Impact of Delaying School Start Time on Adolescent Sleep, Mood, and Behavior

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Objective: To examine the impact of a 30-minute delay in school start time on adolescents’ sleep, mood, and behavior.

Design: Participants completed the online retrospective Sleep Habits Survey before and after a change in school start time.

Setting: An independent high school in Rhode Island.

Participants: Students (n=201) in grades 9 through 12.

Intervention: Institution of a delay in school start time from 8 to 8:30 AM.

Main Outcome Measures: Sleep patterns and behavior, daytime sleepiness, mood, data from the Health Center, and absences/tardies.

Results: After the start time delay, mean school night sleep duration increased by 45 minutes, and average bedtime advanced by 18 minutes (95% confidence interval, 7-29 minutes [$t_{423}=3.36; P<.001$]); the percentage of students getting less than 7 hours of sleep decreased by 79.4%, and those reporting at least 8 hours of sleep increased from 16.4% to 54.7%. Students reported significantly more satisfaction with sleep and experienced improved motivation. Daytime sleepiness, fatigue, and depressed mood were all reduced. Most health-related variables, including Health Center visits for fatigue-related complaints, and class attendance also improved.

Conclusions: A modest delay in school start time was associated with significant improvements in measures of adolescent alertness, mood, and health. The results of this study support the potential benefits of adjusting school schedules to adolescents’ sleep needs, circadian rhythm, and developmental stage.


A number of important biologically based changes in sleep regulation occur during adolescence. Beginning at the onset of puberty, adolescents develop as much as a 2-hour sleep-wake phase delay (later sleep onset and wake times) relative to sleep-wake cycles in middle childhood.1,2 These changes are associated with delayed evening onset of melatonin secretion and are expressed as a shift in circadian phase preference from “morningness” to “eveningness.” Alterations in the regulatory homeostatic sleep drive during adolescence are such that the accumulation of sleep propensity during the time awake appears to be slower relative to younger children. Thus, it is typically easier for adolescents to delay sleep onset. At the same time, adolescent sleep needs do not decrease dramatically, and optimal sleep amounts remain at about 9 to 9 1/4 hours per night. On a practical level, this means that the average adolescent has difficulty falling asleep before 11 PM, and the ideal wake time is around 8 AM.

In addition to the impact of these biological factors, environmental factors and lifestyle/social demands such as homework, extracurricular activities, and after-school jobs can significantly affect sleep patterns in adolescents.5-7 Significant variability is seen in sleep-wake patterns from weekday to weekend, often accompanied by sleeping late on weekends in an attempt to address the chronic sleep debt accumulated during the week.8 This phenomenon of weekend oversleep further contributes to circadian disruption and decreased daytime alertness levels.9

Given these findings, it is not surprising that a large number of studies have now documented that the average adolescent is chronically sleep deprived and pathologically sleepy.10,11 For example, a recent National Sleep Foundation poll found that 80% of adolescents in the United States were getting less than the recommended 9 hours of sleep on school nights. Other studies of adolescents across different environments and in different cultures have reported similar findings in regard to in-
sufficient sleep amounts and irregular sleep-wake sched-
ules.13-15 As a result, high school students are at consid-
erable risk for adverse consequences associated with
inadequate sleep, including impairments in mood, at-
tention, memory, behavioral control, and quality of life.15-20
Inadequate sleep is especially likely to take a toll on aca-
demic performance.20 Multiple studies have shown an
association between decreased sleep duration and lower aca-
demic achievement at the middle school, high school, and
college levels.21-24 as well as a decreased motivation to
learn.25 Specific health-related effects of sleep loss may
include an increased number of driving accidents rel-
ted to drowsiness,26 a lack of exercise,27 an increased
risk for weight gain and obesity,27 and an increased use
of stimulants (eg, caffeine, prescription medications).28

In light of these myriad negative effects on adoles-
cent health and well-being, the identification of poten-
tially modifiable factors that escalate the risk of insuffi-
cient sleep in this population is an important public health
issue. Multiple studies have now suggested that, in par-
ticular, the early start times of many high schools, as well
as some middle schools, may significantly contribute to
inadequate sleep in adolescents.10-13,20,28 Studies compar-
ning schools with start times as little as 30 minutes ear-
lier vs those with later start times have demonstrated the
following adverse consequences: shorter sleep dura-
tion, increased sleepiness, difficulty concentrating, and
behavioral problems.33-35 Conversely, several longitudi-
nal studies have suggested that delaying school start times
may have a significant positive effect on a variety of out-
comes, ranging from decreased dropout and tardiness rates
and increased daily attendance rates to an improvement
in academic grades and standardized test scores and de-
creased rates of motor vehicle crashes related to drowsi-
ness while driving.26,36,37

The aim of this study was to assess the impact of a de-
lay in school start time from 8 to 8:30 AM at an indepen-
dent school in the northeastern United States. Specifi-
cally, student self-reported sleep patterns and behaviors
and sleepiness-related variables were assessed by the ad-
ministration of an online retrospective survey before and
after the 2-month trial period of the change in start times.
School administrative data regarding Health Center vis-
its, dining hall statistics, and tardiness/absences were also
collected before and after the intervention.

METHODS

SAMPLE

The study site was an independent coeducational college prepa-
atory boarding and day school serving grades 9 to 12 and located
in southern New England. Total enrollment for the 2008-2009 aca-
demic year was 357; 190 students (53.2%) were girls, 291 (81.5%)
were boarders, and 66 (18.5%) were day students. Boarders come
from more than 30 states and 20 foreign countries; about 12% are
international students, and 18% are nonwhite.

The daily class schedule is from 8 AM to 3 PM, 4 days per
week; 8 AM to 1 PM on Wednesday; and 8 to 11 AM on Satur-
day. From January 6 to March 6, 2009, the school start time
was delayed to 8:30 AM. To avoid extending the length of the
school day, academic and nonacademic periods (student life,
music programs, etc), assemblies, and afternoon activities (ie,
athletics, theater, etc) were reduced by 5 to 10 minutes.

For boarding students, school night lights-out schedules and
procedures in the dormitories did not change. For grade 9, lights-
out time was 10:30 PM; for grade 10, 11 PM; and for grade 11,
11:30 PM. Seniors (grade 12) were required to be in their dorms
at 11:30 PM but had no official lights-out time. There was no
lights-out schedule on Saturday nights: students were re-
quired to be in their dormitories by 11 PM (grades 9 and 10) or
11:45 PM (grades 11 and 12). Students were not allowed to use
any electronics (eg, computers or cell phones) after lights out
and received a room restriction for any violations. There was
no set wake-up time on Sunday.

PROCEDURES

Parents or legal guardians of all students were initially contacted
by the school administration by e-mail approximately 2 weeks
before the first survey distribution (December 25, 2008) and in-
formed about the study. In a separate subsequent e-mail and sev-
eral reminder e-mails from the principal investigator (J.A.O.), all
parents were asked to give consent for their child’s participation
in the study by clicking on a link in the e-mail that took them to
a secure server (http://www.surveymonkey.com/).

All students were asked to bring their laptops to their regu-
larly scheduled group advisory meeting, access an e-mail mes-
sage from the research assistant (K.B.), and complete the elec-
tronic assent form for the survey. Students who agreed to
participate were then asked to complete the survey online dur-
ing the advisory meeting; students who declined to participate
could not access the survey online. Students who had not re-
ceived parental permission to complete the survey were in-
structed to work on classroom assignments during the survey
administration period. Students who had not received paren-
tal consent to participate in the first survey were not allowed to
complete the second survey (March 5, 2009).

Each survey was assigned a code number and did not con-
tain names or other information that would identify students
personally or allow them to be matched to their survey re-
sponses. Access to the data from all completed surveys was re-
stricted to the principal investigator and research assistant. This
study was approved by the institutional review board of the spon-
soring organization, Lifespan Hospitals of Rhode Island.

MEASURES

The Sleep Habits Survey is a comprehensive 8-page self-report
survey that has been administered to more than 3000 high school
students in Rhode Island,22 as well as to high school students in
a number of other countries.34,39 The Sleep Habits Survey asks about
typical sleep and wake behaviors during the previous week and
includes a Sleepiness Scale and Sleep-Wake Behavior Problems
Scale, Depressed Mood Scale, and assessment of morningness/
eveningness. The Sleepiness Scale is a modified version of the Eps-
worth Sleepiness Scale, which rates sleepiness under various con-
titions; a higher score indicates a greater propensity to fall asleep.
The Sleep-Wake Behavior Problems Scale contains 15 items that
reflect a combination of difficulties with sleep initiation and main-
tenance, as well as other sleep-related problems (eg, night-
mares); a higher score indicates more sleep problems. Minor modi-
fications were made to some of the items for the study population.
The survey took approximately 25 minutes to complete.

To assess the effect on health outcomes, during the 2 weeks
before the first and second survey administrations, the Health
Center created a report regarding Health Center visits, missed
morning appointments, overnight admissions, late pass re-
quests (for a first-period class), and requests to rest in the Health
Center for the academic day or in the afternoon during sports. Food Services also recorded the types and numbers of foods consumed at breakfast during the months of December and February. In addition, the office of the Dean of Students tracked first-period tardies/absences during both time periods.

### Statistical Analyses

Descriptive statistics were calculated for the different components of the survey instrument. We used appropriate parametric and nonparametric statistics, including independent samples t tests, χ² analyses, regressions, and correlations to compare sleep patterns and behaviors, daytime sleepiness, and mood before and after the delay of the start time. Tests for skewness when data were not normally distributed were performed; for all non-normal distributions, data were transformed to achieve normality, and both the transformed and nontransformed data were analyzed. Because there were no significant differences in the results, analyses on the nontransformed data were preserved. Significance level was set at P < .05.

### Results

A total of 278 students received parental permission and were eligible to complete the study (77.9% of all students); 54.3% were girls. Of those students who had received consent, 225 (80.9%) completed survey 1 (57.3% were female) and 201 students completed survey 2 (89.3% of students completing survey 1; 57.2% were female). There were no significant differences in participation rates across grades 9 to 12. The mean age of students participating in survey 1 was 16.4 years and in survey 2 was 16.6 years. At surveys 1 and 2, 82.2% and 87.1% of students, respectively, reported getting mostly Bs or better in academic grades, and 99.5% intended to get at least a college degree.

Table 1 and Table 2 show self-reported mean sleep duration, bedtimes, and wake times. There was a significant increase in sleep duration on school nights of 45 minutes (7 hours 52 minutes vs 7 hours 7 minutes; 95% confidence interval [CI] −49 to −27 minutes; t₁₄₀₁=6.35; P < .001) after the change in school start time. As expected, this was partially explained by a later average wake time at survey 2 (7:25 vs 6:54 AM at survey 1; 95% CI, −36 to −24 minutes [t₁₄₀₁=−10.10; P < .001]). However, the average bedtime on school nights was significantly earlier (18 minutes; 95% CI, 7-29 minutes [t₁₄₀₁=3.36; P < .001]) at survey 2 than at survey 1. The percentage of students getting at least 9.0 hours, 8.0 to 8.9 hours, 7.0 to 7.9 hours, 6.0 to 6.9 hours, and less than 6.0 hours of sleep in surveys 1 and 2 also differed significantly across surveys for school nights (χ²=96.83; P < .001) (Figure 1).

Although non-school night sleep duration was less and average bedtime was earlier at survey 2 compared with survey 1, these differences did not reach statistical significance (difference in sleep duration: −12 minutes; 95% CI, −11 to 25 minutes [t₁₄₀₁=0.79; P = .43]; difference in bedtime: −23 minutes; −2 to 48 minutes; [t₁₄₀₁=1.79; P = .07]) (Table 1). The distribution of sleep amounts was also not significantly different for non-school nights (χ²=3.95; P = .55) (Figure 2). The difference between non-school night and school night bedtimes was also not significant at surveys 1 or 2 (1 hour 17 minutes vs 1 hour 12 minutes; 95% CI, −21 to 30 minutes [t₁₄₀₁=0.43; P = .73]). Weekend oversleep (the difference between school day and non-school day wake times), however, was significantly greater at survey 1 (3 hours 28 minutes vs 2 hours 55 minutes; 95% CI, 19-46 minutes [t₁₄₀₁=4.74; P < .001]).

There was a significant main effect of grade level on sleep duration (regardless of survey; F=28.32; P < .001), with 11th and 12th graders getting significantly less sleep than 9th and 10th graders on school nights; there was a difference of nearly 40 minutes between 9th and 12th graders (P < .001). There was no sex difference in average duration of school night sleep, and there were no interactions among sex, grade, and survey. Self-reported sleep needs were identical across surveys (8.9 hours); most of the students rated themselves as definitely or closer to being an evening type than a morning type (survey 1, 73.2%; survey 2, 75.7%).

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**Table 1. Mean Self-reported Sleep Duration, Bedtimes, and Wake Times by Survey (S) and Grade Level on School Nights and Non–School Nights**

<table>
<thead>
<tr>
<th></th>
<th>Overall</th>
<th>Grade 9</th>
<th>Grade 10</th>
<th>Grade 11</th>
<th>Grade 12</th>
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</thead>
<tbody>
<tr>
<td><strong>School nights</strong></td>
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<tr>
<td>Sleep duration, h:min</td>
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<td></td>
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</tr>
<tr>
<td>S1</td>
<td>7:07 (0.46)</td>
<td>7:52 (1:13)</td>
<td>7:20 (0.50)</td>
<td>8:11 (0.36)</td>
<td>7:13 (0.47)</td>
</tr>
<tr>
<td>S2</td>
<td>7:01 (0.48)</td>
<td>7:47 (1:12)</td>
<td>7:22 (0.51)</td>
<td>8:13 (0.38)</td>
<td>7:15 (0.50)</td>
</tr>
<tr>
<td><strong>Bedtime</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>S1</td>
<td>11:39 PM (0.51)</td>
<td>11:21 PM (0.94)</td>
<td>11:14 PM (0.54)</td>
<td>10:54 PM (0.37)</td>
<td>11:31 PM (0.46)</td>
</tr>
<tr>
<td>S2</td>
<td>11:36 PM (0.50)</td>
<td>11:20 PM (0.93)</td>
<td>11:13 PM (0.52)</td>
<td>10:53 PM (0.36)</td>
<td>11:30 PM (0.45)</td>
</tr>
<tr>
<td><strong>Wake time</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>6:54 AM (0.29)</td>
<td>7:25 AM (0.32)</td>
<td>6:44 AM (0.31)</td>
<td>7:13 AM (0.37)</td>
<td>6:55 AM (0.26)</td>
</tr>
<tr>
<td>S2</td>
<td>6:52 AM (0.28)</td>
<td>7:24 AM (0.31)</td>
<td>6:43 AM (0.30)</td>
<td>7:12 AM (0.30)</td>
<td>6:52 AM (0.24)</td>
</tr>
</tbody>
</table>

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**Table 2. Mean Self-reported Sleep Duration, Bedtimes, and Wake Times by Survey (S) and Grade Level on Non–School Nights**

<table>
<thead>
<tr>
<th></th>
<th>Overall</th>
<th>Grade 9</th>
<th>Grade 10</th>
<th>Grade 11</th>
<th>Grade 12</th>
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</thead>
<tbody>
<tr>
<td><strong>Non-school nights</strong></td>
<td></td>
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<tr>
<td>Sleep duration, h:min</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>9:32 (1.46)</td>
<td>9:20 (1.27)</td>
<td>9:26 (1.32)</td>
<td>9:12 (1.08)</td>
<td>9:45 (1.26)</td>
</tr>
<tr>
<td>S2</td>
<td>9:28 (1.45)</td>
<td>9:18 (1.25)</td>
<td>9:23 (1.31)</td>
<td>9:11 (1.07)</td>
<td>9:42 (1.24)</td>
</tr>
<tr>
<td><strong>Bedtime</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>12:56 AM (1:03)</td>
<td>12:33 AM (0.51)</td>
<td>12:55 AM (1:17)</td>
<td>12:50 AM (1:10)</td>
<td>12:39 AM (0.57)</td>
</tr>
<tr>
<td>S2</td>
<td>12:49 AM (1:02)</td>
<td>12:28 AM (0.50)</td>
<td>12:47 AM (1:09)</td>
<td>12:42 AM (1:04)</td>
<td>12:35 AM (0.53)</td>
</tr>
<tr>
<td><strong>Wake time</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>10:22 AM (1:18)</td>
<td>10:20 AM (1:11)</td>
<td>10:22 AM (1:07)</td>
<td>10:02 AM (0.56)</td>
<td>10:23 AM (1:12)</td>
</tr>
<tr>
<td>S2</td>
<td>10:18 AM (1:16)</td>
<td>10:08 AM (1:07)</td>
<td>10:10 AM (1:00)</td>
<td>10:01 AM (0.54)</td>
<td>10:15 AM (1:05)</td>
</tr>
</tbody>
</table>

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*Data are expressed as mean (SD). For bedtimes and wake times, the standard deviations are expressed as hours:minutes.

b Significantly different from the other survey mean (P < .001).
In contrast, the percentage of students reporting difficulty falling asleep at least several times a week vs never was not significantly different at surveys 1 and 2 (OR, 0.90; 95% CI, 0.49-1.34; \( \chi^2 = 0.12; P = .76 \)). The mean (SD) score on the Sleep-Wake Behavior Problems Scale was significantly higher at survey 1 (31.5 [6.92]) than at survey 2 (25.6 [7.63]; 95% CI, 4.38-7.31: \( t_{315} = 7.86; P < .001 \)).

Table 3 details changes in students' perception of daytime sleepiness and related impairments across surveys; all these differences were all highly significant across time (\( P < .001 \) for all). Differences in the Sleepiness Scale scores were also highly significant (28.5 vs 22.9; mean difference, 5.65; 95% CI, 4.05-7.25; \( t_{392} = 6.85; P < .001 \)) but did not differ by grade or between day and boarding students; girls had higher Sleepiness Scale scores compared with boys (\( F = 22.46; P < .001 \)). The number of students who required assistance with waking on school mornings (ie, alarm clock, parents/dormitory monitor, or roommate) compared with those who reported wak-
percentage of students rating themselves as at least somewhat unhappy or depressed also decreased significantly from survey 1 (65.8%) to 2 (45.1%; OR, 0.43; 95% CI, 0.29-0.64; \( \chi^2 = 17.81; P < .001 \)), as did the percentage feeling irritated or annoyed (84.0% vs 62.6%; OR=0.32; 95% CI, 0.20-0.51; \( \chi^2 = 24.62; P < .001 \)), and Depressed Mood Scale average scores decreased (1.84 vs 1.56; \( F = 27.80; P < .001 \)). Higher depression scores were also found in 11th and 12th graders (\( F = 8.06; P = .005 \)) and in girls compared with boys (\( F = 5.22; P = .02 \)) at survey 1; however, at survey 2 the differences in depression scores between grades (\( F = 0.54; P = .46 \)) and between girls and boys (\( F = 2.06; P = .15 \)) were not significant.

In terms of health consequences, significantly more students self-reported visiting the Health Center for fatigue-related symptoms at survey 1 vs survey 2 (15.3% vs 4.6%; \( \chi^2 = 14.50; P = .03 \)), whereas there was no difference in the number of students visiting the Health Center for medical or psychological concerns. Actual Health Center statistics (Table 4) showed a decline in missed morning appointments and late pass requests at survey 2; there was also a 56% decrease in requests for rest passes. Overnight admissions to the Health Center, however, increased, although this was believed to be at least partially owing to an influenza outbreak at the school during winter term. Food Services data showed a substantial increase in consumption of hot foods (ie, eggs and breakfast meals) at breakfast from December to February (35 vs 83 servings a month). Finally, teacher-reported first class absences/tardies decreased by 45.0% (Table 4).

The results of this survey study of students from an independent school support those of previous research studies examining the impact of delaying high school start times in public high schools settings. A modest (ie, 30-minute) start time delay was associated with a significant increase in self-reported sleep duration and a decrease in a number of ratings of daytime sleepiness. Perhaps more important, students rated themselves as less depressed and more motivated to participate in a variety of activities and were less likely to seek medical attention for fatigue-related concerns in conjunction with the change in start times. Furthermore, as in previous studies, depressive symptoms overall were nega-
tively correlated with reported sleep duration and increased in groups of students (ie, 11th- and 12th-grade students and girls) who reported getting less sleep or being more sleepy or both. Given the recent concerns raised regarding the relationship between insufficient sleep and both depressive symptoms and suicidal ideation in adolescents,38 this positive effect on mood associated with delaying the start time is particularly noteworthy.

Similar to the finding of previous studies,35,36 students in this study reported that their wake time was later after the start time change had been instituted, resulting in an increase in sleep duration. In contrast to the Minnesota study,35,36 which found that bedtimes did not change, in this study students reported going to bed earlier after start times were delayed, resulting in a greater-than-expected increase in average school night sleep duration of 45 minutes. Although this may have been partly owing to seasonal variations in bedtime, anecdotal student comments suggest that the perceived benefits of additional sleep motivated students to further modify their sleep-wake behaviors to optimize sleep duration (eg, “Well for me, ever since the 8:30 start, I have seen how much good 30 minutes of extra sleep does for me, so I have been inspired to... get an additional half hour on top of the 30 minutes.”). Furthermore, despite the initial considerable resistance voiced by the faculty and athletic coaches to instituting the start time delay and the original intentions of the school administration to return to the 8 AM start time after the trial period, students and faculty overwhelmingly voted to retain the 8:30 AM start for the spring term (a faculty quotation: “On a more personal note, I have found the 8:30 start, I have seen how much good 30 minutes of extra sleep does for me, so I have been inspired to... get an additional half hour on top of the 30 minutes.”). In addition, the high percentage of students living on campus also ensured considerable consistency in sleep practices (ie, evening electronic media exposure and lights-out timing) across surveys. We were also able to systematically collect data on a number of health-related outcomes, which would have been extremely challenging in a public school setting.

One of the concerns raised in regard to the potentially negative effects of delaying school start times is that the resultant opportunity for increased time in bed will not necessarily translate to an increase in sleep duration but rather to an increase in sleep onset latency and night wakings (ie, decreased sleep consolidation). However, students at survey 2 did not report an increase in difficulty falling asleep, and the Sleep Habits Survey Sleep-Wake Behavior Problems subscale score was actually lower at survey 2, implying that the increase in sleep duration and earlier reported bedtimes at survey 2 did not come at the expense of poorer quality of sleep and increased difficulty initiating sleep.

The percentage of students getting less than 7 hours of sleep after the change in school start time decreased by 79% (from 33.8% to 7.0%), and the percentage of students getting at least 8 hours of sleep increased from 16.4% to 54.7%. However, it should be pointed out that, even with this significant increase in average sleep duration, only a small minority of students (11%) reported getting the recommended 9 or more hours of sleep on school nights at survey 2. A weekend oversleep of almost 3 hours persisted, and a substantial percentage of students continued to report significant daytime sleepiness after the school start time change (eg, 66.2% reported being sleepy doing homework, 18.0% reported falling asleep in a morning class, and 36.3% reported napping). Thus, although the positive impact associated with delaying school start time by 30 minutes was striking and broad in scope, it fell far short of achieving the ideal, and additional schedule modifications and education of students regarding the impact of sleep loss and fatigue should be considered.

Clearly, the generalizability of these findings is limited by the setting in which they occurred; that is, there are limited parallels between a relatively small, independent, largely boarding school and the average American public high school. However, the highly structured environment and the unique student body of the study school offered some advantages in terms of assessing the impact of the start time change. We were able to compare the same group of students before and after the start time change, removing some confounds inherent in studies that have compared students from 2 different schools with earlier and later start times.34,35 For example, there was much less variability among this group of students in regard to after-school activities and homework requirements (as well as a virtual absence of after-school employment demands) compared with those in a typical high school environment.39 In addition, the high percentage of students living on campus also ensured considerable consistency in sleep practices (ie, evening electronic media exposure and lights-out timing) across surveys. We were also able to systematically collect data on a number of health-related outcomes, which would have been extremely challenging in a public school setting.

Additional study limitations include the lack of a control group of students who did not experience the change in school start times; as a result, we cannot attribute the positive changes in sleep duration and sleepiness to the change in start times alone. Because of confidentiality procedures, it was not possible to match individual presurvey and postsurvey responses, and thus we could assess changes in the aggregate only. Although data regarding frequency of napping were collected, we did not specifically ask for nap duration and thus were not able to assess changes in 24-hour sleep duration. Specific data were also not collected in regard to symptoms of sleep disorders, the presence of which may have affected sleepiness levels. Finally, the study was also based on retrospective subjective self-report data rather than objectively measured sleep variables. However, a previous study comparing Sleep Habits Survey self-report data with sleep diary–reported and actigraphically derived sleep patterns found a high correlation among measures.40

The ongoing debate regarding the more widespread institution of later start times for middle and high schools is a controversial one,41 and the logistical considerations in implementing delayed school start times in high schools are far from trivial. Thus, it is particularly important to continue to rigorously assess outcomes in those schools that have instituted these changes. The results of this study add to the growing literature supporting the potential benefits of adjusting school schedules to adolescents’ sleep needs, circadian rhythm, and developmental stage and of optimizing sleep and alertness in the learning environment.

Accepted for Publication: January 12, 2010.

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As a teenager you are at the last stage in your life when you will be happy to hear that the phone is for you.

—Fran Lebowitz, Social Studies