



VASM Position Statement on School Start Times

Introduction

For decades, the scientific literature has clearly and consistently demonstrated the harms that come from starting middle and high schools too early in the day, including impaired daytime function (e.g., academics and driving) and mental health, and the benefits that can be attributed to delaying those start times. The American Academy of Sleep Medicine (AASM) published a position paper in 2017, advocating for middle and high schools to start no earlier than 8:30 a.m. (1). Response to that position has varied across the Commonwealth of Virginia (2-4). As of 2017-18, the average start time for high schools in Virginia was 8:14 a.m., with only 25% starting at 8:30 a.m. or later (5).

The Virginia Academy of Sleep Medicine (VASM) is the leader in setting standards and promoting excellence in sleep medicine health care, education, and research in Virginia. A task force was created by the VASM Legislative and Education committees on behalf of the Board of Directors; the aim was to re-evaluate the 2017 AASM position paper on delaying middle and high school start times with a focus on the Commonwealth of Virginia and via use of an updated review of the scientific literature on the effects of earlier school start times on adolescents.

This position was adopted by the VASM Board of Directors, with approval of the final version on August 25, 2022

Position

The VASM reaffirms the AASM position (1) that middle and high schools should start at 8:30 a.m. or later. This position is especially relevant to Virginia and supports:

- **Adolescents having the opportunity to obtain sufficient sleep on school nights (1)**
- **Public health and improved safety, with reduction in injuries**
- **Alertness in the classroom, and decreased tardiness and absenteeism, to enable optimal academic performance (1)**
- **Adolescent mental health and well-being (1), and decreased risk taking behaviors**
- **Economic benefits to individuals, communities, and the Commonwealth**

Discussion

An appreciation of the differences in normal sleep patterns and requirements of the developing school-aged and adolescent child is central to the discussion concerning sleep/wake patterns and school start times. Adolescents typically require 8-10 hours of sleep per night (6, 7), yet many teens routinely only achieve 7 hours of sleep or less, particularly during the school week (8). The preponderance of the scientific literature on the topic suggests that early school start times (or any early morning required event) would pose a substantial and cruel burden to an adolescent's innate biology. At the start of adolescence, neurobiological changes to the adolescent's circadian system moves the release of nocturnal melatonin approximately 2 hours later relative to childhood timing, postponing the sleep-wake cycle and resulting in an approximate 2-hour physiologically based sleep phase delay (later onset sleep and wake) (9). Additionally, sleep "pressure" or "sleep drive" builds up more slowly in adolescents as compared to adults throughout the waking day and hence, further drives adolescents' ability to fall asleep to a later hour. There is also evidence that the adolescent circadian clock is less sensitive to light during the morning when light advances the circadian clock and its timing of sleep (10). All this causes teenagers to stay awake longer relative to children and adults, and makes it difficult for most teenagers to sleep any earlier than 11 p.m. The misalignment between the adolescent's natural circadian rhythm and early school start times results in chronic sleep loss and contributes to social jetlag (11), which is the phenomenon of attempting to recover the sleep debt from the week, usually by awakening much later on weekends. While "sleeping in" on weekends may not routinely be seen as a problem, social jetlag in U.S. teens is associated with unhealthy eating behaviors and obesity (12), and increased anxiety (13).

Middle and high school students that start school earlier are known to have a higher risk for achieving insufficient sleep time (14, 15) and showing altered brain development (16). Experience in districts that have delayed school start times has shown that sleep time in students does appropriately increase with this change (17, 18). The extension of sleep is shorter than the delay in school start times due to a typically small delay in bed times and longer delay in rise times (10, 15).

From an academic standpoint, sleep quality has been associated inversely and significantly with academic performance (16, 19). Various studies using sleep restriction protocols have demonstrated the worsening of several neurocognitive functions such as memory, attention, and executive function as a consequence of sleep loss (20-22). In an earlier study from 2001, based on Arlington County public schools, tenth grade students' first period grades improved after a 45-minute start time delay; no significant change was noted in seventh grade students' first period grades after a 20-minute advance of school start times (15). Later start times have been associated with reduced tardiness and daytime sleepiness (17, 23), as well as reduced suspensions and higher course grades among a group of disadvantaged students (24).

Sleep-deprived teenaged drivers can present significant dangers on the road, at times resulting in injury and death. A survey of Fairfax County teens found that 76.6% reported drowsy driving, which was more frequent when there was shorter school-night sleep duration (25). A study of two adjacent, demographically similar Southeastern Virginia cities with strikingly different high school start times (75-80 minutes) revealed that the city with earlier start times (Virginia Beach) demonstrated a significantly

higher adolescent motor vehicle crash rate relative to Chesapeake (which had later high school start times), suggesting early high school starts may pose a significant driving risks to teens (26). These results were replicated in a study of two adjacent, demographically similar Central Virginia counties with distinctly different high school start times: teens from Chesterfield County, who started 85 minutes earlier on average, had significantly higher crash rates than those from Henrico County (27). Delaying high school start times can provide some benefit in Virginia. After Fairfax County delayed high school start times by 50 minutes, there was a significant decrease in adolescent motor vehicle crash rate, compared with just 2 years earlier (28). Similarly, findings from Forsyth, NC estimated an overall decrease of approximately 14% in per capita crash rates of following a 75 minute change in the countywide high school start time, concluding that later high school start times after 8:30 a.m. seemed associated with reduced adolescent crash rates (29). This is especially concerning since novice teen drivers (within 18 months of obtaining their licenses) have already been found to have 4 times the crash and near-crash rate of adults (30). A 2018 American Academy of Pediatrics Policy Statement, entitled The Teen Driver (31), supported delaying high school start times to address “adolescent chronobiology and associated safety risks.”

Sleep quantity and quality adversely impact mental health outcomes and risk-taking behaviors in teenagers. In Fairfax county adolescents (8th, 10th, and 12th graders), a reduction in weeknight sleep was associated with greater chances of feeling hopeless, suicidal thoughts and attempts, and substance use (32). In another national study, a direct relationship was demonstrated between sleep duration and suicidal planning, with an 11% reduction in suicide plans risk for every 1 hour increase in sleep duration (33). Teens who are sleep deprived (obtaining <8 hours of sleep at night) are much more likely to engage in risky behaviors, such as drug and alcohol use, get lower grades, and be at greater risk for car crashes (34). One Swedish study examined a shorter (20 minute) delay in start times (7:40 a.m. to 8:00 a.m.) and did not find this to be associated with any changes in the outcomes examined (behavioral persistence, tiredness, positive attitude towards life); with the authors concluding that the likely that the 20 minute delay may have been insufficient to result in meaningful change (35). Some other studies have suggested delayed school start times are associated with significant reductions in depressed mood, and irritability or annoyance among students at boarding schools (36, 37). Furthermore, a delay beyond 8:30 a.m. to a start time of 10 a.m. was associated with a decrease in student illness over a 2 year period and improvements in the number of students making good academic progress (38).

More appropriate start times for middle and high schools may help to address sleep health disparities (39-41). The impact of start times is not equal among all students, including in Virginia (32). Delaying start times for these schools improves academic performance overall, with larger effects demonstrated in those with lower test scores (42) or who are otherwise disadvantaged (24). However, research on this area has been limited with sometimes conflicting results; more study is needed on this topic.

Delaying school start times in Virginia would have tremendous positive economic effects within a few years of implementation. With delayed school start times, there would be higher academic achievement (evidenced by increased graduation rates), a reduction in mental health disorders and treatment, and fewer preventable deaths from motor vehicle crashes and suicide. This would lead to a more educated, robust, and productive workforce (43). In Virginia, the economic gain per student just two years after

implementation of a delayed start time is estimated to be around \$595 per student. Overall, the modeling and data suggest that the long term positive economic benefits far outweigh any short term costs. After five years, the gain is estimated to increase to \$2129 per student; over 20 years, the gain reaches a staggering \$10,765 per student per year (43). Another study estimated that delaying school start times would result in \$17,500 (in 2011 dollars) in increased future earnings per student, while the cost to the system is as little as \$0 to \$1,950 per student over the course of each student's school career (44). This comparatively modest investment required to delay school start times could thus result in billions of dollars of economic gain for the Commonwealth.

Special considerations

The VASM does not endorse any single plan for achieving delayed middle and high school start times. The diversity of Virginia and Virginians requires that any plan take into account a number of factors unique to each local community.

The mutually compatible goals of delaying school start times are to align the daily school schedule with the time of day in which adolescents are most alert, and to allow middle and high school students the most opportunity to achieve sufficient sleep time. There are some circumstances around the state, such as rural areas or specialty schools, which require extended commutes; in these cases, even later start times may be warranted.

The VASM makes no recommendations regarding start times for elementary schools in Virginia.

Summary

The VASM endorses the 2017 AASM position statement that middle and high schools should begin no earlier than 8:30 a.m. The existing and updated scientific literature repeatedly identifies the detrimental impact of early high school start times, and the benefits of delaying start times, on the safety and well-being of students in Virginia. The adverse effects of early school start times on Virginia's students have been demonstrated, with regards to academic performance, mental health, and driving risks. Data published since the AASM position paper highlight these dangers further. Importantly, recent studies also demonstrate some of the benefits that can come from delaying school start times, including improved academic performance and attendance, reduced depression and suicidality, positive economic impact, and reduction of adolescent motor vehicle crashes.

Early middle and high school start times significantly contribute to the public health epidemic of sleep deprivation in adolescents and its attendant harmful consequences. Thus, addressing start times, a modifiable risk factor, can not only address the teen sleep loss epidemic but also lead to increased productivity, attention, vigilance/safety, performance, and improved health in this vulnerable population.

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References

1. Watson NF, Martin JL, Wise MS, Carden KA, Kirsch DB, Kristo DA, 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 Clinical Sleep Medicine*. 2017;13(04):623-5. doi:10.5664/jcsm.6558.
2. Shapiro TR. Fairfax County high schools to push back start times next fall. *The Washington Post*. 2014 October 24, 2014.
3. Harper J. Virginia Beach School Board reverses course, votes to keep school start times the same. *The Virginian-Pilot*. 2019 December 10, 2019.
4. Gregory S. Norfolk schools will delay changes to start times until at least 2021. *The Virginian-Pilot*. 2020 March 4, 2020.
5. Average start time and percentage distribution of start time for public high schools, by state: 2017–18: National Center for Education Statistics; [cited 2021 September 27, 2021]. Available from: https://nces.ed.gov/surveys/ntps/tables/ntps1718_202000602_s1s.asp.
6. Paruthi S, Brooks LJ, D'Ambrosio C, Hall WA, Kotagal S, Lloyd RM, 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(06):785-6. doi: 10.5664/jcsm.5866.
7. Hirshkowitz M, Whiton K, Albert SM, Alessi C, Bruni O, DonCarlos L, et al. National Sleep Foundation's sleep time duration recommendations: methodology and results summary. *Sleep Health: Journal of the National Sleep Foundation*. 2015;1(1):40-3. doi: 10.1016/j.sleh.2014.12.010.
8. Wheaton AG, Jones SE, Cooper AC, Croft JB. Short Sleep Duration Among Middle School and High School Students — United States, 2015. *MMWR Morb Mortal Wkly Rep*. 2018;67(3):85-90. doi: 10.15585/mmwr.mm6703a1.
9. Widome R, Berger AT, Iber C, Wahlstrom K, Laska MN, Kilian G, et al. Association of Delaying School Start Time With Sleep Duration, Timing, and Quality Among Adolescents. *JAMA Pediatrics*. 2020;174(7):697-704. doi: 10.1001/jamapediatrics.2020.0344.
10. Dunster GP, de la Iglesia L, Ben-Hamo M, Nave C, Fleischer JG, Panda S, et al. Sleepmore in Seattle: Later school start times are associated with more sleep and better performance in high school students. *Science Advances*. 2018;4(12):eaau6200. doi: 10.1126/sciadv.aau6200.
11. Wittmann M, Dinich J, Mellow M, Roenneberg T. Social Jetlag: Misalignment of Biological and Social Time. *Chronobiology International*. 2006;23(1-2):497-509. doi: 10.1080/07420520500545979.

12. Mathew GM, Hale L, Chang A-M. Social jetlag, eating behaviours and BMI among adolescents in the USA. *British Journal of Nutrition*. 2020;124(9):979-87. Epub 05/28. doi: 10.1017/S0007114520001804.
13. Mathew GM, Li X, Hale L, Chang A-M. Sleep duration and social jetlag are independently associated with anxious symptoms in adolescents. *Chronobiology International*. 2019;36(4):461-9. doi: 10.1080/07420528.2018.1509079.
14. Lewin DS, Wang G, Chen YI, Skora E, Hoehn J, Baylor A, et al. Variable School Start Times and Middle School Student's Sleep Health and Academic Performance. *Journal of Adolescent Health*. 2017;61(2):205-11. doi: 10.1016/j.jadohealth.2017.02.017.
15. Wheaton AG, Chapman DP, Croft JB. School Start Times, Sleep, Behavioral, Health, and Academic Outcomes: A Review of the Literature. *Journal of School Health*. 2016;86(5):363-81. doi: 10.1111/josh.12388.
16. Urrila AS, Artiges E, Massicotte J, Miranda R, Vulser H, Bézivin-Frere P, et al. Sleep habits, academic performance, and the adolescent brain structure. *Scientific Reports*. 2017;7(1):41678. doi: 10.1038/srep41678.
17. Bowers JM, Moyer A. Effects of school start time on students' sleep duration, daytime sleepiness, and attendance: a meta-analysis. *Sleep Health*. 2017;3(6):423-31. doi: 10.1016/j.sleh.2017.08.004.
18. Minges KE, Redeker NS. Delayed school start times and adolescent sleep: A systematic review of the experimental evidence. *Sleep Medicine Reviews*. 2016;28:86-95. doi: 10.1016/j.smrv.2015.06.002.
19. Bugueño M, Curihual C, Olivares P, Wallace J, López-Alegría F, Rivera-López G, et al. [Quality of sleep and academic performance in high school students]. *Revista medica de Chile*. 2017;145(9):1106-14. doi: 10.4067/s0034-98872017000901106.
20. Beebe DW, Rose D, Amin R. Attention, Learning, and Arousal of Experimentally Sleep-restricted Adolescents in a Simulated Classroom. *Journal of Adolescent Health*. 2010;47(5):523-5. doi: 10.1016/j.jadohealth.2010.03.005.
21. Sadeh A, Gruber R, Raviv A. The effects of sleep restriction and extension on school-age children: what a difference an hour makes. *Child development*. 2003;74(2):444-55. doi: 10.1111/1467-8624.7402008.
22. Lufi D, Tzischinsky O, Hadar S. Delaying school starting time by one hour: some effects on attention levels in adolescents. *J Clin Sleep Med*. 2011;7(2):137-43.
23. Thacher PV, Onyper SV. Longitudinal Outcomes of Start Time Delay on Sleep, Behavior, and Achievement in High School. *Sleep*. 2016;39(2):271-81. doi: 10.5665/sleep.5426.
24. Bastian KC, Fuller SC. Answering the Bell: High School Start Times and Student Academic Outcomes. *AERA Open*. 2018;4(4):2332858418812424. doi: 10.1177/2332858418812424.
25. Owens JA, Dearth-Wesley T, Herman AN, Whitaker RC. Drowsy Driving, Sleep Duration, and Chronotype in Adolescents. *The Journal of Pediatrics*. 2019;205:224-9. doi: 10.1016/j.jpeds.2018.09.072.
26. Vorona RD, Szklo-Coxe M, Wu A, Dubik M, Zhao Y, Ware JC. Dissimilar Teen Crash Rates in Two Neighboring Southeastern Virginia Cities with Different High School Start Times. *Journal of Clinical Sleep Medicine*. 2011;07(02):145-51. doi: doi:10.5664/jcsm.28101.
27. Vorona RD, Szklo-Coxe M, Lamichhane R, Ware JC, McNallen A, Leszczyszyn D. Adolescent Crash Rates and School Start Times in Two Central Virginia Counties, 2009-2011: A Follow-up Study to a Southeastern Virginia Study, 2007-2008. *Journal of Clinical Sleep Medicine*. 2014;10(11):1169-77. doi: doi:10.5664/jcsm.4192.
28. Bin-Hasan S, Kapur K, Rakesh K, Owens J. School start time change and motor vehicle crashes in adolescent drivers. *Journal of Clinical Sleep Medicine*. 2020;16(3):371-6. doi: doi:10.5664/jcsm.8208.
29. Foss RD, Smith RL, O'Brien NP. School start times and teenage driver motor vehicle crashes. *Accident Analysis & Prevention*. 2019;126:54-63. doi: 10.1016/j.aap.2018.03.031.

30. Simons-Morton BG, Klauer SG, Ouimet MC, Guo F, Albert PS, Lee SE, et al. Naturalistic teenage driving study: Findings and lessons learned. *Journal of Safety Research*. 2015;54:41.e29-44. doi: 10.1016/j.jsr.2015.06.010.
31. Alderman EM, Johnston BD, ADOLESCENCE CO, COUNCIL ON INJURY V, PREVENTION P. The Teen Driver. *Pediatrics*. 2018;142(4):e20182163. doi: 10.1542/peds.2018-2163.
32. Winsler A, Deutsch A, Vorona RD, Payne PA, Szklo-Coxe M. Sleepless in Fairfax: The Difference One More Hour of Sleep Can Make for Teen Hopelessness, Suicidal Ideation, and Substance Use. *Journal of Youth and Adolescence*. 2015;44(2):362-78. doi: 10.1007/s10964-014-0170-3.
33. Fitzgerald CT, Messias E, Buysse DJ. Teen Sleep and Suicidality: Results from the Youth Risk Behavior Surveys of 2007 and 2009. *Journal of Clinical Sleep Medicine*. 2011;07(04):351-6. doi: 10.5664/JCSM.1188.
34. Wahlstrom KL, Owens JA. School start time effects on adolescent learning and academic performance, emotional health and behaviour. *Current opinion in psychiatry*. 2017;30(6):485-90. doi: 10.1097/ycp.0000000000000368.
35. Das-Friebel A, Gkiouleka A, Grob A, Lemola S. Effects of a 20 minutes delay in school start time on bed and wake up times, daytime tiredness, behavioral persistence, and positive attitude towards life in adolescents. *Sleep Medicine*. 2020;66:103-9. doi: 10.1016/j.sleep.2019.07.025.
36. Boergers J, Gable CJ, Owens JA. Later school start time is associated with improved sleep and daytime functioning in adolescents. *J Dev Behav Pediatr*. 2014;35(1):11-7. doi: 10.1097/dbp.000000000000018.
37. Owens JA, Belon K, Moss P. Impact of Delaying School Start Time on Adolescent Sleep, Mood, and Behavior. *Archives of Pediatrics & Adolescent Medicine*. 2010;164(7):608-14. doi: 10.1001/archpediatrics.2010.96.
38. Kelley P, Lockley SW, Kelley J, Evans MDR. Is 8:30 a.m. Still Too Early to Start School? A 10:00 a.m. School Start Time Improves Health and Performance of Students Aged 13–16. *Frontiers in Human Neuroscience*. 2017;11(588). doi: 10.3389/fnhum.2017.00588.
39. Hale L, Troxel W, Buysse DJ. Sleep Health: An Opportunity for Public Health to Address Health Equity. *Annual Review of Public Health*. 2020;41(1):81-99. doi: 10.1146/annurev-publhealth-040119-094412.
40. Hale L, Troxel W. Embracing the School Start Later Movement: Adolescent Sleep Deprivation as a Public Health and Social Justice Problem. *American Journal of Public Health*. 2018;108(5):599-600. doi: 10.2105/ajph.2018.304381.
41. Jackson CL, Walker JR, Brown MK, Das R, Jones NL. A workshop report on the causes and consequences of sleep health disparities. *Sleep*. 2020;43(8). doi: 10.1093/sleep/zsaa037.
42. Edwards F. Early to rise? The effect of daily start times on academic performance. *Economics of Education Review*. 2012;31(6):970-83. doi: 10.1016/j.econedurev.2012.07.006.
43. Hafner M, Stepanek M, Troxel WM. The economic implications of later school start times in the United States. *Sleep Health: Journal of the National Sleep Foundation*. 2017;3(6):451-7. doi: 10.1016/j.sleh.2017.08.007.
44. Jacob BA, Rockoff JE. Organizing Schools to Improve Student Achievement: Start Times, Grade Configurations, and Teacher Assignments. *The Hamilton Project, Brookings Institution*, 2011.