



## Effects of the Young Adolescent Sleep Smart Program on sleep hygiene practices, sleep health efficacy, and behavioral well-being<sup>☆,☆☆</sup>

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### ABSTRACT

**Objectives:** Using a social learning model, the aim of the Sleep Smart Program was to primarily improve sleep health behaviors and secondarily improve academic performance and behavioral well-being.

**Design:** Randomized control trial for a social learning-based preventive intervention program.

**Participants:** A diverse group of seventh graders from 2 urban, middle schools were randomly assigned, according to school, to an 8-session Sleep Smart Program (SS = 70) or a comparison group (comparison = 73). **Measurements:** Sleep patterns, sleep hygiene, and sleep health efficacy; academic performance; and behavioral well-being were assessed at 4 times of measure (baseline, postintervention, 2 follow-up times in eighth grade).

**Results:** SS seventh graders experienced significantly greater sleep health efficacy, improved physiological and emotional sleep hygiene, more time in bed, and earlier bedtimes vs comparison group. SS (vs comparison) participants also reported a significant decrease in internalizing behavior problems and sustained academic performance. Finally, although not maintained at time 4, SS participants continued to report improved sleep health efficacy at time 3, whereas the comparison group participants' sleep health efficacy declined.

**Conclusion:** The Sleep Smart preventive intervention was effective in improving sleep health efficacy, sleep hygiene, time in bed, and bedtimes; in maintaining grades; and in reducing internalizing behavior problems, yet these changes were not sustained at follow-up.

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### Introduction

Over the last 30 years, researchers, educators, and health care providers have recognized early adolescence as a developmental time that is unique and distinct from late childhood and later adolescence, usually defined as ages 10 to 15 years.<sup>1,2</sup> In particular, a nuanced understanding of adolescents' sleep requirements, schedules, and regulatory processes has emerged.<sup>3–7</sup> Laboratory and self-report data have demonstrated that adolescents sleep need of about 9 hours does not change from ages 10 to 17 years and, with the onset of puberty, they experience a circadian phase delay.<sup>3–5,8,9</sup>

Despite this stable or increased need, studies indicate that as early as age 12 (ie, sixth or seventh grade), adolescents obtain less sleep, experience increased daytime sleepiness, and report poor sleep hygiene, including using greater amounts of caffeine close to bedtime (BT) and engaging in screen-based activities that delay sleep.<sup>10–13</sup>

School schedules, extracurricular hours, and other environmental constraints are not beneficial to middle school- and high school-aged adolescents' sleep schedules and requirements.<sup>5,8,14,15</sup> In fact, over the course of early to late adolescence, teens develop a sleep debt by getting a minimal amount of sleep on school nights and then delaying, as well as oversleeping, on weekends.<sup>3,5,14,15</sup> The result is that even early adolescents are frequently absent or late for school, sleepy and moody during school hours, inattentive during class time, and struggle academically.<sup>14,16–18</sup> Furthermore, early adolescents with poor sleep hygiene practices such as consuming caffeine close to BT and/or engaging in physiologically arousing activities (eg, cell phone use, playing video/iPad games) report later BTs, more disturbed sleep throughout the night, and increased daytime sleepiness.<sup>10,19–23</sup> A recent systematic literature review concluded that studies consistently report a significant association between screen time and reduced sleep duration and increased sleep problems for children and adolescents.<sup>10</sup> Similarly, a recent meta-analysis documented that good sleep hygiene (eg, regular BTs, decreased technology use) and physical activity function as protective factors, largely under adolescents' control, and are associated with earlier BTs for 12- to 18-year-olds.<sup>23</sup> In comparison, a negative home environment and evening light, which is less likely to be under early adolescents' control, lead to later BTs. Despite the resounding agreement among health

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professionals that health habits need to be taught early in life,<sup>23–25</sup> only some school districts have started to include sleep hygiene as part of their numerous health education standards (eg, California, Michigan, and Virginia).<sup>26–28</sup> It is unclear, however, as to whether the focus is on teaching about sleep health vs working with adolescents to change their sleep health behaviors.

An increasing number of sleep education programs have been developed with the aim of improving adolescents' sleep practices by providing knowledge on the importance of sleep and strategies by which this change can be achieved. Cortesi et al<sup>29</sup> evaluated the effects of a 2-hour sleep educational program on a sample of Italian high school students. The targeted students and a comparison group were evaluated using a sleep knowledge test before the program, immediately after the program, and during a 3-month follow-up to assess the intervention's effectiveness. Both groups had poor baseline knowledge of sleep; but compared with the control group, the sleep education group showed an average 50% gain in the number of correct answers immediately after the course and good retention of information three months later. De Sousa et al<sup>30</sup> evaluated the effects of a 1-week school-based sleep hygiene program on sleep quality and daytime sleepiness in a small sample of high school-aged students in Brazil. Participants showed improved sleep-wake schedules and shorter sleep latencies reflecting promising behavioral changes; however, sleep quality and daytime sleepiness did not improve.

Moseley and Gradisar<sup>31</sup> developed a school-based sleep intervention program for high school-aged adolescents using a cognitive-behavioral therapy framework with four 50-minute classes over a 4-week period. To evaluate the program's effectiveness, a randomized controlled trial featured 2 groups (program class and control group) assessed at 3 time points. Moseley and Gradisar's<sup>31</sup> program successfully increased sleep knowledge; however, compared to the control group, sleep patterns did not improve. In a follow-up study, the researchers evaluated a motivational-based school intervention for improving adolescents' sleep.<sup>32</sup> Again, the intervention group (vs control) increased their sleep knowledge and their motivation to regularize their sleep schedules. Although the adolescents in the motivation-oriented program did not improve their sleep patterns or daytime functioning, the program participants showed a marked retention rate in sustained sleep knowledge, which may be a precursor to behavioral change. More recently, they evaluated school-based sleep education programs using adjunct bright light therapy and/or parental involvement within a motivational interviewing framework.<sup>33</sup> Contrary to their earlier studies, students reported decreased sleep onset latency and better mood ratings in addition to improved sleep knowledge in comparison to the control group. At a 6-week follow-up, improved sleep knowledge, mood, and decreased sleep onset latency were maintained. Nonetheless, bright light devices and parental involvement did not enhance the adolescents' behavioral changes, and it is not clear if the high school-aged participants maintained their knowledge or sleep changes beyond 6 weeks.

Taken together, these programs illustrate possible avenues to decreasing sleep restriction, improving sleep hygiene, and subsequent behavioral consequences for adolescents and demonstrate the value in raising healthy sleep-related behaviors for older adolescents. Few studies, however, have evaluated the effectiveness of sleep health programs for early adolescents.<sup>31–33</sup>

The current study examined the efficacy of the Sleep Smart Program (SS), a school-based sleep hygiene education program for improving early adolescents' sleep health efficacy, sleep hygiene practices, and patterns to ultimately improve academic performance and behavioral well-being. The program assumes 3-way dynamic interaction among personal/developmental factors (eg, sleep need), environmental influences (eg, sleep arrangements), and behavior (eg, caffeine, screen use). It was developed based on social learning

theory: informative instructions, participatory classroom activities (eg, role playing, age-appropriate games), personal goal setting (utilization of sleep goal charts and diaries), feedback, and reinforcement (relevant rewards and specific recommendations each session). The program used some of the social learning aspects of the Slice of Life program, designed to promote healthy eating and physical activity patterns for adolescents<sup>34</sup>, as well as the Great Sensations Program.<sup>35</sup> Students who participated in the Slice of Life program reported a significant improvement in knowledge and awareness regarding their eating habits and increased appropriate exercising.<sup>34</sup> Similarly, the Great Sensations Program, a nutrition-education project, was effective in decreasing consumption of salty snacks and in increasing the consumption of target or healthy snack foods.<sup>35</sup> The studies' outcomes suggested that school programs developed using social learning principles can be effective in facilitating important behavior changes for early adolescents. In addition, some aspects of the SS were influenced by the skill training model by Botvin et al,<sup>36</sup> which provides adolescents with the necessary knowledge, skills, and personal sleep health efficacy for resisting social influences to smoke or, in this case, drink caffeine and/or stay up late.

Thus, it was hypothesized that students who participated in the program (SS) would obtain more sleep, develop better physiological sleep hygiene practices, and report a greater sense of efficacy regarding their sleep habits than a comparison group that did not participate in the program. In addition, it was hypothesized that those in the SS group might perform better academically and evidence fewer behavioral problems.

## Methods

### *Study design and participants*

Seventh graders and their parents were recruited to participate from health classes in 2 urban, New England, public middle schools with delayed school start times of 8:37 AM. The schools were randomly assigned to either the SS or the comparison conditions before families were recruited for the study, with condition assigned by school rather than by individual classrooms to avoid cross-classroom contamination. Of approximately 300 seventh graders in 12 health classes across the 2 schools, 48% (143 seventh graders) consented to participate (parental consent, seventh grader assent). There was a 100% retention rate between times 1 and 2, whereas some participants left the study at times 3 and 4 largely due to leaving the school or the district (Ns reported in Figure). Of note, of those participants who left the study between times 2 and 3 or 3 and 4, there were no significant differences on any of the dependent variables. Participant characteristics are displayed in Table 1.

### *Procedures*

After November recruitment, baseline (time 1) assessment occurred during January of seventh grade for both the SS and comparison group participants. Then, during February to March, students in the SS condition participated in the 4-week (8 total sessions, twice a week) sleep hygiene program held at the same time and length as their regularly scheduled health class (ie, 40 minutes). Postsession (time 2) assessments for the SS and comparison groups took place 1-week after the end of the program. Sleep Smart booster sessions were held to review and reinforce the sleep smart strategies taught in the initial 8 sessions. The first booster session was held in May of seventh grade with the time 3 follow-up assessment for both groups in October to November of eighth grade. The second booster session was held in February of eighth grade with the time 4 follow-up assessment in April/May of eighth grade. Attendance for the 8 initial

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