Journal of American College Health

ISSN: 0744-8481 (Print) 1940-3208 (Online) Journal homepage: http://www.tandfonline.com/loi/vach20

Development and Evaluation of the Sleep Treatment and Education Program for Students (STEPS)

Franklin C. Brown PhD , Walter C. Buboltz Jr. PhD & Barlow Soper PhD

To cite this article: Franklin C. Brown PhD , Walter C. Buboltz Jr. PhD & Barlow Soper PhD (2006) Development and Evaluation of the Sleep Treatment and Education Program for Students (STEPS), Journal of American College Health, 54:4, 231-237, DOI: 10.3200/JACH.54.4.231-237

To link to this article: http://dx.doi.org/10.3200/JACH.54.4.231-237

Published online: 07 Aug 2010.

Development and Evaluation of the Sleep Treatment and Education Program for Students (STEPS)

Franklin C. Brown, PhD; Walter C. Buboltz, Jr., PhD; Barlow Soper, PhD

Abstract. University students report significantly worse sleep quality than the general population. Sleep problems are related to increased health concerns, irritability, depression, fatigue, and attention and concentration difficulties, along with poor academic performance. Clinical research indicates that psychoeducational interventions are among the most effective methods for improving sleep quality in the general population. Similar studies for university students are lacking. In this study, the authors describe the development of the Sleep Treatment and Education Program for Students (STEPS) and evaluate its effectiveness with a double blind, experimental design. Students in the treatment group reported significantly improved sleep quality and sleep hygiene behaviors at 6 weeks posttreatment.

Key Words: difficulties, insomnia, prevention, sleep, students, treatment, university

College students are notorious for sacrificing sleep to study and socialize during the week and then sleeping long hours on the weekend.[1,2] If left unchecked, such habits can lead to progressively later sleep and wake times, missed classes, poor academic performance, and chronic sleep difficulties.[3] In recent studies, researchers found that only 11% of students met the criteria for good sleep quality,[4] more than 30% reported chronic severe sleep difficulties,[1,5,6] and at least 11% met the criteria for Delayed Sleep Phase Syndrome, which is indicated by progressively delayed sleep and wake times that interfere with sleep quality and daily functioning. In 1 study, researchers found a 13.3% reduction in the average sleep length among college students from 1969 (7.5 hours per night) to 1989 (6.5 hours per night),[7] suggesting insufficient sleep has become more common in recent years.

Sleep difficulties can contribute to physical, emotional, social, academic, and vocational problems. Among the general population, excessive sleepiness is associated with occupational accidents, job dismissal,[8] and almost 7 times more automobile accidents than individuals without known sleep disorders or subjective fatigue.[9,10] Insufficient sleep of less than 6 hours per night can contribute to a 50% reduction in T cells,[11] which can compromise the immune system. Among university students, poor sleep quality is related to emotional imbalance; feelings of tension, anger, depression, fatigue, and confusion; concentration and memory difficulties; and generally lower life satisfaction.[12] Although the cause is uncertain, daytime sleepiness is associated with increased marijuana and alcohol use.[13] Even students who get 8 hours of sleep but shift their sleep schedules by as little as 2 hours report greater depressive symptoms, lowered sociability, and more frequent attention and concentration difficulties.[14–16] Variable sleep schedules accounted for the greatest amount of variance in grades when compared with mood, stress level, social support, hours worked, gender, and age.[17] Furthermore, many students who experience academic difficulties do not realize that poor sleep habits may be contributing to their problems.[18]

Students with fewer than 8 hours of sleep per night may also miss sleep cycles that play a key role in the ability to store newly learned information.[19–21] Research results suggest that memory consolidation, or storing recent experiences, takes place during the rapid eye movement (REM) stage of sleep, when most dreaming occurs. In one study, students with increased REM sleep following intensive learning periods performed better on exams than those without such increases.[19] Students deprived of REM sleep in

Franklin C. Brown *is an assistant professor in the Department of Psychology at Eastern Connecticut State University in Willimantic, CT.* ***Walter C. Buboltz, Jr.****, is an associate professor and* ***Barlow Soper*** *is a professor at Louisiana Tech University in Ruston, LA.*

another study were less able to recall newly learned information than those with intact sleep, but interruption of the other sleep stages did not influence their performance.[20] The connection between REM sleep and learning is of particular importance for students who consistently receive fewer than 8 hours of sleep because the last 2 hours of sleep tend to be the most important for integrating new information.[21]

Although the poor sleep habits of some students may be related to a lifestyle of alcohol and drug abuse,[13] this is certainly not the case with all students. Many may not understand the impact of poor sleep quality and what constitutes good sleep habits. Some may mistakenly believe that sleep missed during the week can be recovered on weekends or that 8 hours of sleep is equally healthy, regardless of when it occurs. Such misconceptions clearly run counter to results of sleep research.[2,16,22–28] As a testimony to this, most students with unhealthy sleep habits also have poor awareness of behaviors that promote sleep.[3] This suggests that lack of knowledge and misinformation about proper sleep habits may contribute to poor sleep habits.

The effect that lack of information has upon the sleep of students is relatively good news. This suggests that disseminating proper information to students may improve their sleep habits. Results of meta-analytic studies indicate that psychoeducational sleep interventions, which are comparable to in-depth cognitive behavioral psychotherapy, are among the most effective techniques.[29–33] Sleep hygiene guidelines and stimulus control instructions are 2 psychoeducational sleep interventions that may prove to be particularly effective with university students.

Sleep hygiene guidelines list activities that can either help or hinder sleep. These include recommendations to completely eliminate caffeine intake or reduce it within 6 hours of bedtime, to reduce or eliminate alcohol consumption close to bedtime, to maintain a consistent sleep–wake schedule, to exercise daily, to eliminate late afternoon and evening naps, and to restrict early afternoon naps to less than 1 hour.[34] These instructions may also recommend morning exposure to bright light by going outside or exposure to an artificial bright lighting of at least 250 lumens, with brighter light producing quicker results.[35,36]

Stimulus control instructions focus on increasing the association between the bedroom and sleepiness. People with insomnia are instructed to use the bed only for sleep and sex; lie down only when sleepy; to get up, go to another room, and do something else (not work or school related) until they become sleepy, if they are unable to sleep within 10 minutes; to get up at the same time every day, regardless of the amount of sleep; and to avoid napping during the day.[37] These instructions are based on observations that insomniacs typically associate the bedroom with anxiety about falling asleep and other nonsleep activities.

Although researchers have suggested means to improve sleep habits among university students,[38] published articles in which authors evaluate such interventions with college students do not exist. Our purposes in this study are (1) to develop a manageable sleep education program, based on suggestions in the literature,[38] to prevent and treat sleep difficulties among students; (2) to evaluate the impact that such a program has on students' knowledge about healthy sleep habits and the importance of such habits; (3) to examine the extent to which students' sleep quality and habits improve after taking part in the psychoeducational program; and (4) to determine whether such a program can prevent students from developing sleep difficulties as the academic term progresses.

We used a double-blind, repeated-measures experimental design to examine the degree of within-subject change according to randomly assigned treatment and control conditions. We chose the double-blind design to reduce experimenter and participant expectation bias, and we used repeated-measures to control for preexisting group differences by measuring the degree of change among participants rather than simply using posttreatment group comparisons. We hypothesized that students in the treatment condition would report significantly greater improvement in their sleep hygiene knowledge, sleep habits, and sleep quality over a 6-week period compared with students in the control condition.

METHODS

Participants

We solicited participants from 2 introductory psychology classes during the early part of the fall term for several reasons. First, introductory psychology classes primarily consist of 1st-year students and therefore are somewhat comparable to university orientation classes, a potential venue for this intervention. Administering the treatment early during the academic term provides information about treatment and prevention efficacy because sleep habits tend to deteriorate as the academic term progresses.[39] The 2 chosen classes took place early during the day and therefore would ensure the probability that participants would be of traditional college age. Finally, introductory psychology is required by all majors and provides a representative sample of major areas of study.

The control condition initially consisted of 95 participants. At 6 weeks posttreatment, 66 (69%) of the original participants (22 men, 44 women) remained. Most of the attrition was due to students forgetting their chosen identification numbers, whereas 5 students were absent and 6 incorrectly completed the survey. The mean age was 19.52 years (SD = 2.96 years). Seventy-eight percent were freshmen, 10% sophomores, 7% juniors, and 5% seniors. The ethnicity makeup was 82% Caucasian, 14% African American, and 3% Hispanic.

The treatment condition initially consisted of 82 participants. At 6 weeks posttreatment, 56 (71%) of the original participants (28 men, 28 women) remained. As with the control group, most of the students who failed to complete the study did not provide a correct identification number, 7 students were absent, and 3 incorrectly completed the survey. The mean age was 19.39 years (SD = 2.45 years). Eighty-four percent were freshmen, 11% sophomores, 5%

juniors, and 5% seniors. The ethnicity makeup was 91% Caucasian, 6% African American, 2% Hispanic, and 2% Native American.

Materials

The Pittsburgh Sleep Quality Index (PSQI)[40] is a 19-item self-report questionnaire designed to measure sleep quality over a 1-month period. The items yield a Global Sleep Quality Score, ranging from 0 to 21, with higher scores indicating worse sleep quality. Scores greater than 5 are considered to meet the criteria for poor sleep quality. The global score is the sum of the 7 component scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction. The PSQI has a high degree of internal constancy (Cronbach's $\alpha = .83$) and equally high global test-retest reliability ($r = .85$). Buysse and colleagues[40] reported that a cutoff score of 5 correctly identified 88.5% of all patients and controls ($\kappa = .75$, $p < .001$), indicating a sensitivity of 89.6% and specificity of 86.5%. This same cutoff score correctly identified 84.4% of patients with disorders of initiating and maintaining sleep, 88% of disorders of excessive sleepiness, and 97% of depressives in the standardization sample.[40] Widespread use of the PSQI[12,41–43] facilitates comparison of the results of the present study with those of previous and future studies.

The Sleep Hygiene Awareness and Practices Scale (SHAPS)[44] has 3 sections. The Sleep Hygiene Awareness section has 13 items that measure the respondent's knowledge about whether certain activities (such as taking a nap or having a regularly scheduled bedtime) are helpful, disruptive, or neutral to sleep. Items are rated on a 7-point Likert-type scale, with 1 indicating very beneficial to sleep, 4 indicating neutral to sleep, and 7 indicating very disruptive to sleep. Converted scores (some are reverse scored) range from 13 to 39, with higher scores indicating lower sleep awareness. The Caffeine Awareness section measures awareness of whether 18 common foods, beverages, and nonprescription drugs contain caffeine. Scores can range from 0 to 100, based on the percentage of items the person answered correctly.[44] The Hygiene Practice section contains 19 items asking how many nights per week (0–7) respondents engage in certain activities known to promote or inhibit sleep. Total Hygiene Practice scores can range from 0 to 133, with higher scores indicating more practices that interfere with sleep.[44] Although Lacks and Rotert[44] did not supply reliability information for the SHAPS, researchers found in a recent study that the Sleep Hygiene Awareness section demonstrated acceptable internal reliability (Cronbach's $\alpha = .78$), the Caffeine Knowledge section had poor internal reliability (Cronbach's $\alpha = .47$), and the Sleep Hygiene Practices section had poor internal reliability (Cronbach's $\alpha = .55$).[45] The Sleep Hygiene Awareness section had acceptable test–retest reliability ($r = .76$, $p < .001$), the Caffeine Knowledge section had poor test–retest reliability ($r = .50$, $p < .001$), and the Sleep Hygiene Practices section had acceptable test–retest reliability ($r = .74$, $p < .001$).[45] Because of the poor psychometric properties of the caffeine awareness section, we did not use it in this study. The sleep hygiene practices section had poor internal consistency; this was likely due to the diverse nature of the questions. However, its stability over time suggested it was useful for this study.

The Sleep Habits Survey (SHS)[1] consists of 10 fill-in-the-blank items that ask for estimates of respondents' sleep habits, such as their sleep time during the week and the weekend. The SHS is descriptive in nature and does not have internal reliability statistics because each item is for a separate behavior (wake time, bedtime, time to fall asleep) and has not been converted to a standardized scale.

We developed the Sleep Treatment and Education Program for Students (STEPS) for this study based on recommendations in the literature.[38] It includes a 30-minute oral presentation (approximately) and handouts that include sleep hygiene guidelines, stimulus control instructions, and information about substances with caffeine. The oral presentation is a script that is read verbatim to groups of college students. It begins by explaining the purpose of STEPS, followed by a brief summary describing the impact sleep difficulties can have on mood and academic performance. The script then reviews the Sleep Hygiene Guidelines, Substances with Caffeine, and Stimulus Control Instructions handouts. The basic premise for the Sleep Hygiene Guidelines and Stimulus Control Instructions handouts were discussed in the preceding literature review. The Substances with Caffeine handout lists the caffeine content of 17 commonly used substances, including beverages such as coffee and colas, foods such as chocolate cake, and medications such as diet pills.

Procedure

We recruited participants from 2 large introductory psychology classes at a mid-sized university in the southern United States, with the prior approval of the university human subjects committee. We assigned the 2 classes, which started within 30 minutes of each other but on different days, to treatment and control conditions. We informed participants orally and in writing that participation was voluntary and that results would be treated anonymously. Both groups completed a packet containing a demographics questionnaire, the PSQI,[40] SHAPS,[44] and the SHS[1] prior to the treatment condition and at 6 weeks posttreatment.

A graduate student volunteer, unaware of the hypotheses of the study, announced the project to the classes, reviewed the informed consent information and instructions for completing the measurement packet, passed out the measurement instruments, and collected the packets when the students finished. In addition to administering the standard completion instructions, the graduate student asked participants to create an identification number that they would remember and to write it in the appropriate space on the measurement instruments. The first graduate student left the room and was replaced by another, also unaware of the hypotheses, who had been trained in the administration of the control and experimental conditions. The control condition consisted of a 30-minute presentation about the

importance of the scientific method. The treatment condition consisted of the 30-minute Sleep Treatment and Education Program for Students.

Six weeks after treatment, the first graduate student returned to the classes, reviewed the completion instructions, and distributed the posttest measurement packet. The data collector asked the participants to write their identification numbers on the surveys. To reduce potential data contamination, the collector asked students who had read about sleep treatments or talked with students from the other group to write an "x" next to their number. The instrument packets with an "x" next to the identification number were not included with the analysis.

RESULTS

We used independent samples *t* tests to compare the demographic composition and baseline sleep measures of the 2 groups. The groups did not differ significantly according to age, ethnicity, or housing status (off- vs on-campus). They also did not differ on baseline measures of the overall or subtest PSQI scores, the sleep hygiene awareness subtest of the SHAPS, nor the SHS items. There were significantly more women, $t(121) = 1.94$, $p = .008$, in the control group ($n = 44$) than there were in the treatment condition ($n = 28$). Students in the treatment group ($M = 29.04$, $SD = 8.99$) had significantly lower baseline scores of sleep hygiene practices, $t(121) = 3.65$, $p \leq .001$, than had the control group ($M = 35.72$, $SD = 10.02$).

We used repeated-measures analysis of variance (ANOVA) to compare the within-subject changes for the dependent variables according to the treatment and control conditions. The within-subject factor was time and had 2 levels: pretest and 6 weeks posttest. The between-subjects factor was the treatment condition and had 2 levels: the control condition and experimental condition. The dependent variables were the PSQI Total Sleep Quality Score and subscale scores, the SHAPS sleep hygiene awareness and sleep hygiene practices scores, SHS variables, which include the difference between week and weekend sleep latency, sleep times, and wake times.

Over a 6-week period, participants in the treatment condition demonstrated significantly better overall sleep quality on the PSQI; $F(1, 120) = 5.83$, $p = .017$, $\eta^2 = .05$, $1 - \beta = .67$; when compared with the control group. Among PSQI subtest scores, the treatment group had significantly lower sleep disturbance scores, $F(1, 120) = 11.59$, $p = .001$, $\eta^2 = .09$, $1 - \beta = .92$; sleep latency, $F(1, 120) = 13.63$, $p > .0001$, $\eta^2 = .10$, $1 - \beta = .96$; and sleep medication use, $F(1, 120) = 4.81$, $p = .030$, $\eta^2 = .04$, $1 - \beta = .59$. Table 1 contains the means and standard deviations of PSQI scores.

Students in the treatment group had significantly better changes in sleep hygiene practices, $F(1, 120) = 21.51$, $p = .0001$, $\eta^2 = .15$, $1 - \beta = .99$, over the 6-week period than did students in the control group. As for specific sleep practice changes over time, those in the treatment group had significant decreases in the number of naps, $F(1, 120) = 6.60$, $p = .01$, $\eta^2 = .05$, $1 - \beta = .72$; hunger before bedtime, $F(1, 120) = 6.43$, $p = .01$, $\eta^2 = .05$, $1 - \beta = .71$; and medications with caffeine, $F(1, 120) = 3.87$, $p = .05$, $\eta^2 = .03$, $1 - \beta = .50$. Both groups demonstrated reductions in relaxation time before bed, but the control group displayed a significantly smaller decrease, $F(1, 120) = 5.35$, $p = .02$, $\eta^2 = .04$, $1 - \beta = .63$. The control group had significant reductions in the amount of disturbances caused by noise during sleep, $F(1, 120) = 6.0$, $p = .02$, $\eta^2 = .05$, $1 - \beta = .68$. There were no significant differences between groups on sleep hygiene knowledge measures. The treatment group ($M = 1.21$, $SE = .13$) had significant, $F(1, 120) = 4.43$, $p = .037$, $\eta^2 = .04$,

TABLE 1. Pittsburgh Sleep Quality (SQ) Index Scores at the Initial Assessment and 6-Week Follow-up

	Initial		6 weeks	
Condition	*M*	*SD*	*M*	*SD*
		*Overall**		
Control	7.28	3.20	7.25	2.97
Treatment	6.60	3.10	5.50	2.23
		Subjective SQ		
Control	1.28	.75	1.13	.60
Treatment	1.21	.56	1.13	.60
		Duration		
Control	.87	.90	.99	.99
Treatment	1.00	1.10	.70	.81
		Daytime dysfunction		
Control	1.05	.64	1.10	.74
Treatment	1.11	.68	1.20	.70
		*Sleep meds**		
Control	.52	.88	.39	.70
Treatment	.27	.67	.13	.38
		*Sleep latency****		
Control	1.72	.98	1.58	.94
Treatment	1.21	.91	.96	.81
		Efficiency		
Control	.46	.80	.69	1.02
Treatment	.64	1.03	.38	.75
		*Disturbance****		
Control	1.39	.58	1.37	.55
Treatment	1.14	.48	1.02	.49

*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$; changes over time, between conditions.

$1 - \beta = .55$, improvements in their sleep latency over the 6-week period when compared with the control group ($M = 1.72$, $SE = .12$). There were no other significant differences between pretest or posttest items on the SHS.

DISCUSSION

In this study, we used an empirically based psychoeducational sleep intervention program to combat increasingly common sleep complaints expressed among university students. The results are promising. The greatest impact of the program, when looking at effect sizes (η^2), was on sleep hygiene practices. Students in the treatment group took fewer naps, went to bed hungry less frequently, and took fewer medications with caffeine 6 weeks after the intervention. Although both groups showed decreases in the amount of presleep relaxation time, students in the treatment group had a lesser reduction. This suggests there is a tendency for students to relax less as the academic semester progresses. Thus, STEPS not only helps reduce some problem behaviors, but can prevent an increase in poor sleep habits as the academic semester progresses. This finding is consistent with results of prior research indicating that student sleep length declined as the academic quarter progressed.[39]

Overall sleep quality in the treatment group also improved over time. Students in the treatment condition demonstrated significantly shorter sleep onset time and fewer sleep disturbances. However, the effect size of treatment on sleep quality was much lower than that of treatment on sleep practices. This likely indicates that the intervention influenced sleep practices more immediately, which in turn, influenced overall sleep quality.

The results of this study also support the need to implement sleep awareness programs, such as STEPS, to prevent the deterioration of sleep quality as the academic term progresses. Using the previously established cutoff score of ≤ 5 as good sleep quality and > 6 as poor sleep quality,[40] 70% of students in the control group reported poor sleep quality at the beginning of the term, and 82% reported poor sleep quality 8 weeks into the term, suggesting that without interventions, sleep quality deteriorates as the term progresses. This is especially noteworthy when considering that 84% of those who met the criteria for poor sleep quality in the original PSQI standardization sample also met the criteria for some form of diagnosable primary sleep disorder.[40]

Although these results generally support STEPS as an important intervention, there are several strengths and limitations to consider when reviewing the results. We designed this study to examine the efficacy of STEPS as both a treatment and preventative measure and did not limit it to students with sleep difficulties. Unfortunately, inclusion of all students may have contributed to moderately low effect sizes and power ($1 - \beta$) of the study. Increasing sample size typically increases power. However, it is not only the sample size but also the variability of the sample that influences the level of power and effect sizes. In many treatment efficacy studies, participants have significant complaints for which they are seeking treatment. In this study, 37% of the participants did not initially fall into the range of poor sleep quality. Comprising a study of only those in need of treatment would likely increase the power and effect sizes, but it would also reduce the relevance of STEPS as a preventative measure. Researchers interested in testing the efficacy of STEPS primarily as a treatment intervention can limit their samples to individuals with significant sleep complaints, which is likely to result in larger effect sizes.

We administered the STEPS program to an entire class of students without attempting to ensure equal numbers of men and women. In previous studies, researchers have demonstrated that women tend to have more sleep complaints than do men.[1,4] There were more women in the control group, and they reported worse sleep hygiene practices at the onset, although there were no significant differences between men and women regarding sleep quality. The use of a repeated-measures design controls for preexisting individual and group differences by comparing the amount of change within participants to their baseline measures. Nonetheless, it is possible that preexisting group differences in sleep hygiene practices may have contributed to the progressive decline of sleep quality among students in the control group. Although random sampling of participants tends to further reduce preexisting group differences, random sampling of the classes was not used in the current study. There was therefore a chance that students in the treatment group might discuss the intervention with students in the control group, thus contaminating the results. If researchers consider random sampling in future studies, it is recommended that they recruit volunteers from throughout the undergraduate student body to decrease the likelihood of intervention contamination in the control group, and then use stratified random selection and assignment to improve group comparison.

There are also both positive and negative aspects to limiting the outcome measures to 6-weeks posttreatment. On the one hand, this time period tends to reduce the chance students will learn about good sleep hygiene from outside sources and also provides comparison with a prior sleep hygiene study using elderly adults.[46] However, as mentioned above, it appears that sleep hygiene practices change first, followed by overall sleep quality. With this in mind, it is possible that larger changes in overall sleep quality may occur over longer periods of time. Data collected 6 months after the treatment may be a better indicator of the intervention effect than data collected after 6 weeks. In addition, such delayed outcome measures may also show whether the intervention has long-term effects on student sleep habits and related sleep quality or whether improvements are short lived.

We used a double-blind format to reduce experimenter- and participant-expectation bias. The use of a control condition in which participants received the pretest measures also helped control for the influence that pretest measures can have on participants. Nonetheless, the use of a pretest may have alerted participants to the expectations of the researcher and must be acknowledged as a potential source of influence for the results. One manner of controlling for this in the future would be to administer the surveys to students several weeks

before the treatment condition so the relationship between the pretest measures and treatment is less clear. Extending the posttest measure to 6 months, as discussed earlier, may further reduce the influence of demand characteristics and experimenter bias on participants.

In summary, these results suggest that the inclusion of a psychoeducational program, such as STEPS, in university orientation classes may significantly reduce student sleep difficulties and improve sleep habits. Despite the significant findings, however, many students in the treatment condition continued to have poor sleep habits and sleep quality. For example, week and weekend wake times differed by more than 3 hours at baseline and did not improve in either condition. Therefore, in addition to providing sleep education programs, universities may wish to consider scheduling classes later in the day to reduce the variability between week and weekend wake times. The prevalence of variable sleep schedules among students;[1,4] the research finding that students with more consistent week and weekend wake times have better sleep quality and academic performance;[2] and the results of this study, which indicate that student sleep habits and quality have a propensity to worsen as the term progresses, all support such scheduling changes. In addition, college counseling center personnel should learn cognitive and behavioral sleep interventions and advertise these services to students who likely do not realize such interventions are superior to medications for improving sleep quality.[29–31,46]

NOTE

For comments and further information, please address correspondence to Franklin C. Brown, PhD, Department of Psychology, Eastern Connecticut State University, 83 Windham Street, Willimantic, CT 06066 (e-mail: brownf@easternct.edu).

REFERENCES

1. Brown FC, Buboltz WCJ, Soper B. Prevalence of delayed sleep phase syndrome in university students. *Coll Stud J*. 2001;35:472–476.

2. Machado ERS, Varella VBR, Andrade MMM. The influence of study schedules and work on the sleep-wake cycle of college students. *Biol Rhythm Res*. 1998;29:578–584.

3. Hicks RA, Lucero-Gorman K, Bautista J. Ethnicity, sleep hygiene knowledge, and sleep hygiene practices. *Percept Mot Skills*. 1999;88:1095–1096.

4. Buboltz WC, Brown FC, Soper B. Sleep habits and patterns of college students. *J Am Coll Health*. 2001;50:131–135.

5. Coren S. The prevalence of self-reported sleep disturbances in young adults. *Int J Neurosci*. 1994;79:67–73.

6. Lack LC. Delayed sleep and sleep loss in university students. *J Am Coll Health*. 1986;35:105–110.

7. Hicks RA, Pellegrini RJ. The changing sleep habits of college students. *Percept Mot Skills*. 1991;72:1106.

8. Guilleminault C, Carskadon M. Relationship between sleep disorders and daytime complaints. In: Koeller WP, Oevin PW, eds. *Sleep*. Basel, Switzerland: Karger, 1977:95–100.

9. Findley LJ, Unverzagt ME, Guchu R. Vigilance and automobile accidents in patients with sleep apnea or narcolepsy. *Chest*. 1995;108:619–624.

10. Findley LJ, Unverzagt ME, Suratt PM. Automobile accidents involving patients with obstructive apnea. *Am Rev Respir Dis*. 1988;138:337–340.

11. Irwin M, McClintick J, Costlow C. Partial night sleep deprivation reduces natural killer and cellular immune response in humans. *FASEB J*. 1996;10:643–645.

12. Pilcher JJ, Ginter DR, Sadowsky B. Sleep quality versus sleep quantity: Relationships between sleep and measures of health, well being and sleepiness in college students. *J Psychosom Res*. 1997;42:583–596.

13. Jean-Louis G, Von Gizycki H, Zizi F, Nunes J. Mood states and sleepiness in college students: influence of age, sex, habitual sleep and substance use. *Percept Mot Skills*. 1998;87:507–512.

14. Zammit GK. Delayed sleep phase syndrome and related conditions. In: Pressman MR, Orr WC, eds. *Understanding Sleep: The Evaluation and Treatment of Sleep Disorders*. Washington, DC: American Psychological Association, 1997:229–248.

15. Zammit GK. Subjective ratings of the characteristics and sequelae of good and poor sleep in normals. *J Clin Psychol*. 1988;44:123–130.

16. Taub JM, Berger RJ. Acute shifts in the sleep-wakefulness cycle: effects on performance and mood. *Psychosom Med*. 1974;36:164–173.

17. Trockel MT, Barnes MD, Egget DL. Health-related variables and academic performance among first-year college students: implications for sleep and other behaviors. *J Am Coll Health*. 2000;49:125–131.

18. Pilcher JJ, Walters AS. How sleep deprivation affects psychological variables related to college students' cognitive performance. *J Am Coll Health*. 1997;46:121–126.

19. De Koninck J, Lorrain D, Christ G, Proulx G, Coulombe D. Intensive language learning and increases in rapid eye movement sleep: evidence of a performance factor. *Int J Psychophysiology*. 1989;8:43–47.

20. Karni A, Tanne D, Rubenstein BS, Askenasy JJM, Sagi D. Dependence on REM sleep of overnight improvement of a perceptual skill. *Science*. 1994;265:679–682.

21. Smith C, Lapp L. Increases in number of REMS and REM density in humans following an intensive learning period. *Sleep*. 1991;14:325–330.

22. Wolfson AR, Carskadon MA. Sleep schedules and daytime functioning in adolescents. *Child Dev*. 1998;69:875–887.

23. Taub JM, Berger RJ. Performance and mood following variations in the length and timing of sleep. *Psychophysiology*. 1973;10:559–570.

24. Taub JM, Tanguay PE, Clarkson D. Effects of daytime naps on performance and mood in a college student population. *J Abnorm Psychol*. 1976;85:210–217.

25. Taub JM. Behavioral and psychophysiological correlates of irregularity in chronic sleep routines. *Biol Psychol*. 1978;7:37–53.

26. Taub JM, Berger RJ. The effects of changing the phase and duration of sleep. *J Exp Psychol Hum Percept Perform*. 1976;2:30–41.

27. Taub JM. Aspects of personality associated with irregular sleep habits in young adults. *J Clin Psychol*. 1979;35:296–305.

28. Taub JM. Effects of ad-lib extended-delayed sleep on sensorimotor performance, memory and sleepiness in the young adult. *Physiol Behav*. 1980;25:77–87.

29. Murtagh DRR, Greenwood KM. Identifying effective psychological treatments for insomnia: A meta-analysis. *J Consult Clin Psychol*. 1995;63:79–89.

30. Morin CM, Wooten V. Psychological and pharmacological approaches to treating insomnia: critical issues in assessing their separate and combined effects. *Clin Psychol Rev*. 1996;16:521–542.

31. Morin CM, Culbert JP, Schwartz SM. Nonpharmacological interventions for insomnia: a meta-analysis of treatment efficacy. *Am J Psychiatry*. 1994;151:1172–1180.

32. Lichstein KL, Riedel BW. Behavioral assessment and treatment of insomnia: a review with an emphasis on clinical application. *Behav Ther*. 1994;25:659–688.

33. Bootzin RR, Perlis M. Nonpharmacologic treatments of insomnia. *J Clin Psychiatry*. 1992;53:37–41.

34. Bootzin RR, Nicassio P. Behavioral treatments for insomnia. In: Hersen M, Eisler RM, Miller PM, eds. *Progress in Behavior Modification*. New York: Academic Press, 1991:1–45.

35. Riedel BW. Sleep hygiene. In: Lichstein KL, Morin CM, eds. *Treatment of Late-Life Insomnia*. Thousand Oaks, CA: Sage Publications, 2000:125–146.

36. Harvey AG. Sleep hygiene and sleep-onset insomnia. *J Nerv Ment Dis*. 2000;188:53–55.

37. Bootzin RR, Epstein DR. Stimulus control. In: Lichstein KL, Morin CM, eds. *Treatment of Late-Life Insomnia*. Thousand Oaks, CA: Sage Publications, 2000:167–184.

38. Brown FC, Buboltz WCJ. Applying sleep research to university students: recommendations for developing a student sleep education program. *J Coll Stud Dev*. 2002;43:411–416.

39. Hawkins J, Shaw P. Self-reported sleep quality in college students: a repeated measures approach. *Sleep*. 1992;15:545–549.

40. Buysse DJ, Reynolds CFI, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res*. 1989;28:193–213.

41. Pilcher JJ, Ott ES. The relationships between sleep and measures of health and well-being in college students: a repeated measures approach. *Behav Med*. 1998;23:170–178.

42. Pilcher JJ, Schoeling SE, Prosansky CM. Self-report sleep habits as predictors of subjective sleepiness. *Behav Med*. 2000;25:161–168.

43. Liu X, Tang M, Hu L, Wang A. Sleep quality and its correlates in college students. *Chinese Mental Health J*. 1995;9:148–150.

44. Lacks P, Rotert M. Knowledge and practice of sleep hygiene techniques in insomniacs and good sleepers. *Behav Res Ther*. 1986;24:365–368.

45. Brown FC, Buboltz WCJ, Soper B. *Relationship of Sleep Hygiene Awareness, Sleep Hygiene Practices, and Sleep Quality*. Behav Med. In Press.

46. McCurry SM, Logsdon RG, Teri L. Behavioral treatment of sleep disturbance in elderly dementia caregivers. *Clin Gerontol*. 1996;17:35–50.