drugs, cigarettes, and alcohol, and fewer car crashes involving teenagers, have been found repeatedly in the many other urban, rural, and suburban districts across the country that have delayed bell times.[88,106] When the large metropolitan Seattle School District pushed its high school start times from 7:50 a.m. to 8:45 a.m., for example, a comparison of two schools made up of students from diverse racial, and ethnic, and socioeconomic backgrounds found, in addition to better grades in both schools, significantly fewer average per-student absences and tardies (from 15.5 to 13.6 and 6.2 to 4.3 respectively) in the school where students were predominantly from racially and ethnically minoritized and/or economically disadvantaged backgrounds.[94] Another district in Kentucky that pushed school start times for middle and high schools one hour later to 8:30 and 9 a.m. showed a 16.5% drop in motor vehicle crash rates, and an increase from 35.7% to 50% in the proportion of students obtaining at least 8 hours of sleep on school nights.[107] Consistent with this and other studies of crash rates, Jackson Hole, Wyoming's percentage of car crashes involv-

ing teenage drivers dropped by 70% when its high school delayed its start time from 7:35 a.m. to 8:55 a.m.[106]

More modest changes in school start times have also seen benefits. One independent high school in the U.S. delayed high school start times by 30 minutes to 8:30 a.m., which resulted in the number of students reporting receiving at least 8 hours of sleep jumping from 16.4% to 54.7%, reports of increased sleep satisfaction and motivation, and reduced daytime sleepiness, fatigue, and depressed mood.[105] Further, class attendance improved, and fatigue-related health center visits were reduced. An examination of within-school effects of changes in middle school start times from 1999-2006 also showed a two percentile gain in math test scores, with similar results seen for reading scores.[92] Effects were strongest for students in the lowest percentile of test scores. Secondary schools that have delayed start times have also seen disproportionately greater improvements in graduation rates, attendance, grades, and test scores in students of lower socioeconomic status and from minoritized racial and ethnic backgrounds.[67]

This evidence led the American Academy of Pediatrics (AAP) to release a position statement in 2014 recommending that middle and high schools start classes no earlier than 8:30 a.m.[1] This recommendation has since been adopted by numerous health, education, and civic organizations including The American Medical Association, The American Academy of Sleep Medicine, The National Sleep Foundation, The National PTA, The National Education Association, and The Centers for Disease Control and Prevention. The AAP recommendation also prompted both California and Florida to pass statewide legislation prohibiting high schools from requiring attendance before 8:30 a.m. or middle schools from requiring attendance before 8 a.m. (Positions statements and resolutions on sleep and school start times can be found on the Start School Later website at startschoollater.net/position-statements.html). In response to the growing body of literature on the benefits of later school start times for adolescents, these position statements from national organizations and subsequent legislative efforts to push school start times later for middle and high school students in some states, the RAND Corporation in 2017 conducted a cost-benefit analysis on the economic effects of delaying school start times in the U.S.[108] They estimated that, within just two years, shifting school start times to 8:30 a.m. would result in an $8.6 billion gain to the U.S. economy, on the basis of improved graduation rates and reduced car crash rates alone. They note that this cost-benefit analysis likely underestimates the financial gain associated with delayed school start times, given its highly conservative approach, which used the highest cost options for changing school bell times while overlooking the benefits of addressing other costs other consequences of insufficient sleep (e.g., higher suicide rates, increased obesity, and mental or behavioral health issues).

School Start Times and Adolescent Sleep Health Disparities

Defining Disparities and the Baltimore Context

The National Institutes of Health define a health disparity as "a health difference that adversely affects defined disadvantaged populations, based on one or more health outcomes."[109] The "defined disadvantaged populations" referred to exist because of the sociohistorical circumstances of the United States. Health disparities are generally considered preventable and unjust[110] and include a higher burden of disease, earlier disease onset or more aggressive progression, premature or excessive mortality, poorer or suboptimal health behaviors, and worse daily functioning or symptom burden from health conditions than those experienced by non-disadvantaged populations.[109] Marginalized groups or populations disproportionately affected by health disparities include people who are Black/African American; Hispanic/Latino; Native American/Alaska Native; Asian American; Native Hawaiian and other Pacific Islander; LGBTQ; experiencing poverty; and living in rural communities.[109] This is highly relevant for Baltimore students, as 71% of City Schools students are Black or African American, 19% are Hispanic or Latino, and the majority are from low-income backgrounds (72%).[111]

Sleep Health Disparities in Adolescence

The research on disparities in sleep health indicates that individuals from low-income backgrounds and from minoritized racial and ethnic groups tend to have worse sleep,[112–116] largely due to differential exposure to adverse environmental and social conditions (e.g., social stress) across the lifespan. In 2018, a literature review of findings from 23 studies investigated racial and ethnic sleep disparities in American school-aged children and

adolescents ages 6-19 years.[117] In every study, disparities emerged in one or more sleep outcomes, including sleep duration, quality, bedtime/sleep onset time, wake time, sleep/wake problems, daytime sleepiness, efficiency, night-to-night variability, and fragmentation. Most studies examining sleep duration found that White children slept longer than Black and Hispanic/Latino children. Data on Asian children were limited but revealed that this group slept a shorter amount than White children but longer than Black and Hispanic/Latino children. All studies that measured bedtime found racial/ethnic disparities, where youth from minoritized groups had later bedtimes than White youth. When separated into age groups, similar racial and ethnic disparities for children (6-13 years) and adolescents (14-19 years) emerged. The percentage of those with insufficient sleep increased with age by 15% on average across racial/ethnic groups. More recent studies continue to support these findings,[118,119] which again, can be attributed to differential exposure to social and environmental stressors like racism and discrimination, and adverse socioeconomic conditions.[119,120] Indeed, adolescents from low-income backgrounds tend to experience poorer sleep outcomes across several parameters, including shorter duration, delayed timing, more irregular sleep, and worse sleep quality.[118,121,122] They are also often exposed to numerous stressors that are independently linked with poorer sleep, including living in neighborhoods with higher levels of violent crime, nighttime noise, and artificial light at night, compounding risk for sleep health disparities.[123,124] Sleep disparities experienced by Baltimore youth may in many ways contribute to disparities in their mental (e.g., depression), physical (e.g., obesity; high blood pressure), and behavioral health across the outcomes discussed in Section II.

As experienced firsthand by Laura Sterni, a pediatric sleep physician and contributor to this report, pediatric sleep clinics in Baltimore City are filled with sleepy children of all ages. The most common diagnosis is inadequate sleep. Medical practitioners who work with youth can provide the typical "sleep hygiene" tips—such as maintaining a regular bedtime schedule, sleeping in a dark, quiet room, and turning off electronics—but it quickly becomes evident that youth living in our city face many sleep-related challenges that are not easily overcome. In Baltimore City, youth often find themselves sleeping in noisy city environments, sharing beds with multiple family members, and/or living with caregivers who work nights or multiple shifts that affect the family schedule and limit bedtime supervision. Many of the clinic patients have had a range of adverse childhood experiences, including significant community violence, leading to anxiety, hypervigilance, and insomnia. Any policy that further disadvantages this particularly vulnerable group of children should be of great concern, including school start times that are not aligned with youth sleep needs. We must do all we can to provide our children with—and certainly not deprive them of—the most basic of needs: sufficient sleep.

School Start Times as a Social Determinant of Health

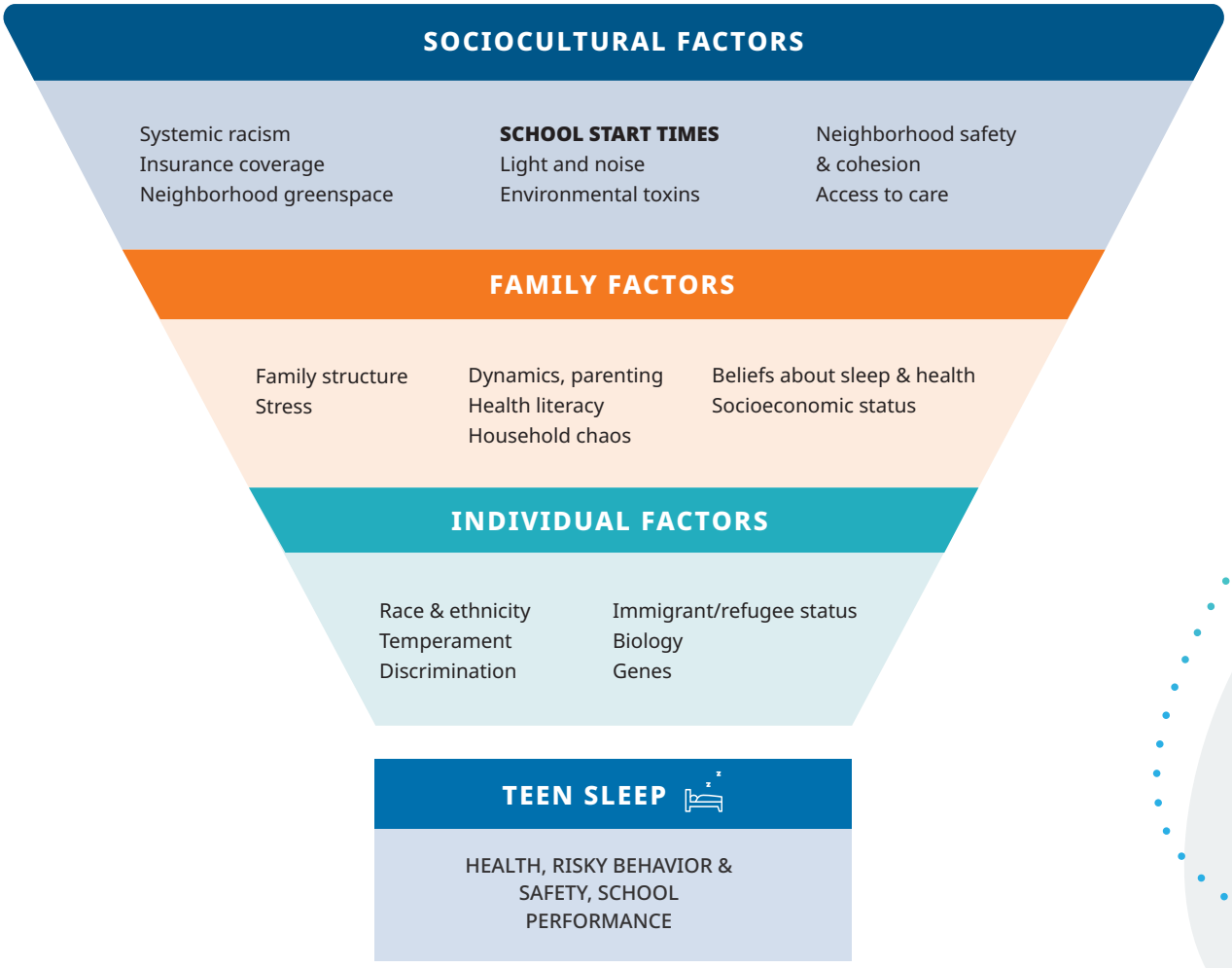
The majority of City Schools' students are already at risk for worse sleep, as they predominantly belong to sociodemographic groups disproportionately affected by disparities in social determinants of health. Social determinants of health encompass the environmental factors that influence health, including where we are born, live, work, and engage in various activities.[125] These factors, such as economic stability, neighborhood conditions, social context, education, and healthcare access, are shaped by the distribution of resources[126] and starkly differ across racial and ethnic groups due to intersections between structural racism and classism.[127–129] Disparities in social determinants of health, such as environmental (light; noise) and social (e.g., discrimination) conditions, can disproportionately harm children in disadvantaged populations, affecting their biology through disrupted sleep and circadian rhythms, contributing to poor mental, physical, and social outcomes (e.g., academic engagement). Racially and ethnically minoritized individuals also have a higher likelihood of exposure to adverse or traumatic childhood experiences (e.g., physical and sexual abuse; household dysfunction)[130–132] along with other stressors such as food and/or housing insecurity.[133] Moreover, students in urban settings such as Baltimore are more likely than higher-income, suburban groups to live in concentrated poverty.

Early school start times are yet another social determinant of health, often harming academically and socially vulnerable students disproportionately. A non-exhaustive list of direct and indirect stressors that contribute to disparities and that can be potentially exacerbated by earlier school start times include transportation requirements where low-income and racially and ethnically minoritized students are more likely to have longer commutes to school, including the need to take public transit as opposed to car drop off. The average commute time for middle and high school students taking public transit to school in Baltimore is 45 minutes.[134] Many disadvantaged families cannot compensate for challenges of early school start times in ways commonly employed by more advantaged families such as driving a student who misses a bus to school, buying the teenager a car, obtaining an excused absence or tardy, acquiring prescriptions for antidepressants or stimulants, negotiating for individual relief plans (e.g., online courses or permission to arrive late), or affording a private school with a later start time. In fact, students with lower-income backgrounds have been shown to benefit disproportionately from later school start times.[102]

Early school start times are thus a modifiable and addressable social determinant of

health that likely exacerbate existing health disparities for middle and high school students (**Figure 3**). Shifting to developmentally appropriate school start times (e.g., start time of 8:30 a.m. or later, depending on commute time) in Baltimore would promote health equity among these adolescents, defined as "the assurance of the conditions needed for optimal health among all people regardless of social group membership."[135]

Figure 3. School Start Times as a Social Determinant of Health that Interacts with Social-ecological Factors Across Multiple Levels to Contribute to Disparities in Sleep, Health, Behavior, and Wellbeing of Teens. Adapted from Billings et al., 2021.



Baltimore City Public School System and School Start Times: The Story

Overview and Background

There are no zoned City Schools high schools and only a few zoned middle schools, meaning that families have full choice to select the specialized school that best meets their children's needs and interests. Some middle and high schools are highly selective, and students vie for seats based on their academic record.[136] This means that many middle and high school students do not go to school in their neighborhoods and instead must commute.

As of the 2023-24 academic year, City Schools student enrollment was 75,811 students (grades 6-8: 16,321; grades 9-12: 21,781).[136] Most of these students experience poverty, are Black or African American, and lag in measures of academic achievement compared with Maryland state averages, tracking with national "opportunity gap" trends, which refers to the longstanding education disparities among Black and Brown students resulting from the legacy of racism in U.S. schools and society.[137] More specifically, 71% of City Schools students are African American (Black), 19% are Hispanic/Latino, and 72% have low-income backgrounds, including students who are unhoused, in foster care, or participating in programs for low-income families.[136]

There are 162 schools and programs in City Schools. For adolescents in grades 6-12, there are 72 elementary/middle schools (K-8), five middle schools (6-8), nine middle/high schools (6-12), two elementary/middle/high schools (K-12), and 32 high schools (9-12). In addition, City Schools has 41 elementary schools and one pre-K school. The district has a 71% graduation rate, and 37% of City Schools graduates go on to college. Overall, 15% of those enrolled are students with disabilities, and 13% are multilingual learners. Compared with

the state English Language Arts proficiency of 48%, City Schools has a 24.1% proficiency on the state's standardized assessments. In mathematics, 40.3% of Maryland's students are proficient versus 16.7% in City Schools.[136]

Given the numerous historic and societal contextual issues distressing City Schools such as enduring systemic racism, historic discriminatory real estate practices and policies, and low tax-supported school funding, City Schools has more than its fair share of significant challenges to promoting student success. Its numerous successes are in many respects due to the continuous dedication of many teachers and administrators, suggesting that future innovations can make a positive difference in the academic lives of students in Baltimore City. In addition, City Schools engagement in the pursuit of student wholeness—defined as "an environment where students are inspired to pursue their passions and achieve their full potential…through engaging, safe, and supportive surroundings that cater to students' academic, social, emotional, and physical needs"— is particularly notable. Accordingly, the City Schools report, "Building a Generation: City Schools' Blueprint for Success," lists "school quality and student support" as a focus area.[138] Within this section, the report emphasizes culture, climate, and connectedness, all-important factors for student success, as areas in which to help with student attendance and well-being. School start times that give all students an opportunity to obtain sufficient sleep are a significant aspect of this student well-being category, though they are not discussed in the City Schools report.

On June 8, 2022, City Schools announced in their online newsletter that 93 schools would have new "bell schedules" for the 2022-23 school year (City Schools, 2022).[139] According to the announcement, school start times would shift 30 minutes earlier, on average, in the fall of 2022.[139] The district announcement explained that the changes were being made to accommodate the national school bus driver shortage and invited questions from teachers, parents, and students. In the memo, officials responded to several questions including "Did you consider research that shows the benefits of later school start times for adolescents?" In response to this question, they noted, "We discussed later school start times for adolescents with many of our stakeholders. Stakeholders recognized that both earlier and later school start times have benefits and challenges. Taking this and many factors into consideration, we decided that high school start times will continue to be staggered for the next school year."[139,140] According to this announcement, stakeholders included the Associated Student Congress of Baltimore City, school supervisors, principals, the Special Education Citizens' Advisory Committee, the Maryland Transportation Authority, the Parent and Community Advisory Board, Baltimore School Police, and district office staff.[139] In addition, staff from City Schools presented to the Parent and Community Advisory Board on April 7, 2022.[141] At that

time, City Schools was considering a uniform start time for all city high schools. The Parent and Community Advisory Board encouraged City Schools to share this information as soon as possible, particularly given that the school-choice deadline had already passed, and any schedule changes could present significant challenges for young people and their caregivers. The Parent and Community Advisory Board submitted a list of questions to City Schools, which were not answered until early June. At that time, the Parent and Community Advisory Board learned that the plan had changed; rather than a uniform time, which would be more equitable for youth in the city, City Schools planned earlier start times for many schools without discussion with the Parent and Community Advisory Board or the public (Parent and Community Advisory Board, June 13, 2022, statement).[141]

Despite over 30 years of existing research verifying the adverse health outcomes of early school start times for students, much of it reviewed here, City Schools executives moved forward with this change. In response to the plan, the non-profit organization, Start School Later, wrote a letter to the City Schools superintendent and the Board of School Commissioners outlining their concerns. Shortly thereafter, community members organized a Baltimore City Start School Later chapter.[142] Members of the chapter and other concerned community members including one of the authors of this report, Amy Wolfson, a sleep psychologist and national adolescent sleep and juvenile services expert, and Sam Abed, then Secretary of Juvenile Services, met with the City Schools CEO and some of her executive staff to discuss the change and attended a Zoom open forum for parents and community members (June 16, 2022) to discuss the pending change.[143] School leaders emphasized during this meeting that changing bell times was necessary to accommodate about 6,200 students who must use school buses (e.g., unhoused students, students with individualized education plans, and pre-kindergarten students) and a small group of students who are offered van and cab services. Despite the concerns and research shared with them, they expressed no interest in moving toward later as opposed to earlier school start times.

Since City Schools implemented its new school start time policies, three letters to the editor (two from City Schools high school students)[144,145] and an op-ed[146] were published in the *Baltimore Sun* about the negative consequences of the new, early school start times for high school students. In July 2022, a public radio station in Baltimore, WYPR, discussed the challenges of these new school start times.[147] More recently, the *Baltimore Banner* published an opinion article by two Loyola University Maryland students, one a graduate of Baltimore City College High School, and both of whom are contributors to this report.[148] As local college students, they underscored the concerns for vulnerable youth in their hometown and discussed the consequences of early school start times for Baltimore's middle and high school students' sleep health, mental health, and commute times.

Eric Thompson for The Baltimore Banner

School Start, Dismissal, and Travel Times in City Schools

We examined school bell schedules for 150 Baltimore City schools (excluding 12 special education/specialized schools/programs) for the 2021-22, 2022-23, and 2023-24 school years.[149] These analyses included 42 elementary schools (grades preK-5; one preK-2), 70 elementary/middle schools (largely grades PreK/K-8), four middle schools (grades 6-8), eight middle/high schools (grades 6-12), and 26 high schools (grades 9-12). The school start time and dismissal time ranges for these schools by level are reported in **Table 1**. Because school start times were similar in the 2022-23 and 2023-24 school years, we only report on 2021-22 (the year prior to implementation of earlier start times) and the current year, 2023-24. School start times varied significantly between schools, ranging from 7:30 to 9:15 a.m. (1.75-hour difference). Importantly, this range differed somewhat across the five school levels (median=8 a.m.).

During each of the school years, 68% of City Schools started prior to 8:30 a.m., with a staggering 81% of high schools starting before 8:30 a.m. in 2023-24, up from 54% in 2012-22 (**Figure 4**). Next, we looked more in depth at the percentage of schools with early start times by examining the percentage starting earlier than 8 a.m. and from 8-8:29 a.m. (**Figure 5**). We observed a slight decrease in schools starting 8-8:29 a.m., from

Table 1. School Start and Dismissal Times and Enrollment by Academic Year and School Level

	2021 - 2022		2023 - 2024		
	School Start Time Range	Dismissal Range	School Start Time Range	Dismissal Range	Number of Schools
Elementary Schools	7:30-9:15	2:10-3:55	7:30-9:15	2:10-4:00	42
Elementary/ Middle Schools	7:30-9:15	2:10-4:00	7:30-9:15	2:20-4:00	70
Middle Schools	8:00-8:45	2:50-3:35	7:45-8:45	2:35-3:35	4
Middle/High Schools	8:00-9:00	2:50-3:50	8:00-9:00	2:50-3:50	8
High Schools	7:45-9:00	2:35-4:15	7:30-9:00	2:20-4:00	26
All Schools	7:30-9:15	2:10-4:15	7:30-9:15	2:10-4:00	150

Note: Table does not include data from 2022-2023 as there were few school start time changes from 2022-23 to 2023-24.

Figure 4. Percentages of BCPSS Schools with Start Times < 8:30 a.m.

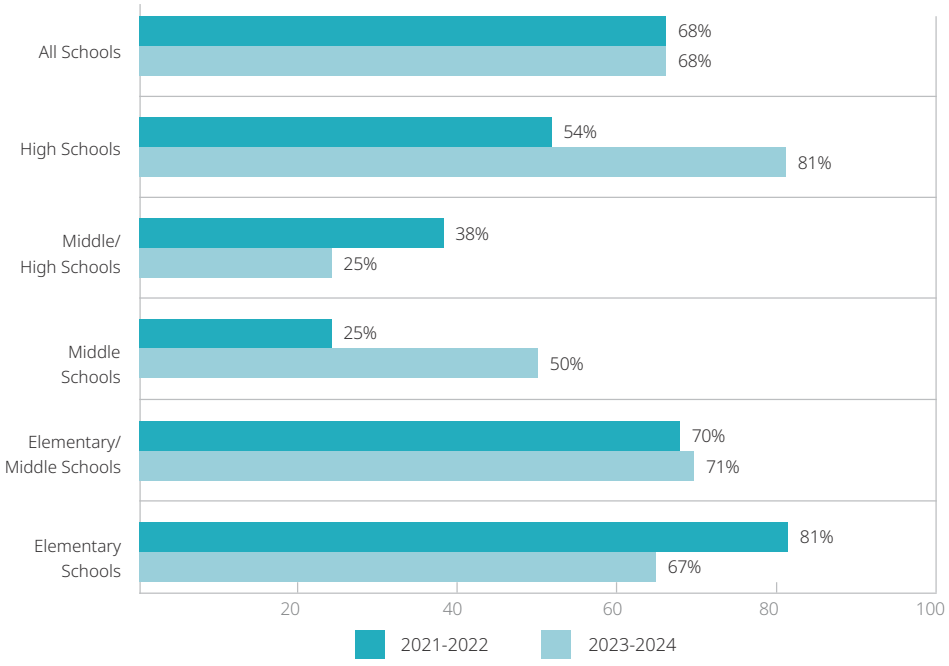
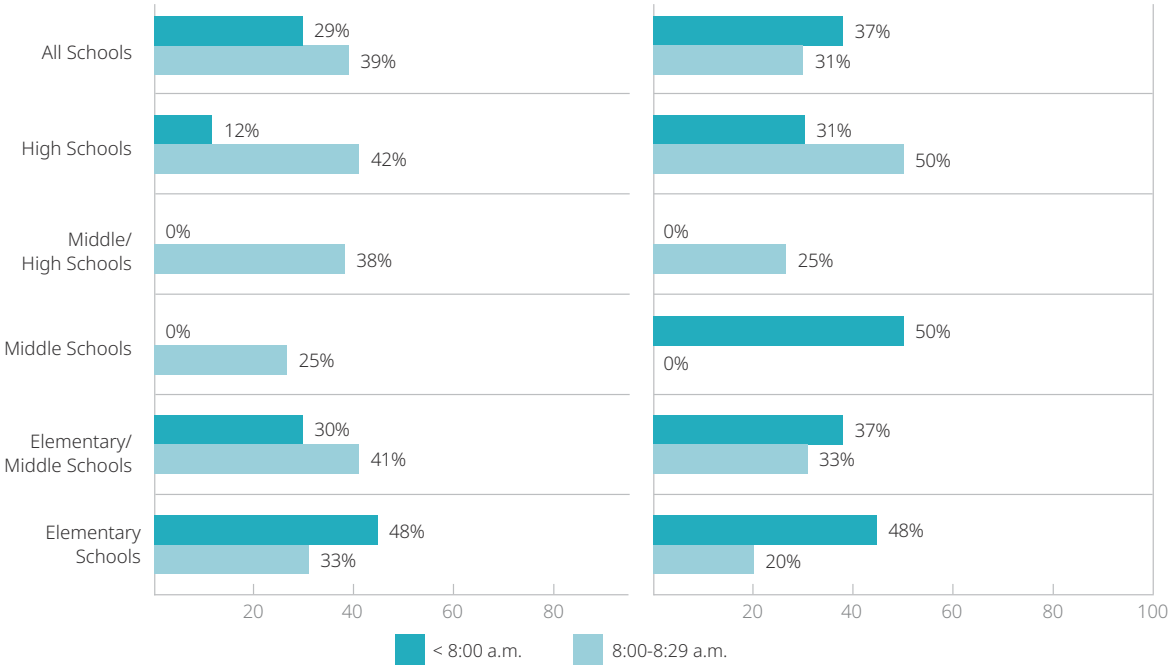


Figure 5. Percentages of BCPSS Schools with Start Times <8:00 am and 8-8:29 a.m.



39% in 2021-22 to 31% in 2023-24, with a larger increase in schools starting earlier than 8 a.m., from 29% in 2021-22 to 37% in 2023-24. Most striking, when considering school level, 12% of high schools started at 8 a.m. or earlier in 2021-22, increasing to 37% in 2023-24, and the proportion starting at 8-8:29 a.m. increased from 42% in 2021-22 to 50% in 2023-24 (2021-22 mean=8:22 a.m. (SD=:24) vs. 2023-24 mean=8:04 a.m. (SD=:28)). Of the four traditional middle schools, only one started at 8 a.m. in 2021-22 (25%), while two out of the four (50%) moved to earlier than 8 a.m. for the following two school years. In contrast, it is noteworthy that amid largely earlier City Schools school start times for the last two school years, 62% of the middle/high schools started at 8:30 a.m. or later in 2021-22, increasing to 75% in 2023-24.

We also examined school bell schedules for the 87 neighborhood schools (e.g., students attend based on their zone) versus the 63 non-neighborhood schools (e.g., choice, charter, specialized schools, and schools with entrance criteria, **Table 2.**). We found that on average, neighborhood schools started slightly earlier than non-neighborhood schools. In 2023-24, the mean school start time was 8:07 a.m. (SD=:34) for neighborhood schools and 8:13 a.m. (SD=:33) for non-neighborhood schools. In 2021-22, 79% (N=69) of neighborhood schools (across grade levels) started before 8:30 a.m. versus 52% (N=33) of the non-neighborhood schools. In 2023-24, slightly fewer (71%, N=62) neighborhood schools started prior to 8:30 a.m., whereas an increased number of non-neighborhood schools started before 8:30 a.m. (62%, N=41). Later school start times associated with the non-neighborhood schools that consist of choice/charter/entrance criteria schools are congruent with the national trend that private

Table 2. School Start and Dismissal Times and Enrollment by Academic Year and School Type

	2021 - 2022				2023 - 2024				
	SST Range	% SST <8:00 a.m.	% SST 8-8:29 a.m.	Dismissal Range	SST Range	% SST <8:00 a.m.	% SST 8-8:29 a.m.	Dismissal Range	Number of Schools
Neighborhood	7:30-9:15	40.2	39.1	2:10-3:55	7:30 - 9:15	42.5	28.7	2:10-4:00	87
Non-Neighborhood	7:30-9:00	14.3	38.1	2:10-4:15	7:30 - 9:15	30.2	33.3	2:20-4:00	63

Note: SST = School start times; Non-Neighborhood = choice, entrance requirement, specialized, etc.

middle/high schools tend to start later than public schools in the same area.

City Schools dismissal times were also captured for this report. Like start times, City Schools dismissal times ranged across the school district by nearly 2 hours for both years (2023-24: 2:10-4 p.m.); however, on average, they did not change compared to start times over the same period. Of note, 31% of high schools had dismissal times before 3 p.m. in 2021-22 (mean=3:15 pm, SD=:27) versus 66% in 2023-24 (mean=3 p.m., SD=:32).

One example of a school that advanced start times is Baltimore City College High School, one of the most highly selective high schools in the city. City College's start times advanced from 7:45 a.m. in 2021-22 (dismissal time of 2:35 p.m.) to 7:30 a.m. in 2023-24 (dismissal time of 2:20 p.m.). Recent graduates recall that most students were barely making it to school on time for their first-period class, whether they were dropped off by a family member, drove themselves, or rushed from the bus stop to school after a long commute. According to these new alumni, teachers report increased tardiness and sleepy students in their early morning classes since bell times moved earlier, and those who enter after the start of the school day can typically slip into class without a record of their absenteeism and/or tardiness.

School transportation has been discussed in Baltimore over the years, as it is the only school district in Maryland that depends mainly on public transportation for commuting to school. A 2017 Baltimore Education Research Consortium report[146] found that approximately 13,000 (60%) high school students rely on public transportation, with approximately 68% of them requiring at least one transfer to get to school. The report also emphasized that if all students were to use the Maryland Transit Administration (MTA) to get to school on time, the system would not have the capacity to meet such a demand. Earlier school start times are likely to further compromise the system and/or more students will require alternative means to get to school on time. The report also pointed out that for students to attend a selective school in the city, often the travel time will be considerably longer, anywhere from 45 to 60 minutes (average 45 minutes), each way daily.[150]

Similarly, the 2021 Fund for Excellence report, *Not in Service: Why public transit must aim to serve students,* documented that 73% of middle and high school students rely on the MTA (representing 18% of the annual ridership on the MTA).[134] If not using the MTA, students rely on getting a ride from a family member and/or using Lyft, with relatively few students walking to and from school. Furthermore, if students live 1.5 miles from their school choice, City Schools pays for their public transportation to and from school between the hours of 5 a.m. and 8 p.m. (It is disconcerting that an adolescent could need to leave for school as early as 5 a.m.)

Based on these reports, it is not uncommon that a student would need to take 1-3 buses and/or require about a one-hour commute time to get to school. In most cases, such a student whose first class is scheduled for

7:30 a.m., for example, would have to wake up no later than 5:30 a.m. to make sure they had enough time to get ready for school, make their first bus, and allot time for transfers and delays (**Figure 6**). As this report noted earlier, this sleep schedule is not developmentally aligned with adolescents' sleep needs (i.e., an average of at least 9 hours of sleep, and no less than 8) or biological clock (i.e., natural, physiological shift toward later bedtimes and waketimes).

For this report, we conducted a modeling analysis to understand the impact of school start times on public transportation times and schedules in Baltimore based on the current school start times. We derived central addresses for each Baltimore ZIP code using data from Google Maps. We then entered these central addresses into the Maryland Transit Administration's "Trip Planner" feature located on their website. Using these central ZIP codes, we calculated hypothetical transit routes, leave time, commute time, and number of transfers for each City Schools choice school based on its school start time. Our analysis included 39 choice/entrance criteria schools (25 high schools, four middle/high schools, six middle schools, and four elementary/middle schools). Overall, school start times ranged from 7:30 to 9 a.m. (median=8:15 a.m.). This modeling analysis suggested that, on average, students would need to leave home by 7:24 a.m. to report to school on time (range: 6:48-7:58 a.m.) with a mean total travel time of 51 minutes (range: 4-67 min) and on average, 1.9 transfers (range: 1.4-2.4) (**Figure 7**). In general, these travel times are like those presented in the 2017 Baltimore Education Research Consortium report.

Figure 6. A Hypothetical Day in the Life of a Baltimore City High School Student with an Early School Start Time and Long Commute

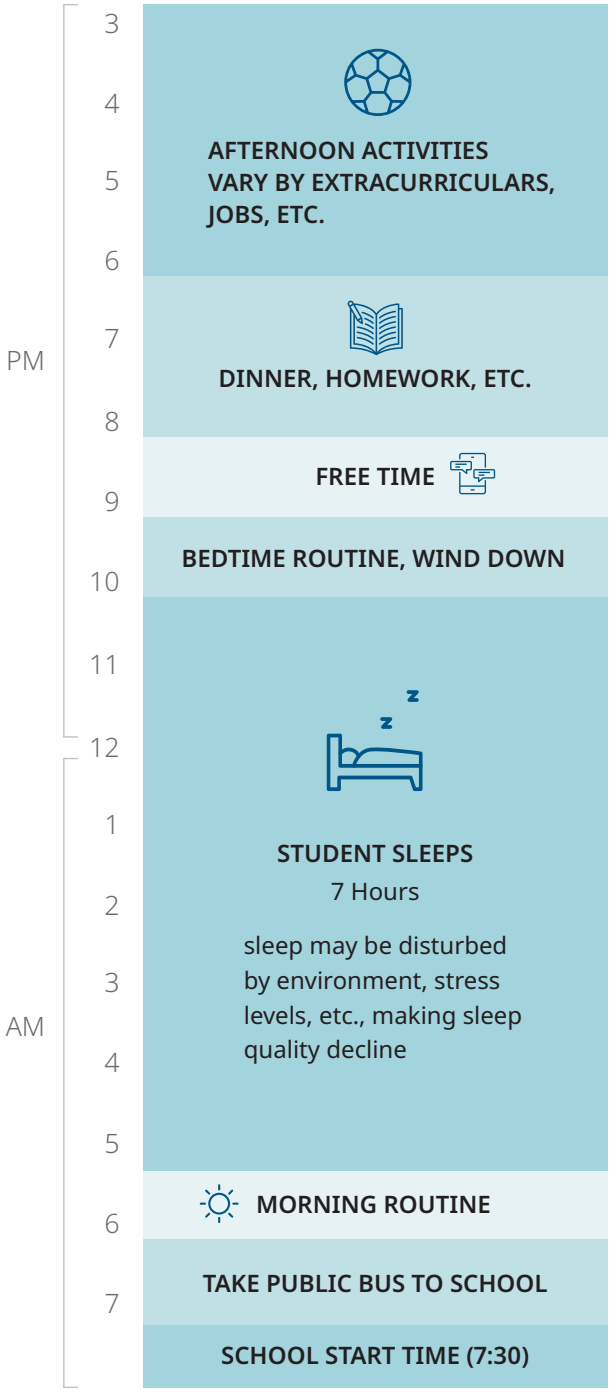


Figure 7. Visualization of the Average Baltimore City High School Student's Morning Commute to School

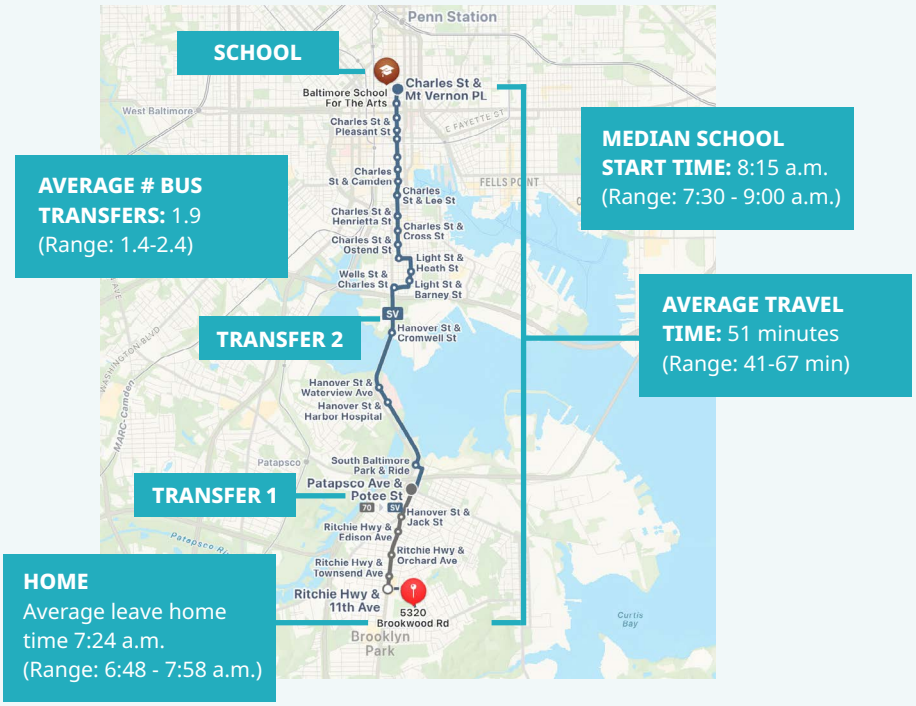


Photo courtesy of Shutterstock

As displayed in **Figure 8**, prior to these school start time changes, Baltimore City adolescents were already obtaining insufficient sleep. Specifically, according to the CDC's Youth Risk Behavior Surveillance System survey data from 2013-2022,[8] the percentage of middle school students in Baltimore getting under 8 hours of sleep on an average school night increased from 55% in 2012-13 to 62.2% in 2021-22. Similarly, in 2014-15, 75.4% of Baltimore high school students reported getting under 8 hours of sleep on average, increasing to 80.6% in 2018-19. Compared to the state level data for the same years, 54% of Maryland middle school students (data available from 2021-22) and 79% of high school students (data available from 2018-19) reported getting under 8 hours of sleep on an average school night. Recently released state level data for 2022-23 is similar, with 50.6% of middle school students and 77.5% of high school students reporting getting under 8 hours of sleep on average school nights.

Figure 8. Percentages of Baltimore Students Obtaining Sufficient Sleep on Average

Baltimore's School Start Times: Considerations, Opportunities, and Recommendations

City Schools leaders, parents, teachers, and students have a unique and powerful opportunity to continue their leadership in public education and to improve the health of Baltimore's youth by setting and ensuring developmentally appropriate school start times across the entire district. Recognizing this opportunity rests on City Schools leaders accepting and articulating a basic principle: the potential for students in Baltimore (and anywhere for that matter) to obtain sufficient and regular sleep should not be contingent on home ZIP code. It also rests on being aware of and accepting a compelling body of scientific evidence showing the significant harm of requiring adolescents to be in class too early in the morning, and the health and academic benefits of starting school at times that allow for healthy sleep. Ample resources exist to help the district follow the best change management practices for ensuring healthy school start times, for example the Children's National Medical Center's Division of Sleep Medicine Blueprint for Change Team in the report "School Start Time Change: An In-Depth Examination of School Districts in the United States."[151]

As this report documents, studies not only show a linear association between school start time and sleep duration but also that delaying school start times increases the proportion of students getting more sleep and having more regular and developmentally aligned sleep-wake schedules, along with numerous associated benefits to mental health, safety, and school performance. Notably, these studies also show a dose-response association between sleep and school start time—that is, the later school starts, the more sleep students get. A start time of 8:30 a.m. is the tipping point after which most middle and high school students get at least eight hours of sleep. Though this is still less than the optimal 9 hours of nightly sleep adolescents need,[4,5] it puts students at the absolute minimum amount per night of the 8-10-hour range recommended for this age group. In addition, evidence showing disproportionate benefits of later start times for students with low socioeconomic status and with the lowest

school performance[94,97,102,121,152] suggests that some of City Schools most vulnerable students are likely to benefit at least as much, if not more, from later school start times—particularly with respect to school performance, attendance, and graduation rates. These disproportionate benefits suggest that later start times may ultimately be a mechanism for building health equity by reducing the opportunity gap among some of Baltimore's most vulnerable youth, including students who are unhoused and/or who have alternative living situations.

In a meeting with members of the research team for this report, City Schools officials outlined some of the transportation challenges (e.g., overburdened drivers, driver shortages, union guidelines) and costs that have been the largest drivers of school start times for City Schools, including the recent shift to earlier start times for many schools. Indeed, bell times for individual schools are no longer set by their principals but by City Schools transportation staff in order to maximize the ability for bus drivers to make multiple runs each morning. We learned that City Schools provides school bus transportation for 7% or 5,188 of its 75,469 students, and 2.6% of these students are in middle or high school, with most others taking public transportation or walking (data from School Year 2023-24, communication with Transportation department staff). While the transportation logistics for these students is important, developing transportation strategies and schedules that provide all students with the opportunity to obtain sufficient and well-timed sleep will help ensure the health and well-being of all students and should be prioritized.

That is why, the complexities of transportation planning notwithstanding, City Schools must reconsider ways to resolve transportation challenges without jeopardizing the health and success of its students. The creativity and dedication of City Schools Transportation staff have shown in developing and fighting for the implementation of other solutions to address bus-driver shortages (e.g., lobbying for and starting a bus-driver training program) will be enormously helpful here, together with lessons from the many other districts, including those managing much higher student transport numbers, that have found ways to align start times with adolescent sleep needs. These assets must also be paired with support from leadership (e.g., CEO and school principals) and financial resources (e.g., to purchase routing optimization software that sets healthy school start times as a non-negotiable variable). We acknowledge that City Schools face resource constraints, but officials must recognize that investing in systems that allow for school start times that provide adolescents the opportunity for more optimal sleep are also investments in their academic success, not to mention their physical and mental health.

Based on 1) the extensive research on adolescent sleep and circadian rhythms, 2) the significant and unnecessary damage to health, safety, and school performance associated with insufficient and misaligned sleep-wake schedules, and 3) the clear and compelling outcome studies establishing both the feasibility and effectiveness of delaying school start times for the success of all adolescents, we recommend that City Schools take the following specific steps:

1. Set District-Wide Parameters ("Guardrails") Limiting How Early Schools Can Require Attendance

A For youth in Baltimore City to have the opportunity to obtain the optimal 9 hours of sleep each night, City Schools should establish a non-negotiable regulation that all elementary/middle schools, middle schools, middle/high schools, and high schools start required instruction no earlier than 8:30 a.m.

B Knowing youth in Baltimore have particularly long commute times and use public transportation to get to and from school, even 8:30 a.m. may be too early. Taking this into account, most non-neighborhood high schools may need to start no earlier than 9 a.m.

C Schools should not effectively require middle and high school students to be on a bus or commuting to school before 7:30 a.m. In fact, based on the Maryland Department of Education's Orange Ribbon for Healthy Schools Certification Program (enacted in 2016),[153] schools cannot require middle and high school students to be on a bus before 7:30 a.m.

These recommendations are consistent with the AAP 2014 Adolescent School Start Times Policy Statement[1] and numerous subsequent policy statements and recommendations from professional healthcare and education organizations, e.g., U.S. Surgeon General, American Medical Association, Centers for Disease Control and Prevention, National Parent Teacher Association, and National Education Association. (Position statements and resolutions on sleep and school start times can be found on the Start School Later website at startschoollater.net/position-statements.html.) The recommendations are also consistent with the Maryland Department of Education's Orange Ribbon for Healthy Schools Certification Program.[153] The purpose of the Orange Ribbon program is to recognize local school systems that create, implement, and enforce school start times that are consistent with school start times recommended in a 2014 report by Maryland's Department of Health and Mental Hygiene (DHMH).[154] That report, *A Study of Safe and Healthy School Hours for Maryland Public Schools to the Maryland General Assembly*, was created at the request of the Maryland General Assembly (via House Bill 883). Notably, in 2024, Maryland General Assembly considered House Bill 1418, which proposed requiring that public middle schools start no earlier than 8 a.m. and high schools no earlier than 8:30 a.m., with school districts given three years to implement the new, healthier school start times, and at least two large and diverse Maryland districts (Anne Arundel and Howard counties) have already set a floor on how early their middle and high schools can start classes based on the same research. HB 1418 did not come to a vote in 2024, but its sponsor plans to re-introduce it in 2025.

2. Community Sleep Health Education and Engagement

A To optimize the ability for students, families, and the entire Baltimore City community to obtain healthy sleep, City Schools should take the lead in developing a public relations campaign to disseminate sleep-health awareness and education programs and materials.

B To improve public sleep-health awareness and community engagement, which is essential for the successful implementation of new school hours, City Schools should facilitate outreach (e.g., via websites, videos, community forums) to community stakeholders.

While starting school later does not guarantee that every adolescent in City Schools will get healthy sleep, not starting school later guarantees that most adolescents in the district will not get healthy sleep. It is helpful to think of later school start times as both a prerequisite and an opportunity for healthy sleep, as well as to recognize the need for students, families, and school communities to use that opportunity to their advantage. Many studies have shown that sleep-health education improves sleep habits, duration, and efficacy; helps screen for sleep disorders; and improves various aspects of daytime functioning such as alertness across the lifespan.[155–159] By providing students and the wider school community access to such education, school communities can maximize the benefits of developmentally appropriate school start times.

Sleep health education for, and authentic engagement with, the wider school community is also important in implementing later start times successfully. Studies of hundreds of communities that have implemented later start times show that authentically and iteratively engaging community members that might be affected by school schedules (e.g., people involved in traffic management, school transportation, childcare, city government, neighborhood associations, after-school programs, businesses that employ students, etc.) in change plans and logistics facilitates community buy-in, alleviates perceived concerns, yields creative solutions to logistical challenges, and ultimately yields successful change for the entire community.[151] We have learned from the experiences of these school districts that anticipation of potential negative outcomes associated with school start time changes is often worse than reality, and communities generally adjust to start time changes. For example, employers shift student worker hours, and traffic may worsen initially but levels out as commuting patterns adapt.[151]

Change management studies have also demonstrated that school districts have the most success with systemic change when it includes education about sleep health and school start times, including the reasons for changes and ways to best use the new opportunities for healthy sleep provided by healthier hours. For example, to help ensure a smooth change process, the Seattle school district implemented a community education campaign including both in-person forums and a dedicated website featuring accessible videos describing changes in sleep patterns during adolescence and their relationship to school start times, explaining the benefits of change and addressing potential concerns.[151]

3. Consider the Impact of Unsupervised After-School Hours

In conjunction with the health benefits of delaying start times, growing research suggests that delaying release times can potentially support city-wide adolescent misconduct prevention efforts. For that reason, we recommend that as City Schools considers limiting how early district schools may start in the morning, they also consider the potential public safety benefits of delaying release times. Currently about two out of every three City Schools (64%) have a release time of 3 p.m. or earlier (median=2:40 p.m.), with only 4% of schools releasing students at 4 p.m. and no schools releasing students after 4 p.m. A more widely implemented delay in release times (for example, to 4-4:30 p.m.) has the potential to reduce youths' opportunities for unstructured socializing with peers at a time of day when adolescent misconduct peaks (around 3–4 p.m.).[74] In fact, research shows that in recent years, unstructured socializing with peers continues to increase youths' risk of engaging in misconduct[70,71] and that changes in unstructured socializing accounted for 86% of changes in youth risk behaviors from 1999-2017.[160] It may therefore be prudent to implement policies that further reduce the unsupervised time youth spend with peers after school—such as before parents/adult guardians return home from work and/or before formal or school-sponsored activities begin.

4. Support Statewide School Start Time Legislation

Consistent with the concept that a student's opportunity to obtain sufficient and regular sleep should not depend on ZIP code, we recommend that City Schools support legislation setting statewide parameters as guardrails to ensure that schools cannot require students to be in class at unsafe, unhealthy, and counterproductive times. Such statewide lower limits are similar to other guardrails Maryland sets by requiring districts to be in session for at least 180 school days per school year or specifying that students be in class a minimum of 1,080 school hours during a 10-month period (Md. Code, Education § 7-103). Rather than requiring or mandating local districts to implement a specific schedule, they allow each district to choose schedules that best meet that district's needs, so long as those schedules are consistent with the sleep, health, safety, and learning needs of students. Statewide guardrails thus empower every local district, including City Schools, to prioritize the well-being of students over adult vested interests that often turn sleep and school start times—non-negotiable matters of public health and children's welfare—into negotiable school budget items, ensuring that developmentally appropriate school hours will be "off the table" as a potential remedies to future budget shortfalls. This is the premise of Maryland's HB 1418 (discussed above), which, in keeping with the California (2019) and Florida (2023) laws, would require that public middle schools start no earlier than 8 a.m. and high schools no earlier than 8:30 a.m., with school districts given three years

to implement the new, healthier school start times. Similar legislation has been introduced in Hawaii, Louisiana, Maine, Massachusetts, Nevada, Pennsylvania, New Jersey, New York, Texas, and West Virginia.

5. Address Additional Social Determinants of Health on Adolescent Sleep

Finally, while developmentally appropriate start times are an essential component of adolescent sleep health, ensuring healthy sleep for Baltimore's youth will also require considering the impact of other social determinants of healthy sleep among Baltimore's youth. Achieving that will require engagement and commitment well beyond the school system. Factors such as homelessness, family conflicts, discrimination, poverty, hunger, and the lack of quiet, dark, and comfortable sleeping areas may continue to affect students' sleep and circadian rhythms regardless of school start time and thus must be addressed to fully realize the benefits of later and developmentally appropriate start times. Examples of interventions that target these factors and can help with further reducing sleep health disparities in Baltimore teenagers include: investment in programs aimed at promoting early childhood development among children in under-resourced communities, increased income/employment opportunities (e.g., livable wages; Earned Income Tax Credit; protections for workers), community-led improvement of housing and neighborhoods, urban-planning-related policy changes targeting the physical environment (e.g., reducing nighttime traffic noise and artificial light, reducing air pollution; expanding access to green space, increasing neighborhood safety), and ensuring access to quality healthcare (e.g. the Affordable Care Act).[161]

Implementing later school start times, as with implementing any systemic intervention, may introduce unforeseen challenges for students that will require careful attention. Efforts to address the sleep health of City Schools students through the implementation of later school start times should include assessments both pre- and post-implementation of later start times of any potentially negative effects of start time changes on other aspects of the well-being of socially vulnerable populations, including minoritized youth and school-aged children from socioeconomically disadvantaged backgrounds, and plans to mitigate them should be developed. Racial equity impact assessments are a common example of tools used for this purpose.[162]

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Amy R. Wolfson, PhD is Professor of Psychology at Loyola University Maryland and an Adjunct Professor in the Department of Mental Health at the Bloomberg School of Public Health, Johns Hopkins University. Over the last 30 years, her scholarship has focused on adolescents' sleep health and daytime functioning. She is one of the authors of the American Academy of Pediatrics (AAP) Policy Statement on School Start Times for Adolescents (2014) and co-edited *Sleep Health's* special issue on adolescent sleep and school start times. Dr. Wolfson's current collaborative work is examining the sleep health and environment for youth residing in Maryland's Department of Juvenile Services (DJS) facilities, and she is part of a multidisciplinary team developing *Fostering Sleep*, an evidence-based

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