

SPECIAL ARTICLES

Delaying Middle School and High School Start Times Promotes Student Health and Performance: An American Academy of Sleep Medicine Position Statement

Nathaniel F. Watson, MD, MS¹; Jennifer L. Martin, PhD²; Merrill S. Wise, MD³; Kelly A. Carden, MD⁴; Douglas B. Kirsch, MD⁵; David A. Kristo, MD⁶; Raman K. Malhotra, MD^{7,8}; Eric J. Olson, MD⁹; Kannan Ramar, MD⁹; Ilene M. Rosen, MD, MS¹⁰; James A. Rowley, MD¹¹; Terri E. Weaver, PhD, RN¹²; Ronald D. Chervin, MD, MS¹³; for the American Academy of Sleep Medicine Board of Directors

¹University of Washington Medicine Sleep Disorders Center and Department of Neurology, University of Washington, Seattle, Washington; ²Veteran Affairs Greater Los Angeles Health System, North Hills, California and David Geffen School of Medicine at the University of California, Los Angeles, Los Angeles, California; ³Methodist Healthcare Sleep Disorders Center, Memphis, Tennessee; ⁴Saint Thomas Medical Partners - Sleep Specialists, Nashville, Tennessee; ⁵Carolinas Healthcare Medical Group Sleep Services, Charlotte, North Carolina; ⁶University of Pittsburgh, Pittsburgh, Pennsylvania; ⁷SLUCare Sleep Disorders Center; ⁸Department of Neurology, Saint Louis University, St. Louis, Missouri; ⁹Division of Pulmonary/Sleep/Critical Care, Mayo Clinic, Rochester, Minnesota; ¹⁰Division of Sleep Medicine, Department of Medicine, Perelman School of Medicine at the University of Pennsylvania, Philadelphia, Pennsylvania; ¹¹Wayne State University, Detroit, Michigan; ¹²College of Nursing, University of Illinois at Chicago, Chicago, Illinois; ¹³University of Michigan Sleep Disorders Center, University of Michigan, Ann Arbor, Michigan

During adolescence, internal circadian rhythms and biological sleep drive change to result in later sleep and wake times. As a result of these changes, early middle school and high school start times curtail sleep, hamper a student's preparedness to learn, negatively impact physical and mental health, and impair driving safety. Furthermore, a growing body of evidence shows that delaying school start times positively impacts student achievement, health, and safety. Public awareness of the hazards of early school start times and the benefits of later start times are largely unappreciated. As a result, the American Academy of Sleep Medicine is calling on communities, school boards, and educational institutions to implement start times of 8:30 AM or later for middle schools and high schools to ensure that every student arrives at school healthy, awake, alert, and ready to learn.

Keywords: health, high school, middle school, performance, student

Citation: Watson NF, Martin JL, Wise MS, Carden KA, Kirsch DB, Kristo DA, Malhotra RK, Olson EJ, Ramar K, Rosen IM, Rowley JA, Weaver TE, Chervin RD. Delaying middle school and high school start times promotes student health and performance: an American Academy of Sleep Medicine position statement. *J Clin Sleep Med.* 2017;13(4):623–625.

The American Academy of Sleep Medicine (AASM) is the leading professional society dedicated to the promotion of sleep health. As the leading voice in the sleep field, the AASM improves sleep health and promotes high-quality, patient-centered care through advocacy, education, strategic research, and practice standards. The AASM has a combined membership of more than 10,000 accredited member sleep centers and individual members, including physicians, scientists, and other health care professionals, many of whom are involved in higher education. The AASM is dedicated to advancing sleep health policy to improve the health and well-being of the general public.

- Adolescent mental health and psychological well-being
- Adolescent driving safety

POSITION

The AASM asserts that middle school and high school start times should be 8:30 AM or later to support:

- An adequate opportunity for adolescents to obtain sufficient sleep on school nights
- Optimal alertness in the classroom environment to facilitate peak academic performance
- Reduced tardiness and school absences to foster improved opportunities for learning

DISCUSSION

As children progress into their teenage years, they experience delayed patterns of melatonin secretion and a slower build-up of homeostatic sleep pressure during wakefulness.¹ These changes reflect a delayed circadian rhythm that contributes to later sleep onset and later morning awakening, with teenagers typically struggling to fall asleep before 11:00 PM.² The AASM recommends that teenagers 13 to 18 years of age should sleep 8 to 10 hours per 24 hours on a regular basis to promote optimal health, and this recommendation has been endorsed by the American Academy of Pediatrics, Sleep Research Society, and American Association of Sleep Technologists.^{3–6} Because sleep onset is not instantaneous, and it is normal to spend some time awake in bed during the sleep period, a teenager who goes to bed at 11:00 PM would need to sleep until 7:30 AM or later in order to obtain sufficient sleep. Early middle school and high school start times work contrary to this change in adolescent circadian physiology and truncate students' sleep

opportunity, resulting in chronic sleep loss.⁷ Presently, 68.4% of United States high school students sleep 7 hours or less on school nights, while only 23.2% sleep 8 hours, 6.0% sleep 9 hours, and 2.4% sleep 10 hours or more.⁸

Short sleep in adolescents is associated with poor school performance, obesity, metabolic dysfunction and cardiovascular morbidity, increased depressive symptoms, suicidal ideation, risk-taking behaviors, athletic injuries, and increased motor vehicle accident risk.^{9–17} Increased motor vehicle accident risk is particularly concerning because young, novice drivers have a higher crash risk when sleep deprived, and motor vehicle crashes account for 35% of all deaths and 73% of deaths from unintentional injury in teenagers.^{18–20}

Importantly, a delay in school start time has beneficial impacts on teenage students. Studies show that implementation of later school start times for adolescents is associated with longer total sleep time, reduced daytime sleepiness, increased engagement in classroom activities, and reduced first-hour tardiness and absences.^{7,21–23} Delayed school start times also are associated with reduced depressive symptoms and irritability.^{21,22} Reaction time improves, and crash rates decline by 16.5%, following a school start time delay of 60 minutes.^{12,13} Extension of sleep time also facilitates behavioral weight loss interventions in adolescents.²⁴

While an operational change in school start times does not automatically assure longer sleep durations, this change, coupled with inclusion of relevant and targeted educational materials regarding the importance of sleep into middle school and high school curricula, will help motivate students, teachers, and parents to prioritize sleep and implement healthy sleep practices. This includes a cool, dark, quiet sleep environment; adequate time for 8 to 10 hours of sleep per night; consistent bedtimes and wake times on weekdays and weekends; a regular bedtime routine to cue the body that sleep is imminent; and morning light exposure. Furthermore, the use of sleep-disrupting electronic devices near bedtime or during the night should be avoided, because light emitted from electronic devices, particularly blue wavelengths, can suppress the production of melatonin and contribute to difficulty falling asleep.²⁵ These practices will benefit the student regardless of school start time.

The compelling rationale for delayed school start times must be conveyed to all stakeholders including students, families, teachers, school administrators, school boards, athletic directors, coaches, and transportation workers. These efforts should focus on the importance of sleep for health, safety, performance, and student well-being in order to maximize the desired effect of helping adolescents get the sleep they need. Middle school and high school administrators also need to understand the importance of preventing extracurricular activities, including team practices and workouts, from being scheduled before 8:30 AM.

Although adequate sleep duration is necessary, it alone is insufficient to ensure optimal student performance. Good sleep quality, appropriate timing and regularity of sleep, and the effective treatment of sleep disorders also are essential. Parents of students who are experiencing extreme difficulty awakening to arrive at school on time, or who experience significant

daytime sleepiness, should consider scheduling a consultation with the adolescent's primary care provider or a sleep medicine specialist to evaluate for a sleep disorder, regardless of the student's school start time.

CONCLUSIONS

Every middle school and high school student deserves the opportunity to start school awake, alert, and ready to learn. The benefits of later school start times have gained attention in recent years in the eyes of the public, school boards, educators, researchers, and physician organizations.²⁶ However, there are substantial gaps between published scientific knowledge and public awareness of the untoward consequences of early start times and, conversely, the important benefits of later start times. Based on the available evidence, the AASM calls on primary academic institutions, school boards, parents, and policy makers to raise public awareness and improve education in order to promote a national standard of middle school and high school start times of 8:30 AM or later. The AASM also encourages a collaborative and participatory approach among all stakeholders to support school boards as they overcome a variety of real and perceived barriers to the implementation of delayed school start times.

REFERENCES

- Jenni OG, Achermann P, Carskadon MA. Homeostatic sleep regulation in adolescents. *Sleep*. 2005;28(11):1446–1454.
- Crowley SJ, Acebo C, Carskadon MA. Sleep, circadian rhythms, and delayed phase in adolescence. *Sleep Med*. 2007;8(6):602–612.
- Paruthi S, Brooks LJ, D'Ambrosio C, et al. Recommended amount of sleep for pediatric populations: a consensus statement of the American Academy of Sleep Medicine. *J Clin Sleep Med*. 2016;12(6):785–786.
- Frey S, Balu S, Greusing S, Rothen N, Cajochen C. Consequences of the timing of menarche on female adolescent sleep phase preference. *PLoS One*. 2009;4(4):e5217.
- Carskadon MA, Acebo C, Seifer R. Extended nights, sleep loss, and recovery sleep in adolescents. *Arch Ital Biol*. 2001;139(3):301–312.
- Roenneberg T, Kuehne T, Pramstaller PP, et al. A marker for the end of adolescence. *Curr Biol*. 2004;14(24):R1038–R1039.
- Morgenthaler TI, Hashmi S, Croft JB, Dort L, Heald JL, Mullington J. High school start times and the impact on high school students: what we know, and what we hope to learn. *J Clin Sleep Med*. 2016;12(12):1681–1689.
- Wheaton AG, Olsen EO, Miller GF, Croft JB. Sleep duration and injury-related risk behaviors among high school students--United States, 2007-2013. *MMWR Morb Mortal Wkly Rep*. 2016;65(13):337–341.
- Wahlstrom K, Dretzke B, Gordon M, Peterson K, Edwards K, Gdula J. Examining the impact of later school start times on the health and academic performance of high school students: a multi-site study. University of Minnesota Libraries Digital Conservancy website. <http://conservancy.umn.edu/handle/11299/162769>. Published February 2014. Accessed February 13, 2017.
- 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. *J Youth Adolesc*. 2015;44(2):362–378.
- Milewski MD, Skaggs DL, Bishop GA, et al. Chronic lack of sleep is associated with increased sports injuries in adolescent athletes. *J Pediatr Orthop*. 2014;34(2):129–133.

12. Danner F, Phillips B. Adolescent sleep, school start times, and teen motor vehicle crashes. *J Clin Sleep Med*. 2008;4(6):533–535.
13. 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. *J Clin Sleep Med*. 2014;10(11):1169–1177.
14. Mitchell JA, Rodriguez D, Schmitz KH, Audrain-McGovern J. Sleep duration and adolescent obesity. *Pediatrics*. 2013;131(5):e1428–e1434.
15. Au CT, Ho CK, Wing YK, Lam HS, Li AM. Acute and chronic effects of sleep duration on blood pressure. *Pediatrics*. 2014;133(1):e64–e72.
16. Azadbakht L, Kelishadi R, Khodarahmi M, et al. The association of sleep duration and cardiometabolic risk factors in a national sample of children and adolescents: the CASPIAN III study. *Nutrition*. 2013;29(9):1133–1141.
17. Meininger JC, Gallagher MR, Eissa MA, Nguyen TQ, Chan W. Sleep duration and its association with ambulatory blood pressure in a school-based, diverse sample of adolescents. *Am J Hypertens*. 2014;27(7):948–955.
18. Martiniuk AL, Senserrick T, Lo S, et al. Sleep-deprived young drivers and the risk for crash: the DRIVE prospective cohort study. *JAMA Pediatr*. 2013;167(7):647–655.
19. Hutchens L, Senserrick TM, Jamieson PE, Romer D, Winston FK. Teen driver crash risk and associations with smoking and drowsy driving. *Accid Anal Prev*. 2008;40(3):869–876.
20. Miniño A. Mortality among teenagers aged 12–19 years: United States, 1999–2006. *NCHS Data Brief*. 2010;(37):1–8.
21. Owens JA, Belon K, Moss P. Impact of delaying school start time on adolescent sleep, mood, and behavior. *Arch Pediatr Adolesc Med*. 2010;164(7):608–614.
22. 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):11–17.
23. Vedaa Ø, Saxvig IW, Wilhelmsen-Langeland A, Bjorvatn B, Pallesen S. School start time, sleepiness and functioning in Norwegian adolescents. *Scandinavian Journal of Educational Research*. 2012;56(1):55–67.
24. Valrie CR, Bond K, Lutes LD, Carraway M, Collier DN. Relationship of sleep quality, baseline weight status, and weight-loss responsiveness in obese adolescents in an immersion treatment program. *Sleep Med*. 2015;16(3):432–434.
25. Chang AM, Aeschbach D, Duffy JF, Czeisler CA. Evening use of light-emitting eReaders negatively affects sleep, circadian timing, and next-morning alertness. *Proc Natl Acad Sci U S A*. 2015;112(4):1232–1237.
26. Adolescent Sleep Working Group, Committee on Adolescence, Council on School Health. School start times for adolescents. *Pediatrics*. 2014;134(3):642–649.

SUBMISSION & CORRESPONDENCE INFORMATION

Submitted for publication February 1, 2017

Submitted in final revised form February 1, 2017

Accepted for publication February 2, 2017

Address correspondence to: Nathaniel F. Watson, MD, MS, University of Washington Medicine Sleep Center, Box 359803, 325 Ninth Avenue, Seattle, WA 98104-2499; Tel: (206) 744-4337; Fax (206) 744-5657; Email: nwatson@uw.edu

DISCLOSURE STATEMENT

The authors comprise the 2016–2017 board of directors of the American Academy of Sleep Medicine, with the exception of Dr. Wise, who completed his term on the board in June 2016.