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Delayed high school start times later than 8:30 AM and impact on graduation rates and attendance rates

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ABSTRACT

Objectives: The first purpose of this study was to investigate changes in high school graduation rates with a delayed school start time of later than 8:30 AM. The second aim of the study was to analyze the association between a delayed high school start time later than 8:30 AM and attendance rates.
Design: In the current study, a pre-post design using a repeated-measures analysis of variance was used to examine changes in attendance and graduation rates 2 years after a delayed start was implemented.
Setting: Public high schools from 8 school districts (n = 29 high schools) located throughout 7 different states. Schools were identified using previous research from the Children's National Medical Center's Division of Sleep Medicine Research Team.
Participants and measurements: A total membership of more than 30,000 high school students enrolled in the 29 schools identified by the Children's National Medical Center's Research Team. A pre-post design was used for a within-subject design, controlling for any school-to-school difference in the calculation of the response variable. This is the recommended technique for a study that may include data with potential measurement error.
Results: Findings from this study linked a start time of later than 8:30 AM to improved attendance rates and graduation rates.
Conclusions: Attendance rates and graduation rates significantly improved in schools with delayed start times of 8:30 AM or later. School officials need to take special notice that this investigation also raises questions about whether later start times are a mechanism for closing the achievement gap due to improved graduation rates.

Introduction

Sleep experts agree that school start times are not in synchronization with adolescent sleep cycles, affecting learning and overall well-being of students.[1,2] Proven scientifically, the drive to fall asleep and alert from sleep shifts during adolescence.[3,4,5] Previous studies suggest that adolescents need 9 hours or more a night to function at peak performance,[4,6,7] making 8:30 AM or later an ideal start time for adolescent sleep/wake cycles.[8–12] School start times influence wake times but other factors impact bedtimes. Two national convenience samples were studied to compare changes in bedtime and wake time from 1981 and 2003-2006 among adolescent students 15 to 17 years old. Findings from this comparative study indicated that over the span of time, socioeconomic factors and daytime activities predicted weekday bedtime and school start time predicted weekday wake time.[13] If irregular pubertal sleep patterns result in a decreased sleep drive before 11:00 PM because the adolescent body begins to produce melatonin at 11:00 PM and stops at about 8:00 AM,[10,14] then only a small window of time exists to obtain optimum sleep. Using basic math calculations, it is evident that the amount of sleep recommended is difficult if not impossible to obtain based on the majority of existing bell schedules. To date, a concern lingers that a failure to shift start times may lead to chronic sleep deprivation in high school students. A disconnect occurs because the only way to overcome sleep deprivation is to increase nightly sleep time to satisfy biological sleep needs, a solution that is not an option for most adolescents given the existing bell times.[15]

To draw more attention to the commonly accepted practice of setting early bell schedules, on August 6, 2015, the Centers for Disease Control and Prevention released information outlining the school start times of 40,000 middle and high schools.[16] The report indicated that fewer than 20% of middle and high schools start at 8:30 AM or

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later.[16] More specifically, 42 states reported that 75% to 100% of public schools start before 8:30 AM[16] Survey findings raise awareness about the reluctance by school officials to adjust bell schedules to match adolescent sleep patterns.[17] Furthermore, decisions to condone existing start times persist despite politician and physician attempts to urge local district and state leaders to consider scientific evidence before setting bell times.[18–20] Stated clearly in a 2005 study published in *Pediatrics*,[5] physicians concluded boldly that decision makers set students up for failure by endorsing traditional school schedules. The plea to delay start times is not only expressed by physicians but also by politicians that have called for federal oversight to enact public policies that align to the sleep/wake cycle.[19] Reasons to dismiss schedule changes vary; however, one argument against the implementation for later school start times is due to a belief by stakeholders that delayed adolescent sleep onset is a behavioral choice, influenced by factors such as socializing with peers and accommodating late job schedules.[21] This stance seems counterintuitive given that evidence suggests that biological processes of the sleep/wake cycle, and not merely teen preferences, are responsible for the delay in drive for sleep.[4,5]

Consequences of inadequate sleep

An important research finding to consider is that insufficient sleep has been associated with an increase in suicidal attempts, suicidal ideation, substance abuse, and depression in adolescents.[22] Studies showed that inadequate and fragmented sleep impacts student well-being. Winsler and colleagues[22] surveyed adolescents (n = 27,939) and conclude that a shortened duration of sleep by 1 hour increased feelings of hopelessness, doom, suicidal ideations, attempted suicides, and substance abuse. Furthermore, insomnia and major depression were 2 symptoms related to sleep quality and quantity in a 2013 study.[23] The study revealed teens that attempted suicide were found to have higher rates of insomnia and sleep disturbance.[24] Experts stress that the relationship between sleep disturbance and completed suicide is important to recognize and further suggest that this could be used as an indicator to initiate intervention and prevention efforts in teens at risk for suicide.[24]

Other high-risk behaviors associated with inadequate sleep have been investigated. Increased rates of automobile accidents were related to earlier start times.[25] Specifically, a study in Virginia found that students that started school at 8:30 AM or later had fewer car accidents.[26] Students that attended early classes were more likely to participate in criminal activity and had a higher incidence of engagement in risk-taking behaviors such as drug or alcohol abuse.[27] Furthermore, inadequate sleep in teens has been linked to more problems with regulation of emotions and higher rates of mood disorders.[28,29] O'Brien and Mindell[29] conclude from self-reports (Sleep Habits Survey and Youth Behavior Survey) distributed to 388 adolescent participants (14-19 years) that students that slept fewer hours reported greater alcohol use than students that slept longer on school nights. Teens that do not obtain an adequate amount of sleep are also more likely to smoke cigarettes, engage in sexual activity, and use marijuana.[27,30]

Benefits of sufficient sleep

Evidence suggests that a delay in school start time promotes improvement in attendance and tardiness during first-period classes.[12,31] In Wahlstrom's[11] study, 18,000 Minneapolis high school students (9th-11th grade) showed an improvement in grades and attendance rates when bell times changed from 7:15 AM to 8:40 AM.[12] In this study, there was a significant improvement in attendance rates for 9th to 11th grade students not continuously enrolled in the same high school, with speculation offered that continuously enrolled students already had high attendance rates predelay start time so changes were not as remarkable.[12] Researchers note in the 1998 School Start Time Study that students attending schools with later start times were significantly less likely to arrive to class late because of oversleeping, compared with peers attending schools with earlier start times.[32] Research that compared the academic outcomes of 2 different middle schools in New England showed that students at the earlier starting school were tardy 4 times more frequently.[33] Edwards[34] also finds later start times related to decreased absences. Recently, in a 3-year study with 9000 students in 8 public high schools over 3 states, Wahlstrom and colleagues[35] found significant increases in attendance and reduced tardiness with a start time of 8:35 AM or later.

Importance of stakeholder consideration to adjust bell times

The decision to continue to set high school start times earlier than 8:30 AM supports the hypothesis that school officials are not using scientific evidence as the basis for their actions. With all of the current emphasis on improving K-12 education, the potential of this study to demonstrate significant changes in attendance and graduation rates of students simply by adjusting school start times is a critical component of educational reform and of critical importance to educational leaders. Scientific research has established the link between adolescent circadian rhythms, sleep debt, and negative impacts on cognitive function, behavior, attendance, health difficulties, and social and emotional health.

Prior research conducted by Wahlstrom[11] examined the effects of school start times in various districts with conclusions linked to improved graduation rates in only 1 school district 3 years after the implementation of a delayed start time of 8:30 AM. Extended research that examines the impact of delayed start times in other districts throughout the country will add rigor to the previous findings. Therefore, the first aim of this investigation is to compare predelay (8:30 AM or earlier) graduation completion rates with postdelay (later than 8:30 AM) graduation rates in the same 8 school districts 2 years after implementation. The second purpose of this study is to assess whether attendance rates improve with a delay in school start time of later than 8:30 AM in the morning.

Participants and methods

This study examines the impact of delayed school start times on the percentage of high school absences and graduation rates at the school level. The data for the study are from *School Start Time Change: An In-Depth Examination of School Districts in the United States*[36] from the Children's National Medical Center's (CNMC) Division of Sleep Medicine predelay and postdelay school start times. The CNMC team collected data from school districts throughout the nation that successfully implemented delayed start times in high schools. Additional data, graduation rates, and attendance rates are obtained from state repositories. The current research was conducted using the data from the state repositories of 29 schools in 7 states and 8 school districts (of 38 districts in the original study) specifically collecting attendance and graduation rates at 2 periods (predelay and postdelay). This design controls for school-to-school differences and eliminates competing explanations for any observed changes in the response variables. It is acknowledged that not all schools calculate the response variables using the same methodology. However, as mentioned, the design of the study, a within-subject design, allows for any school-to-school difference in the calculation of the response variable to be controlled for. In addition, the analytical technique used for this study, a general linear model (analysis of variance, or ANOVA), reduces measurement error (any school to school variability) to a greater extent than a difference score analysis, and has