Sleep Health 1 (2015) 66–74

Contents lists available at ScienceDirect

Sleep Health

Journal of the National Sleep Foundation

journal homepage: http://www.elsevier.com/locate/sleh

Evaluation of novel school-based interventions for adolescent sleep problems: does parental involvement and bright light improve outcomes?☆

Daniel Bonnar, MPsych(Clin) [a], Michael Gradisar, PhD [a,*], Lynette Moseley, MPsych(Clin) [a], Anne-Marie Coughlin, PhD, ClinPsych [a], Neralie Cain, MPsych(Clin) [a], Michelle A. Short, PhD [b]

[a] Flinders University, School of Psychology, Adelaide, South Australia, Australia
[b] Centre for Sleep Research, University of South Australia, Adelaide, South Australia, Australia

ARTICLE INFO

Article history:
Received 14 November 2014
Received in revised form 25 November 2014
Accepted 26 November 2014

Keywords:
Adolescent
Sleep
Delayed sleep phase
Depressed mood
Motivational interviewing
Light therapy

ABSTRACT

Objectives: The current study aimed to evaluate school-based motivational sleep education programs (SEPs) with adjunct bright light therapy (BLT) and/or parental involvement (PI).
Design: Randomized controlled trial.
Setting: Six high schools, matched on socio-economic status (SES).
Participants: A total of 193 adolescents (mean age, 16.3 ± 0.4 years, 79%f).
Intervention: Classes were randomly assigned to (i) SEP + BLT, (ii) SEP + PI, (iii) SEP + BLT + PI, or (iv) classes-as-usual (CAU). Sleep education programs involved 4 × 50 minute classes (over 4 weeks) based on a Motivational Interviewing framework (*Sleep Med* 2011;12:246-251). Students in BLT groups attempted a weekend phase advance using portable green light LED glasses (500 nm; 506 lux). Parents of PI groups watched a series of 4 YouTube clips (2-3 minutes in length) outlining their adolescent's learning in class and how they could assist. Students in the CAU groups continued their regular classes.
Measurements: Online questionnaires measuring sleep knowledge, sleep patterns (bedtime, sleep latency, total sleep time [TST], etc) and mood at preintervention and postintervention and 6-week follow-up. Intervention groups also completed a motivation-to-change questionnaire and provided qualitative feedback.
Results: Improvements in sleep knowledge (d = 0.59-0.88), sleep onset latency (d = 0.45-0.50), TST (d = 0.32-0.57), and mood (d = 0.24-0.46) were observed in all intervention groups relative to the CAU group. Similar improvements were observed in a subgroup of students identified as having delayed sleep timing (ie, sleep knowledge: d = 0.45-0.92; sleep onset latency: d = 0.59-0.82; TST: d = 0.82-1.18). Increases in motivation to regularize out of bedtimes, obtain morning bright light (BLT groups), and avoid sleeping-in on weekends occurred (all P < .005).
Conclusions: This motivational SEP produced meaningful and similar benefits for adolescents in all intervention groups. Longer BLT (ie, over school holidays) and more intensive parental inclusion should be investigated in future studies.

Introduction

A primary biologic regulatory process causing late sleep times during adolescence is delayed circadian timing, whereby the 24-hour circadian rhythm delays during adolescent development.[1] Psychosocial pressures (eg, study, part-time work, and peer influence) have been found to further compound adolescents' late sleep times.[2,3] Consequently, adolescents' can obtain insufficient sleep when late sleep times combine with early school start times.[4] To relieve accumulated sleep debt incurred during the school week, adolescents often sleep in on weekends.[1,2,5] Unfortunately, weekend sleep-ins prevent morning bright light (BL) exposure, which can help to regulate circadian rhythms and sleep timing.[1,6-8] Hence, a vicious cycle of delayed sleep timing and chronic sleep restriction can develop.

Delayed sleep timing and associated sleep restriction during adolescence are associated with a number of short-term consequences and long-term negative health consequences, including

☆ Australian New Zealand Clinical Trials Registry: ACTRN12613000975796.

* Corresponding author at: Flinders University, School of Psychology, GPO Box 2100, Adelaide, SA, 5001, Australia. Tel.: +61 8 82012192; fax: +61 8 82013877.
E-mail address: grad0011@flinders.edu.au (M. Gradisar).

http://dx.doi.org/10.1016/j.sleh.2014.11.002
2352-7218/

excessive sleepiness,[9] poor academic performance,[10] school nonattendance,[11] depressed mood,[12-14] and an increased risk of car accidents.[15] Hence, the significant impact from adolescent sleep difficulties highlights the need for appropriate interventions.

The widespread nature of adolescent sleep problems has prompted some researchers to suggest that this issue should be addressed within a public health framework rather than on an individual basis.[3,4] The school classroom and sleep education programs (SEPs) have been proposed as an ideal setting to modify and improve adolescents' sleep.[3,16] Accordingly, several studies have devised and implemented SEPs but have thus far shown little efficacy.[3] Most of these studies are also subject to methodological shortcomings such as small sample size, no control group, and/or no follow-up.[17-22] In an earlier study, Moseley and Gradisar[16] attempted to overcome these issues and trialed a cognitive-behavioral–based SEP with 81 high school students. Although students in the intervention increased their sleep knowledge and regularized their delayed sleep timing at postintervention, no long-term behavioral change occurred (at 6-week follow-up). A key finding was that adolescents were not motivated to change sleep behaviors.

To address the issue of low intrinsic motivation, Cain et al[23] adapted Moseley and Gradisar's[16] SEP to fit a motivational interviewing (MI) framework.[24,25] Results from 104 adolescents showed students in the SEP condition increased their sleep knowledge, and this time was motivated to increase sleep duration and regularize bedtimes relative to classes-as-usual students (CAU; the control condition). However, no significant improvements in sleep behaviors or mood were found. Two important findings from these studies were: (i) although students knew it was important to make behavioral changes (eg, regularize sleep timing), they were not confident in doing so, and (ii) students were reluctant to spend time outside obtaining BL to regulate sleep timing. To improve treatment outcomes in MI-structured SEP programs, additional support in these 2 areas is required.

One method of overcoming low confidence to affect change is to provide support from significant others.[23,25] Parental support could be incorporated into SEPs to increase adolescents' confidence in making and maintaining successful sleep-related behavioral change.[3] Evidence from clinical trials suggests that parental involvement (PI) in the regulation of adolescent sleep practices produces positive outcomes.[6] However, parent involvement in these studies typically consists of strict enforcement measures, such as parent-set bedtimes.[26] In contrast, it has been suggested that SEPs should aim to create environments in which adolescents feel supported by their parents to endorse healthier sleep practices while maintaining a sense of autonomy.[3] One possible way of achieving this objective is to provide sleep education to parents using a noninvasive method (eg, online videos) and encourage them to assist or engage in dialog if requested by their teenage child. Accordingly, one aim of the current study was to investigate whether the inclusion of parents in SEPs improved sleep and mood outcomes for students.

Bright light therapy (BLT) is a common intervention used to regularize the sleep patterns of adolescents with delayed sleep timing.[6-8,27] Incremental advances of wake-up time with immediate exposure to BL advances delayed circadian rhythms, thereby improving the timing of sleep patterns (ie, individuals fall asleep and wake up earlier).[28-31] Considering students are mostly unwilling to spend time outside immediately after waking, an alternative novel source of BL (eg, portable light devices) could better enable students to “re-time” their sleep patterns. Although BL devices have been used effectively with adolescents in clinical trials,[6-8,27] they have not yet been used in an SEP. Thus, a second aim of the current study was to evaluate whether including BL in an MI-structured SEP program would lead to improved outcomes.

The primary motive of the SEPs in the present study is to increase sleep knowledge and motivation-to-change sleep behaviors (eg, reducing weekend sleep-ins) to improve adolescents' sleep (ie, bedtimes, sleep onset latency, and total sleep time [TST]). However, it is also important to assess functional outcomes of sleep improvements.[32] Depressed mood has been recently quantified as likely stemming from sleep disturbance during adolescence.[13] Given the significant impact of both sleep and mood on adolescent morbidity and mortality,[33,34] the present study will investigate whether SEPs also improve depressed mood. Investigations will center on comparisons between adolescents in SEP classes vs CAU (control condition), as well as performing analyses on a subgroup of adolescents with delayed sleep timing.

Method

Participants

Participants were 193 year 11 students (mean age, 16.3 ± 0.4 years; 79%f) from 5 coeducational schools and 1 all-girls school in the Adelaide metropolitan area. Schools were matched on SES. The mode school start and end times were 8:40 am and 3:15 PM, respectively. Two classes from each school participated, acting as either a CAU (n = 52) or 1 of 3 intervention conditions: SEP + PI (n = 63), SEP + BL (n = 35), or SEP + PI + BL (n = 43). Figure 1 presents participant flow through the study. Year 11 students were selected for this study due to the increased occurrence and frequency of sleep difficulties in older adolescence,[5] while not having the workload associated with the final year of secondary schooling. As the SEP was interested in regularizing the sleep patterns of adolescents whose sleep timing was delayed, a subclinical group of students with delayed sleep timing (DST) (n = 88) was identified.[16,23] The 2 criteria selected to identify these students were discrepant weekday-weekend out-of-bedtimes (>2 hours) and reduced sleep duration on school nights (<8 hours). The only exclusion criterion was atypical development (ie, autism spectrum disorder, IQ disability); however, no students met this criterion. Seven students (4%) reported taking medications known to affect sleep, including antidepressants (n = 5), dexamphetamine (n = 1), and occasionally sleeping tablets (n = 1). Students were asked to make no changes to their medication use during the study. The study was approved by both the Southern Adelaide Clinical Human Research Ethics Committee and the Ethics Committee of the Department of Education and Child Development, South Australia.

Design

The study used a 4 (program: SEP + PI, SEP + BL, SEP + PI + BL, CAU) × 3 (time: preintervention, postintervention, 6-week follow-up) mixed-model design. Primary outcome measures were bedtime, TST, sleep onset latency (SOL) on school nights, and the secondary outcome of depressed mood.

Measures

Sleep knowledge

Sleep knowledge was measured using a quiz adapted from Cain et al.[23] Adolescents answered true, false, or don't know to 16 items relating to information about adolescent sleep. Correct answers were scored 1 and incorrect and “don't know” responses as 0. All groups completed the quiz preintervention and postintervention. Participants were not told they would be completing the quiz a second time so as to prevent studying. Internal consistency was $\alpha = .55$.