

Stress and Sleep Disturbances in Female College Students

Shih-Yu Lee, PhD, RNC; Caroline Wuertz; Rebecca Rogers, BS; Yu-Ping Chen, ScD, PT

Objective: To describe the sleep characteristics and examine the associations among perceived stress, sleep disturbances, depressive symptoms, and physical symptoms among female college students. **Methods:** A total of 103 students completed a battery of questionnaires. **Results:** The students experienced high stress during the school year. The majority of them slept less than 6 hours during weekdays and experienced moderate fatigue. High stress levels are associated with sleep disturbances, less nocturnal total sleep time, higher fatigue severity, and more de-

pressive symptoms. Perceived stress and sleep disturbances are significant predictors for depressive symptoms and physical symptoms. Compared to the good sleepers, the poor sleepers reported more daytime sleepiness, depressive symptoms, and physical symptoms. **Conclusions:** Interventions to reduce stress and improve sleep are critically needed in college education.

Key words: female, college students, sleep, stress, depressive symptoms, daytime sleepiness, physical symptoms

Am J Health Behav. 2013;37(6):851-858

DOI: <http://dx.doi.org/10.5993/AJHB.37.6.14>

Sleep disturbances are common among college students.¹⁻³ These sleep disturbances could be associated with stress derived from their academic challenges and daily life.¹⁻³ Stress and its effects on health are areas of concern for many health care providers. The concept of stress has been used in many different ways over the past century: stress as stimulus, stress as response, and stress as interaction and transaction.⁴ Lazarus and Folkman⁵ defined stress as the complex interaction between an individual and his/her environment that can impact one's well-being. College students experience predictable, stressful life events during the school year that can lead to sleep deprivation and further endanger their well-being. Most students may sense the stress derived from school work; however, they may not realize that sleep deprivation is also a stressor in addition to their daily life stress, and altogether could have negative impacts on their physical and mental health.

Stress was first conceived as a basis of poor

health more than 2 centuries ago. The biological reactions accompanying adaptation to stress result in both short- and long-term adverse impacts to physical and mental conditions.^{5,6} When an individual faces a stressful situation, the sympathetic portions of the autonomic nervous system are activated and a fight-or-flight reaction⁶ is manifested as accelerated heartbeat, increased respiration, and redistribution of blood from peripheral areas of the body into the head and trunk. Each stressor activates the sequence just described, thereby enabling the body to fight or take flight. The autonomic response occurs quickly and lasts only a short time; the endocrine response initiates more slowly and lasts longer. Setting off this response many times over a long period has a wear-and-tear effect on the body; eventually, it lowers resistance to disease. Ample evidence indicates that physical and psychological distress can affect an individual's susceptibility to disease, such as depression, insomnia, cardiovascular disease, diabetes, and rheumatoid arthritis.⁷ College is a well-known time for stress. Stress is detrimental to good health and sleep habits, both of which are crucial for academic success. Increased stress levels and psychological problems are associated with poor quality sleep in college students.⁸

Stress and sleep problems are inextricably linked and affect health and well-being. Sleep disturbance is defined as sleep deprivation resulting from inadequate total sleep time or sleep disruption result-

Shih-Yu Lee, Associate Professor, Caroline Wuertz, Student Research Assistant, and Rebecca Rogers, Student Research Assistant, School of Nursing, Georgia State University, GA. Yu-Ping Chen, Assistant Professor, Department of Physical Therapy, Georgia State University, GA.

Correspondence Dr Lee; slee29@gsu.edu

ing from fragmented sleep during the night, which leads to adverse health outcomes.⁹ Sleep disturbances can also cause daytime sleepiness, which can lead to poor performance.⁹ The National Institutes of Health (NIH) estimate that sleep problems add \$15 billion to annual health care costs and cost industry about \$50 billion yearly in lost productivity.⁷ The 2007 Sleep in America Poll survey, which focused on adult women in different developmental stages, found that about half of the women experienced sleep problems nightly.¹⁰ Epidemiologic studies reveal that sleep loss increases the risks of cardiovascular disorders, diabetes mellitus, and mortality.¹¹⁻¹³ Other common symptoms associated with sleep disturbances include fatigue and depressive symptoms.⁷

The prevalence of sleep disturbances is different in various ethnic groups.⁹ Sleep disturbances are more prevalent among American females compared to males, and these sleep problems negatively affect their daytime functioning and physical and psychological well-being.^{10,14} Women are more vulnerable to the effects of sleep disturbances than men because of several physio-psycho-social factors, such as cycling hormones¹⁵ and engagement in multiple social roles.¹⁰ Explaining the effects of cycling hormones is beyond the scope of this paper; however, researchers have hypothesized that follicle-stimulating hormone (FSH) may modulate melatonin circadian rhythms among postmenopausal women,¹⁶ and the changes in FSH may be responsible for substantive changes in the nature of sleep for females. To date, several studies have explored sleep patterns among college students and show that sleep problems are common^{1,2,17} and can impact academic performance and mood changes.^{17,18} A limited number of studies have focused on the sleep issues in female students; however, the studies that included females neglected the impact from hormones that can threaten the validity of findings. In addition, few studies have examined the relationships among sleep disturbances and physical and mental health among female students.

The data reported in this paper are baseline data from a larger scale, 2-phase prospective study in which we used multiple survey questionnaires to assess the impact of stress and sleep disturbances to health-related well-being (ie, fatigue, depressive symptoms, and physical symptoms) among female college students. The following research questions were addressed:

1. What are the sleep characteristics of female college students during the school year?
2. What are the relationships among perceived stress, sleep, and health-related well-being (ie, fatigue, depressive symptoms, and physical symptoms)?
3. To what degree are depressive symptoms explained by an individual's personal characteristics (ie, ethnicity, age, body mass index), perceived stress, and sleep disturbances?

4. To what degree are physical symptoms explained by an individual's personal characteristics (ie, ethnicity, age, body mass index), perceived stress, and sleep disturbances?

The following hypothesis (H) was tested:

- H1. Women with poor sleep have adverse health outcomes such as increased fatigue severity, daytime sleepiness, depressive symptoms, and more physical symptoms than women with good sleep.

METHODS

Participants

A convenience sample of 103 female college students aged 18 years and above was recruited from a university in the southern United States. Women were excluded for: (1) history of endocrine, immune, or metabolic disorders; (2) current use of medications that may alter sleep; (3) history of a diagnosed sleep disorder; (4) employment as a shift worker; and (5) pregnancy (because sleep patterns of pregnant women are different from those of non-pregnant women). At the end of the study, each participant received a sleep hygiene booklet and a report on her sleep patterns. The participants (Table 1) were predominantly undergraduate students (88.3%), white (48.5%), single (62.1%), without children (87.4%), and with financial difficulty (64.1%). These female students ranged in age from 18 to 53 (26.3 ± 7.9) with a normal body mass index (63.7% with a BMI between 20 and 25). Among the ethnic groups, Blacks had the highest BMI (26.40 ± 6.70) and Asians had the lowest BMI (21.54 ± 1.92). A sample of 103 allows the detection of a medium effect size with power of 80% with up to 7 predictors to test the hypothesis in a multiple regression study.

Procedure and Instruments

To recruit students for participation, the classes in the college of health professions were randomly selected. The first author who had no personal or professional relationship with any of the selected classes went to the classrooms and spent about 5-10 minutes to address the purpose of the study, eligibility criteria, contact information, and to inform students that participation would require an average commitment of 8-10 minutes per day for one week to complete the questionnaires. The potential study participants were informed that participation in this study was voluntary and that their decision about participation in this study would not affect their grades. Then, a sign-up sheet was passed around in the classroom so those who were interested could leave their contact information for further appointment and screening. Once the potential study participants' eligibility was determined, they received detailed information about this study, and an opportunity was given for them to consider participation privately. Informed consent was obtained from each study participant.

Data were collected in the beginning of the semester in fall 2011 and spring 2012 while the

Table 1
Demographics of the Female College Students (N=103)

Variables (cut-off)	Mean (SD)	Frequency (%)	Above Cut-off (%)
Age	26.3 (7.9)	---	---
Ethnic group:			
White		50 (48.5)	
Black		26 (25.2)	
Hispanic		10 (9.7)	
Asian		17 (16.5)	
Program of study			
Undergraduate		91 (88.3)	
Graduate		12 (11.7)	
Employed			
Yes		51 (49.5)	
No		52 (50.5)	
Financial difficulty			
Yes		66 (64.1)	
No		36 (35.0)	
Self-reported health status			
Good		95 (92.2)	
Fair		8 (7.8)	
Marital status			
Single		64 (62.1)	
Married		25 (24.3)	
Living with a partner		14 (13.6)	
Have Children			
Yes		13 (12.6)	
No		90 (87.4)	
TST needed (hours)	7.80 (1.18)	---	---
TST mean (< 7 hours)	7.15 (1.04)		43.7
Weekdays	6.89 (1.13)		54.4
Weekend	7.81 (1.46)		32.0
GSDS (≥ 3)	2.58 (1.05)		35.0
PSQI (≥ 5)	6.29 (2.98)		68.0
ESS (>9)	7.96 (4.06)		46.1
PSS (≥ 13.7)	16.27 (6.4)		56.3
CES-D (≥ 16)	11.85 (8.91)		25.2
Morning fatigue (≥ 3.2)	3.81 (1.5)		61.2
Physical symptoms (median 5)	5.50 (3.2)		

Note.

GSDS= General Sleep Disturbance Scale; PSQI= Pittsburg Sleep Quality Index;

ESS= Epworth Sleepiness Scale; PSS=Perceived Stress Scale; CES-D= Center of Epidemiology Scale-Depression; TST= Total Sleep Time

students were not having major examinations. All of the questionnaires listed below, along with a consecutive 7-day sleep diary and demographic information, were collected. Study participants were asked to complete the 7-day sleep diary to record their sleep-wake patterns first, and then to complete the questionnaires. Data from the sleep diary were used to calculate their total nocturnal sleep time. The data were collected within 7 days after the menstrual period (before luteal phase) to avoid extraneous factors, such as premenstrual syndrome and special sleep patterns during the luteal phase which may cause an underestimation

of sleep.¹⁶

All of the questionnaires adopted in this study have sound psychometric qualities. The Perceived Stress Scale (PSS),¹⁹ a 10-item, 5-point Likert scale (0= never, 4= often), was used to describe global stress the female college students experienced in the past week. Higher scores indicate a greater level of stress perception. A cut-off point of 13.7 is suggested for females.¹⁹ In addition to global stress, we also asked the participants to rate the level of their financial difficulty on a 10-point scale (1= a little difficulty, 10= extreme difficulty). The General Sleep Disturbance Scale (GSDS), a

21-item, 0-7 rating scale, was used to assess the study participants' degree of sleep disturbance in the past week.²⁰ A cut-off score of 3 for the total scale distinguishes good from poor sleepers.²⁰ The Pittsburgh Sleep Quality Index (PSQI),²¹ a 19-item, 0-3 rating scale, was used to measure an individual's subjective sleep quality and disturbances over a 1-month time interval. A total score above 5 suggests insomnia.²¹ The Epworth Sleepiness Scale (ESS), an 8-item, 0-3 rating questionnaire, was used to measure the degree of sleepiness during daytime.²² Higher scores indicate a higher degree of sleepiness; an individual who scores 9 or above indicates "very sleepy" and should seek medical advice.²²

In this study, health-related well-being is defined in terms of depressive symptoms, fatigue severity, and physical symptoms. The Center for Epidemiologic Studies Depression Scale (CES-D),²³ a 20-item scale with a possible score range of 0-60, was used to measure the study participants' psychological health. Study participants with CES-D scores ≥ 16 were immediately referred to the on-site student counseling center. Fatigue was measured with the Numerical Rating Scale for Fatigue (NRS-F),²⁴ a self-rated 18-item scale, scored from 0 (not fatigued) to 10 (extremely fatigued). To decrease the study participants' burden, only a 7-item short version of the fatigue scale was included in this study. Cronbach's alpha coefficients for the 7-item version of the NRS-F ranged from .89 to .97 in prior studies.²⁵ The Physical Symptom Inventory (PSI),²⁶ an 18-item scale, was used to measure the participants' physical health. For each item, participants indicate "yes" or "no" on a rating scale of 18 physical symptoms (eg, upset stomach, headache, and infection) over the past 30 days. Participants also were asked to differentiate whether or not they saw a doctor if they experienced any physical symptoms.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences 18 (SPSS, Inc., Chicago, IL). All of the data were verified for accuracy by reviewing questionable data in the questionnaires. Descriptive and frequency statistics were computed for nominal and ordinal level data, and measures of central tendency were obtained for interval and ratio level data. Internal consistency reliability measures for all instruments were calculated using Cronbach's alpha coefficients with an exception of using Kuder-Richardson-20 for the Physical Symptoms Inventory, and all with an acceptable alpha of 0.8 and above. Analyses of variance (ANOVAs) were used to determine if there were any significant differences in sleep characteristics by ethnic group. Based on normal distribution of the variables, the associations among the variables were assessed by Pearson product-moment correlation coefficient to answer research question 2. Hierarchical regression analyses were performed

to answer research question 3 and 4 to determine whether any independent variables predicted depressive symptoms and physical symptoms. Independent t-tests were used to test the hypothesis and to determine if there were any mean differences in health-related outcome variables between poor sleepers and good sleepers.

RESULTS

We approached approximately 550 students, and 153 of them signed up for further screening; however, only 103 met the criteria, consented to participate, and completed this study. We did not ask why the rest of the students were not interested; however, anecdotally, the students expressed they were too busy to take part in this study. These students experienced high global stress (16.3 ± 6.4) as measured by the PSS. About 46% of the study participants experienced a clinically significant daytime sleepiness as measured by the ESS (7.96 ± 4.06). These female students also reported moderate morning fatigue severity, and about 61% experienced a clinically significant fatigue severity. The study participants reported a moderate level of depressive symptoms as measured by the CES-D, and about 25% of them scored above the cut-off point of 16. The PSI was used to assess the total physical symptoms in the past month. Only 3 participants were symptom-free; on average, they experienced a total of 5.5 symptoms ($SD=3.2$), with a median of 5 symptoms. The most common symptoms were fatigue (76.7%), followed by headache (74.8%), trouble sleeping (52.5%), backache (52.4%), and upset stomach (50.4%). However, only a few of them had visited a doctor because of the above physical symptoms.

Sleep Characteristics

These students reported in the GSDS that, on average, they experienced sleep disturbances about 3 nights during the past week (Table 1) and none of them had good sleep nightly. It was surprising to note that about 68% of them were identified as insomniacs by using the total scores of PSQI (> 5), with an average of 6.29 ($SD=2.98$) and median of 6 (ranging from 1 to 18). On average, they went to bed around 11:34 p.m. ($SD=112$ minutes) and got up around 7:25 a.m. ($SD=87$ minutes); however, there was a wide variance in both bedtime (range 9:30 p.m. to 3:45 a.m.) and arise time (range 5:00 a.m. to noon). The nocturnal total sleep time (TST) was calculated from the 7-day diary. On average, they slept about 7 hours (ranging from 4 to 9.5 hours). Their TST was significantly less than what they needed to feel rejuvenated ($t[102]= 4.15, p < .001$), and they slept less during weekdays compared to weekend days ($t[102]=6.50, p < .001$). Altogether, data indicate they were sleep deprived and their activity (sleep-wake) circadian rhythms were not well-synchronized, which may increase their vulnerability to adverse health outcomes.²⁷ About half of the study participants scored ESS

Table 2
Correlations among Stress, Sleep, and Health-related Well-being

Variables	1	2	3	4	5	6	7
1. PSS	---						
2. GSDS	.53**	---					
3. PSQI	.56**	.61**	---				
4. ESS	.43**	.57**	.47**	---			
5. CES-D	.74**	.49**	.65**	.41**	---		
6. AM Fatigue	.33**	.48**	.33**	.18	.36**	---	
7. TST	-.20*	-.33**	-.28**	-.33**	-.26**	-.29*	---
8. Physical Symptoms	.43**	.44**	.56**	.29**	.51**	.29**	-.19*

*p < .05 ** p < .01

Note.

PSS= Perceived Stress Scale; GSDS= General Sleep Disturbance Scale; PSQI= Pittsburg Sleep Quality Index; ESS= Epworth Sleepiness Scale; CES-D= Center of Epidemiology Scale-Depression; TST= Total Sleep Time. -.19*

above the cut-off point of 9, indicating they were very sleepy during daytime and should seek medical attention for their daytime sleepiness problem.

Given that ethnicity may play a role in sleep characteristics,²⁸ we also explored if there were any significant differences by ethnic group. It turned out that only TST needed to feel refreshed ($F[3, 99] = 2.94, p = .04$) and the nocturnal TST

during the weekend ($F[3, 99] = 3.34, p = .02$) were different among ethnic groups. Whites needed the greatest amount of sleep time (8.01 ± 1.22 hours), but Blacks needed the least (7.05 ± 1.09 hours) to feel refreshed. Whites also slept longest (8.24 ± 1.29 hours) during the weekend compared to the other ethnic groups. Although there was no statistical significance, on average, Asian slept the least

Table 3
Variables Associated with Depressive Symptoms and Physical Symptoms

Predictor	Depressive Symptoms			Physical Symptoms		
	B	β	ΔR^2	B	β	ΔR^2
Step 1 (covariate)						
Age	-.08	-.07		-.01	-.03	
Ethnic groups	.02	.00		-.13	-.05	
BMI	-.09	-.05	.008	.005	.007	.003
Step 2						
PSS	.79	.57**		.48	.41**	
PSQI	1.06	.33**	.625**	.10	.20*	.298**
Total R²			.633**			.301**

*p < .05 ** p < .01

Note.

PSS= Perceived Stress Scale; GSDS= General Sleep Disturbance Scale; PSQI= Pittsburg Sleep Quality Index; ESS= Epworth Sleepiness Scale; CES-D= Center of Epidemiology Scale-Depression; TST= Total Sleep Time.

Table 4
Comparison Between Good Sleepers and Poor Sleepers Based on PSQI

Variables	Good sleepers (N = 33) Mean (SD)	Poor sleepers (N = 70) Mean (SD)	t-values* (df = 101)
Age	24.58 (5.99)	27.16 (8.58)	1.56
TST 7-days	7.43 (.78)	7.02 (1.11)	1.91
Weekdays	7.17 (.96)	6.75 (1.18)	1.77
Weekend	8.06 (1.17)	7.70 (1.57)	1.15
ESS	6.36 (3.67)	8.72 (4.04)	2.84**
PSS	12.97 (4.47)	17.83 (6.61)	3.82**
CES-D	7.09 (5.77)	14.10 (9.27)	3.99**
AM Fatigue	3.47 (1.65)	3.97 (1.42)	1.56
Physical Symptoms	3.91 (2.29)	6.26 (3.29)	3.69**

*p < .05 ** p < .01

Note.

Good sleepers= PSQI ≤ 5 Poor sleepers= PSQI >5

PSQI= Pittsburgh Sleep Quality Index; TST= Total Sleep Time; GSDS= General Sleep Disturbance Scale; ESS= Empower Sleepiness Scale; PSS= Perceived Stress Scale; CES-D= Center of Epidemiology Scale-Depression.

amount of time during the weekdays (6.5 ± .92 hours) compared to the other ethnic groups. Findings from this study are consistent with those from the 2010 National Sleep Foundation.²⁸

Correlations among Stress, Sleep, and Well-being

Bivariate correlations were used to examine the associations (Table 2) among perceived stress, sleep disturbances (GSDS, PSQI), daytime sleepiness (ESS), depressive symptoms, fatigue severity (NRS-F), nocturnal total sleep time, and physical symptoms (PSI). The women’s perceptions of their overall stress was significantly and positively associated with sleep disturbances, daytime sleepiness, depressive symptoms, morning fatigue severity, less nocturnal total sleep time, and more physical symptoms (p < .05). Although 64% of the study participants experienced financial difficulty, the financial burden only accounted for about 6% of their global stress and was not significantly associated with any well-being outcome variables that we measured in this study (p > .05). The individuals who reported poor sleep also experienced more fatigue, depressive symptoms, and physical symptoms. Those who had less total nocturnal sleep time also experienced higher fatigue severity and reported more depressive and physical symptoms.

Predictors for Depressive Symptoms and Physical Symptoms

The last 2 research questions were answered by hierarchical regression analyses to determine the extent to which variables account for the variance in of severity of depressive symptoms and physical symptoms. The personal characteristics (ie, age, ethnicity, and BMI) were entered into the models first, as these variables are known to be associated with the outcome variables, depressive symptoms, and physical symptoms, followed by the perceived stress measured by the PSS and sleep quality measured by the PSQI (Table 3). No significant association between personal characteristics and outcome variables was found for either model. The final model contained only 2 significant predictors for the depressive symptoms: perceived stress (t= 10.81, p < .001) and poor sleep quality (t= 8.00, p < .001), which accounted for 63.3% of the variance in depressive symptoms (F[5, 98]= 32.01, p < .001). Perceived stress (t=4.52, p < .001) and poor sleep quality (t= 5.92, p < .001) accounted for 30.1% of the variance in physical symptoms (F[5, 98]= 8.00, p < .001).

Comparison of Normal and Poor Sleepers on Health-related Well-being

Based on the PSQI score, the study participants were categorized into normal sleepers (PSQI ≤ 5) and poor sleepers (PSQI > 5) to test the hypotheses (Table 4). Compared to good sleepers, poor sleepers perceived significantly higher stress levels (above the cut-off point) and experienced higher daytime sleepiness (p < .01). Poor sleepers also re-

ported significantly more physical and depressive symptoms ($p < .01$). Both groups reported an above cut-off score for morning fatigue severity. Although the rest of the health-related outcome variables were all below the cut-off points, for the depressive symptoms, 30% of the poor sleepers and 6% of the good sleepers scored above the cut-off point.

DISCUSSION

This study described the female college students' sleep characteristics and their effects, along with the impact of stress on physical and mental health outcomes; further, it examined whether poor sleepers experienced more adverse health outcomes than good sleepers. Results showed serious existing and potential health problems for these women. Although all of the study participants were without a history of physical and depression problems or sleep disorders, they were stressed out, sleep deprived, fatigued, sleepy during the daytime, and had significantly high depressive symptoms and physical symptoms. These findings also suggest that stress derived from daily life was associated with poorer health-related well-being and that poor sleepers were more vulnerable to adverse health outcomes. As we hypothesized, women who were classified as poor sleepers (PSQI >5) experienced more depressive symptoms and physical symptoms compared to good sleepers. Perceived stress and poor sleep are significant predictors of depressive symptoms and physical symptoms.

College students experience predictable, stressful life events typically associated with reduced sleep, a change in circadian phases in an "experiment of nature" that occurs during the school year. A major advantage of studying these phenomena with this naturalistic approach is that sleep and well-being can be examined in a natural context over extended periods, rather than in a contrived laboratory context over short intervals. In this study, participants kept a sleep diary to record their bedtime and arise time for 7 consecutive days and nights. Findings from the sleep diary revealed that more than half of the students slept less than 7 hours during weekdays and they tended to catch up on their sleep debt during the weekend. The total nocturnal sleep time for these students was significantly less than what they needed to feel refreshed; on average, the total sleep time during weekdays was about one hour less than what they desired to have. In addition, their activity circadian rhythms were not synchronized, demonstrated by the large variance in their bedtime and awaking time records from the 7-day sleep diary. These findings are consistent with prior studies showing that college students are sleep deprived^{2,17} and that adult Blacks require the least amount of nocturnal sleep time to function well.²⁸ Other studies also found that insomnia could contribute to emotional distress and suicidal ideation for college students.^{1,18} Altogether, these findings highlight a critical need for preventive care for col-

lege women.

Limitations

This study is unique in 2 ways. First, it included an ethnically diverse group of women and explored their sleep characteristics and the relationships of these characteristics with stress and health outcomes. Second, it used both a standardized questionnaire and a 7-day sleep diary to comprehend participants' sleep patterns better and to differentiate between weekday and weekend sleep patterns. Although the study findings contribute to knowledge about female college students' stress and sleep patterns and their impact on well-being, findings should be considered in light of the use of a convenience sample rather than a random sample. Moreover, the geographic location was limited to an urban area in the southern US. In addition, this study only relied on self-report data which could result in bias. Future studies should include objective measurements, such as the wrist actigraph, to assess sleep-wake patterns, and blood or saliva samples to examine biomarkers that are associated with stress, sleep disturbances, and health outcomes.

Conclusions

Female college students in this study were distressed and experienced multiple adverse physical and emotional symptoms. Only about 19% of the students we approached to participate ultimately took part in this study. Those who did not sign up for this study possibly were experiencing higher levels of stress or had some conditions which dissuaded them from participating. Although stress likely will continue to be a characteristic of college life, administrators and college health professionals can work with students to find ways to alleviate stress and improve academic performance. Researchers at a large private university found that first-year students demonstrated reductions in depressive symptoms, along with improvements in sleep quality, after undergoing a self-administered cognitive behavior program.¹⁷ Additional research and attention to the problems of stress and poor sleep among college students will continue to benefit this population.

A better understanding of the associations among stress, sleep disturbances, and adverse health outcomes could advance clinicians' knowledge in the prevention and treatment of certain diseases related to stress and sleep problems. Interventions, such as mind-body exercise to reduce stress, improve sleep, and decrease depressive symptoms, are needed to promote students' well-being. Educational materials in the areas of stress-coping and sleep hygiene and their impact on health outcomes should be mandatorily included in the college curriculum. This study also shows that ethnicity plays a role in individual sleep characteristics; studies should attempt further exploration of the causes of differences across ethnic groups from both a genetic and an environmental perspective. Fail-

ure to understand the mechanisms linking sleep disturbances with different developmental stages among diverse ethnic groups of women is a possible reason that an effective intervention has not yet been developed and tested. Tailored interventions may be the key to promote better health and well-being, and thus, improve the quality of life for college women.

Human Subject Statement

The Institutional Review Board at Georgia State University approved the study.

Conflict of Interest Statement

The research was supported by the Scholarly Support Program at Georgia State University. The authors acknowledge no conflict of interest with the funding or the research study

REFERENCES

1. Sing CY, Wong WS. Prevalence of insomnia and its psychosocial correlates among college students in Hong Kong. *J Am Coll Health*. 2011;59:174-182.
2. Orzech KM, Salafsky DB, Hamilton LA. The state of sleep among college students at a large public university. *J Am Coll Health*. 2011;59:612-619.
3. Forquer LM, Camden AE, Gabriau KM, Johnson CM. Sleep patterns of college students at a public university. *J Am Coll Health*. 2008;56:563-565.
4. Rice VH. *Handbook of Stress, Coping, and Health*. Thousand Oaks, CA: Sage; 2000.
5. Lazarus RS, Folkman S. *Stress, Appraisal, and Coping*. New York: Springer; 1984.
6. Selye H. *The Stress of Life*. New York: McGraw-Hill; 1976.
7. NIH. National sleep conference: Frontiers of knowledge in sleep and sleep disorders. Washington, DC: National Institutes of Health; 2004. Available at: http://www.nhlbi.nih.gov/meetings/slp_front.htm. Accessed September 9, 2005.
8. Lund HG, Reider BD, Whiting AB, Prichard JR. Sleep patterns and predictors of disturbed sleep in a large population of college students. *J Adolesc Health*. 2010;46:124-132.
9. Lee KA. Impaired sleep. In: Carrieri-Kohlman V., Lindsey AM, West CM, eds. *Pathophysiological Phenomena in Nursing*. 3rd ed. St. Louis: Saunders; 2003:363-385.
10. NSF. 2007 sleep in America pool. 2007; Available at: <http://www.sleepfoundation.org/site/c.huIXKjM0Ix/b.2574229/k.14DA/2007>. Accessed April 15, 2007.
11. Alvarez GG, Ayas NT. The impact of daily sleep duration on health: a review of the literature. *Prog Cardiovasc Nurs*. 2004;19:56-59.
12. Van Cauter E, Holmback U, Knutson K, et al. Impact of sleep and sleep loss on neuroendocrine and metabolic function. *Horm Res*. 2007;(67 Suppl1):2-9.
13. ter Wolbeek M, van Doornen LJ, Kavelaars A, van de Putte EM, Schedlowski M, Heijnen CJ. Longitudinal analysis of pro- and anti-inflammatory cytokine production in severely fatigued adolescents. *Brain Behav Immun*. 2007;21:1063-1074.
14. Jean-Louis G, Magai C, Casimir GJ, et al. Insomnia Symptoms in a Multiethnic Sample of American Women. *J Womens Health (Larchmt)*. 2008;17:15-25.
15. Nelson HD. Menopause. *Lancet*. 2008;371:760-770.
16. Parry BL, Meliska CJ, Sorenson DL, et al. Increased melatonin and delayed offset in menopausal depression: role of years past menopause, follicle-stimulating hormone, sleep end time, and body mass index. *J Clin Endocrinol Metab*. 2008;93:54-60.
17. Trockel M, Manber R, Chang V, et al. An e-mail delivered CBT for sleep-health program for college students: effects on sleep quality and depression symptoms. *J Clin Sleep Med*. 2011;7:276-281.
18. Nadorff MR, Nazem S, Fiske A. Insomnia symptoms, nightmares, and suicidal ideation in a college student sample. *Sleep*. 2011;34:93-98.
19. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav*. 1983;24:385-396.
20. Lee KA. Self-reported sleep disturbances in employed women. *Sleep*. 1992;15:493-498.
21. Buysse DJ, Reynolds CF, 3rd, 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.
22. Johns MW. Reliability and factor analysis of the Epworth Sleepiness Scale. *Sleep*. 1992;15:376-381.
23. Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. *Appl Psychol Meas*. 1977;1:385-401.
24. Lee KA, Hicks G, Nino-Murcia G. Validity and reliability of a scale to assess fatigue. *Psychiatry Res*. 1991;36:291-298.
25. Lee SY. *Acculturation and ICU stress among Chinese/Chinese-American parents*. University of California, San Francisco: UMI: 3136069; 2004.
26. Spector PE, Dwyer DJ, Jex SM. Relation of job stressors to affective, health, and performance outcomes: a comparison of multiple data sources. *J Appl Psychol*. 1988;73:11-19.
27. Lee SY, Hsu HC. Stress and health-related well-being among mothers with a low birth weight infant: the role of sleep. *Soc Sci Med*. 2012;74:958-965.
28. NSF. 2010 sleep and ethnicity. 2010. Available at: <http://www.sleepfoundation.org/article/sleep-america-polls/2010-sleep-and-ethnicity>. Accessed June 6, 2011.

Copyright of American Journal of Health Behavior is the property of PNG Publications and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.