Association of Stress, General Health, and Alcohol Use with Poor Sleep Quality among U.S. College Students

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ABSTRACT
Background: Poor sleep among college students is a major, growing problem associated with lower academic performance, higher rates of health and emotional problems, and development of chronic sleep disorders. Purpose: Though previous studies have focused on individual colleges, our study purpose was to reveal the association of behaviors and function to sleep quality in a large sample of students from across the United States. Methods: We analyzed data from the Fall 2009 American College Health Association’s National College Health Assessment–II survey using descriptive statistics, independent sample t tests, chi-square tests, and logistic regression to find a representative, matched sample of 14,870 college students, both with and without a sleep problem, measured by daytime sleepiness. Results: Our correlational analysis revealed that sleep quality decreased with increasing levels of stress or alcohol/cigarette use and with decreasing levels of general health (all Ps < .001). Discussion: College interventions should include efforts to address sleep quality to improve students’ academic performance and long-term quality of life, especially for students experiencing substantial stress or poor general health. Translation to Health Education Practice: Educators, advisors, and leaders should incorporate sleep quality improvements into their services and programs for all students, especially students in at-risk groups.

Background
Sleep quality is foundational to cognitive, psychomotor, and emotional functioning. Because these abilities are critical for college students to succeed, it is particularly alarming that 20% to 60% of college students report poor quality sleep.1–3 College students are especially vulnerable to sleep problems due to their social maturity level and to self-imposed stress stemming from their increased educational and social demands.4 Despite a few promising interventions, sleep quality has not improved over the last decade. Instead, sleep problems are increasing among college students, and the consequences of poor sleep are mounting to serious proportions.3 Unfortunately, health educators, administrators, and other key personnel on college campuses seeking to improve both students’ health and their academic performance have little guidance about how these are affected by sleep quality. In this article, we outline the research literature on poor sleep among students and its associated problems, analyze data revealing both the national scope of the problems and specific factors associated with poor sleep, and recommend focusing campus health interventions on sleep quality issues.

The 2011 Sleep in America Poll survey documented that young adult sleepers (age 19 to 29 years) frequently reported sleep disturbances and were identified as one of the cohorts at risk for developing sleep disorders.5 Sleep disorders in young adults have reached an epidemic level in the United States, creating a significant public health problem.6 For example, in a public poll of 293 Generation Y-ers (aged 19–29 years), 23% said that they get an inadequate amount of sleep, 51% do not get good sleep, 67% often feel unrefreshed from their sleep, and 66% admitted they have driven when drowsy.5 Symptoms of poor sleep quality and/or quantity, such as excessive daytime sleepiness and tiredness, occur more than 2 days a week in 25% to 50% of U.S. college students.3,7 Beyond the United States, poor sleep quality in college students is also found in many countries.8,9 Furthermore, college students with poor sleep quality experience significant function and chronic disease–related problems. Sleep problems have been consistently identified for over 10 years as a top issue affecting academic performance.7,10,11 Reduced sleep quality has been associated with increased stress,12–14 use of marijuana and alcohol,15,16 and motor vehicle crashes.16,17
Wilner, 18 found that college students with poor sleep quality had higher levels of anxiety, depression, hostility, interpersonal sensitivity, obsessive-compulsive behaviors, phobic anxiety somatization, and psychoticism disorders per clinician rating. The negative correlation between poor sleep and emotional health, 18, 19 physical health, 16, 19 academic achievement and retention,10, 20, 21 and quality of life is clear, 19, 22-24 and it may last a lifetime.

Confusing the picture is the fact that most college students who report emotional health issues of stress, relationship problems, 19 and depression 23, 24 also self-report their physical health as “excellent.” 25 Because most of this surveying has not been specific to sleep quality, 25 the relationship between physical health and sleep quality in these populations is not well understood.

In addition to the research revealing possible consequences of poor sleep, several studies have focused on particular behaviors to identify possible causes of poor sleep. Emotional and academic stress may lead to poor sleep quality in college students, and the relationship appears to be circular. 1, 26 Lund et al. 1 found that perceived stress was the most significant contributor to poor sleep quality, providing 24% of the variance, whereas other evidence suggests that poor sleep quality may contribute to the association between stress and poor health. 26

Alcohol and cigarette use may have important impacts on college students’ sleep quality, but the literature provides limited and sometimes contradictory conclusions. Use of alcohol in college students is common, with over 66% of students using alcohol in the last 30 days. 7 Alcohol use and tobacco smoking were both associated with poorer sleep quality compared to college students who did not use these substances. 22 Geoghegan et al. 27 found reduced sleep quality and quantity with low doses of alcohol: they reported actigraphic measurements of a dose–response relationship between alcohol intake and decreased sleep-onset times, reduced sleep duration, and increased number of awakenings. However, the rebound wakefulness they found with low doses was not objectively demonstrated at higher doses. 27 Other researchers found that increasing amounts and frequency of alcohol use significantly altered sleep patterns through sleep disruption, sleep fragmentation, later bedtimes, and insufficient sleep. 15, 28 Galambos et al. 29 found that poorer sleep in students was predicted by alcohol use and increased time studying and preparing for examinations. In contrast, students with better sleep quality did not use alcohol; spent less time studying, perhaps because they were more alert; and socialized more. 22 College students’ use of alcohol is an issue of concern internationally: many countries have reported excessive alcohol use in college populations that puts them at risk for alcohol dependence. 30

Some studies of adolescents and young adults focus on the relation between drug use, particularly non-medical use, and sleep quality. A high rate of drug use was reported in adolescents and young adults (16–22 years) related to sleep/wake problems; over 70% used cannabis and alcohol to sleep, and 82% used amphetamines, ecstasy, and cocaine to stay awake. 31 Wong et al. 32 studied sleep problems and sleep deprivation in adolescents, finding that this predicted the first step to substance abuse and may lead to adult alcohol abuse, illicit drug use, and nicotine dependence. About 60% of undergraduate college students use stimulants, including caffeine, to increase alertness. 16 Frequent use of caffeinated energy drinks is associated with reduced sleep quality. 33 Clegg-Kraynok et al. 34 documented reduced sleep quality in students with current or past non-medical use of psychostimulants.

Purpose

Though other studies have documented poor sleep quality and some associated behaviors in individual college populations, our study broadens the lens to document the relationships of selected behaviors and functioning to poor sleep quality across a large sample of students from multiple U.S. colleges. Specifically, we intended to characterize the association of selected variables including alcohol/cigarette use, other drug use, general health, and stress with sleep quality.

Methods

Instrument

The data we analyzed came from the American College Health Association (ACHA) National College Health Assessment II (NCHA II) survey administered in Fall 2009, with results made available to researchers in Fall of 2012. These data reflect the trend of poor sleep quality reported by young adults and college students that continued through 2014. 5, 7, 11 Our Institutional Review Board determined that this secondary analysis of NCHA data did not require their review because it did not meet the definition of human subjects research under federal regulations.

The ACHA-NCHA II is a national survey of U.S. college students’ behaviors and perceptions about a wide range of health topics, 11 and it provides the most comprehensive information yet available about college
students, 19,377 had
in the ACHA
students at more than 57 institutions that participated
The original data set included a sample of 29,750 college
Data Set
.87 for variables considered in this study.
Reliability and validity of this
in the Kendall’s tau b.33 Reliability and validity of this
instrument compare favorably with nationally represen-
tative databases such as the National College Health Risk
Behavior Survey.35 Principal component analysis with
oblique rotation yielded the same factor structure and
reliability of Cronbach’s alpha ranging between .71 and
.87 for variables considered in this study.

Data Set
The original data set included a sample of 29,750 college
students at more than 57 institutions that participated
in the ACHA’s NCHA II survey in Fall 2009. Of those
students, 19,377 had “no sleep problem to a little sleep
problem” (NSP); 7,425 college students had “more than a
little to a very big sleep problem” (SP); and 2,948 were
missing data.

Sample and propensity weighting
We compared the group with data to the group missing
data by using independent sample t tests and chi-square
tests based on key demographic variables, including age,
gender, and race; because all tests yielded nonsignificant
results, we ignored those students missing data and
proceeded with those having data, for a resulting sample
size of 26,802.

However, this sample needed further refining: not only
were the SP group and the NSP group imbalanced in size,
but the groups contained significant baseline differences
in 11 of 15 summary variables used to characterize
students according to demographics, relationship status,
and health-related information. To control for differences,
we entered those items into a logistic regression to
calculate propensity scores that would, given the set of
observed covariates mentioned above, predict the like-
lihood for each student of either having a sleep problem
or having no sleep problem. We wanted to find students
with and without sleep problems who were similar in all
other characteristics, so that we could isolate other factors
that might significantly predict sleep problems. We set
the propensity score for SP students at 1 and determined
scores for NSP students in such a way that higher scores
indicated greater similarity to SP students and lower
scores indicated lower similarity to SP students. Using the
propensity scores, we then computed weights to create
equally sized groups of students with and without sleep
problems. Matching based on propensity scores yielded
2 groups of 7,425 students each that were suitable for
comparison and data analyses.

Measures
Of the 65 questions in the NCHA II survey, we initially
selected 32 (17 demographic, 15 behavior and function)
to analyze because their content was relevant to sleep
quality in the literature. We included questions about
participant characteristics and those behaviors and
functions that were most closely associated with sleep
problems. We excluded data from questions about factors
not previously emphasized in sleep research literature or
not directly related to the purpose of this study (e.g.,
Within the last 12 months, how often did you wear a seat
belt when you rode in a car?).

To represent sleep quality, we selected a question
about daytime sleepiness because sleepiness is a
consequence of various sleep problems commonly
found in this population (e.g., sleep deprivation,
insomnia, delayed sleep phase).3,16,22 This question
asked students whether they had had problems with
daytime sleepiness in the last 7 days. Students could
choose one of 5 response categories: no sleep problem
at all, a little problem, more than a little problem, a big
problem, or a very big problem. We defined our
development variable, daytime sleepiness, as a sleep quality
variable with the following dichotomous values: 1 =
having “more than a little to a very big sleep problem”
and 0 = having “no problem to a little problem.” The
dependent variable of sleep quality was dichotomized
due to large discrepancies in group sizes and to quantify/
interpret the contribution of each independent variable
separately, using calculated odds ratios.

Although the survey data offered many independent
variables to consider, we selected only 4 to determine their
specific relationship to sleep quality: alcohol/cigarette use,
other drug use, general health, and stress. These variables
were chosen after a through literature review that revealed
studies of sleep quality in college students with limited
samples and/or unclear associations.

The survey measured these variables by 2 different
methods, as explained below. Alcohol/cigarette use and
other drug use were measured with an averaged subscale score based on yes/no responses. Higher scores indicate greater use. Scores for alcohol/cigarette use ranged from 0 to 5 according to students’ responses to 5 items: cigarettes, cigars, tobacco from hookah, alcohol, and marijuana. Alcohol and cigarette use are measured as one factor in the NCHA II survey; therefore, in our analysis we used this grouping, because the scores for each tracked closely together and were consistent with independent validation. Scores for “other drug use” ranged from 0 to 10, according to responses to 10 items: MDMA, hallucinogens, inhalants, opiates, methamphetamines, cocaine, anabolic steroids, sedatives, other club drugs, and other illegal drugs.

In place of yes/no responses, the general health and stress questions asked students to use rating systems with 5 categories. For perceived general health, students could choose excellent, very good, good, fair, or poor. For the level of stress the student had experienced within the last 12 months, students could choose no stress, less than average stress, average stress, more than average stress, or tremendous stress.

Statistical analyses

We analyzed all data with SPSS 21.0 (IBM Corporation, Armonk, NY). We also cleaned the data to identify missing, duplicate, or incomplete data and to determine whether it complied with the assumption of normality. We examined distributions of quantitative data with descriptive statistics, including, for continuous data, mean and standard deviation (or median and interquartile range for data not normally distributed) and, for categorical data, frequencies and percentages. We examined relationships between categorical characteristic variables and an outcome measure of sleep quality using the chi-square test, and we used independent sample t tests to compare continuous variables between the 2 groups. After conducting a univariate logistic regression, we entered those variables that showed significance (P < .10) into a multivariate backward stepwise regression to determine which ones were independently related to the dependent variable of sleep quality. All statistical significance is reported at P ≤ .05.

Results

Characteristics of sample

Before matching, the 2 groups differed significantly in 11 summary variables, but the matching procedure eliminated all but 2 significant differences (81.8%). Significant differences between the NSP student group and SP student group were found in gender and fraternity/sorority membership. College students with sleep problems had an average age of 19.87 years old (SD = 1.72) and were predominantly female (68.5%), Caucasian (75.9%), enrolled full time (97.8%), single (94.9%), and not a member of a fraternity or sorority (88.6%). Table 1 shows descriptive information for the 2 groups before and after propensity score matching.

Significant predictors of sleep problems

The multivariate logistic regression revealed 3 significant independent predictors of sleep problems: increased level of stress, lowered general health, and frequent alcohol/cigarette use (Table 2). As expected, although students tend to self-report good physical health regardless of emotional health issues, students have greater sleep problems if their general health is worse, if their level of stress increases, or if they use more alcohol/cigarettes.

Table 1. Characteristics of students in the no sleep problem and sleep problem matched groups.

<table>
<thead>
<tr>
<th>Variable</th>
<th>No Sleep Problem (N = 7425)</th>
<th>Matched Sleep Problem (N = 7425)</th>
<th>95% CI for Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (Female)</td>
<td>4914 (66.2)</td>
<td>5091 (66.6)</td>
<td>0.90 0.84 0.96</td>
</tr>
<tr>
<td>Age</td>
<td>19.89 (1.70)</td>
<td>19.87 (1.73)</td>
<td>1.54</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>5639 (75.8%)</td>
<td>5641 (75.9%)</td>
<td>1.00 0.93 1.08</td>
</tr>
<tr>
<td>Black</td>
<td>335 (4.5%)</td>
<td>315 (4.2%)</td>
<td>0.94 0.80 1.10</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>372 (5.0%)</td>
<td>376 (5.1%)</td>
<td>1.01 0.89 1.17</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>820 (11.0%)</td>
<td>836 (11.2%)</td>
<td>1.02 0.99 1.13</td>
</tr>
<tr>
<td>American Indian/Alaskan</td>
<td>59 (0.8%)</td>
<td>60 (0.8%)</td>
<td>1.02 0.73 1.46</td>
</tr>
<tr>
<td>Native/Native Hawaiian</td>
<td>101 (1.4%)</td>
<td>97 (1.3%)</td>
<td>0.96 0.73 1.27</td>
</tr>
<tr>
<td>Biracial</td>
<td>81 (1.1%)</td>
<td>83 (1.1%)</td>
<td>1.03 0.75 1.39</td>
</tr>
<tr>
<td>Other</td>
<td>185 (2.5%)</td>
<td>167 (2.2%)</td>
<td>0.90 0.87 1.11</td>
</tr>
<tr>
<td>Enrollment (part-time)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship status</td>
<td>7047 (94.8%)</td>
<td>7057 (94.9%)</td>
<td>1.03 0.89 1.19</td>
</tr>
<tr>
<td>Fraternity or sorority member</td>
<td>762 (10.2%)</td>
<td>850 (11.4%)</td>
<td>1.13 1.02 1.25</td>
</tr>
</tbody>
</table>

CI indicates confidence interval. The propensity score for students in the sleep problem group is 1; for students in the no sleep problem group, higher scores indicate greater similarity to students in the sleep problem group, and lower scores indicate lower similarity to students in the sleep problem group. Statistical significance is shown in bold.
Poor sleep quality among college students is a growing problem nationwide.2,3,6,8,14 It is also confirmed that poor sleep quality is a growing problem,15,22,28,31,32 it also confirms connections between stress and sleep quality,3,12-14,26 and between general health and sleep quality,19,23,24 which are less well documented and less well understood. Sleep quality is often compromised in college students who feel increased stress given their academic, vocational, and social schedules.12-14 As a consequence of poor sleep, many students resort to unhealthy behaviors in an attempt to remedy their poor sleep quality.14,16,22,23,31-34 The psychological factors related to college students’ attitudes about their sleep health, though identified to a degree in this study, need specific further study.

In contrast with other investigations, we did not find a significant association between sleep quality and other drug use.31,32,34 Nevertheless, because the survey was conducted in the fall semester, we believe that the data may overrepresent students new to college life who have had limited exposure to other drug use.

Poor sleep quality among college students is a growing, nationwide problem2,3,6,8 associated with higher stress levels,13,14 increased alcohol use,16,32 and poorer health,18,19,22-24 as well as with compromised cognitive and academic performance.15,20,21 Although college students are aware of their sleep problems, they have little insight into the other problems associated with poor sleep, the impact of their social schedule, or practices that can improve the quality of their sleep.3,8,24

The data have limitations that may affect interpretation of the results. First, though the survey was offered to the entire U.S. college student population, the schools that chose to participate were more often major universities and large colleges, so small colleges and commuter-based schools with a distinct student composition may not be able to generalize from these findings. Second, the survey results are based on self-report, which inherently contain bias due to over- or underreporting. Third, the data included participant responses from a fall semester, when many students are new to college life. Because the data were collected through self-report and during a fall semester, we suspect that students may have underestimated the extent of their alcohol use and daytime sleepiness. The associations we found may in fact be even stronger than we have demonstrated with the data available.

Although the data we analyzed were collected in 2009, subsequent studies,5,11 as we outlined earlier, have only confirmed that poor sleep quality is a growing problem nationwide. Further studies are needed to increase our understanding of sleep health and its consequences, the psychological factors that influence beliefs and attitudes about sleep health, and the barriers between knowing about sleep health and acting to improve it. Such studies would greatly aid in developing effective interventions.

### Table 2. Associations of selected behaviors and functioning variables with sleep quality.9

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Univariate Analysis</th>
<th>Multivariate Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95% CI</td>
</tr>
<tr>
<td>Alcohol/cigarette use</td>
<td>1.12</td>
<td>1.08–1.16</td>
</tr>
<tr>
<td>Other drug use</td>
<td>1.26</td>
<td>1.09–1.47</td>
</tr>
<tr>
<td>General health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>Ref</td>
<td>Ref</td>
</tr>
<tr>
<td>Very good</td>
<td>0.79</td>
<td>0.74–0.84</td>
</tr>
<tr>
<td>Good</td>
<td>1.34</td>
<td>1.25–1.44</td>
</tr>
<tr>
<td>Fair</td>
<td>2.10</td>
<td>1.83–2.41</td>
</tr>
<tr>
<td>Poor</td>
<td>2.97</td>
<td>2.03–4.33</td>
</tr>
<tr>
<td>Stress</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No stress</td>
<td>Ref</td>
<td>Ref</td>
</tr>
<tr>
<td>Less than average</td>
<td>0.44</td>
<td>0.38–0.50</td>
</tr>
<tr>
<td>Average</td>
<td>0.55</td>
<td>0.51–0.59</td>
</tr>
<tr>
<td>More than average</td>
<td>1.62</td>
<td>1.51–1.72</td>
</tr>
<tr>
<td>Tremendous</td>
<td>2.69</td>
<td>2.3–3.02</td>
</tr>
</tbody>
</table>

9 OR indicates odds ratio; CI, confidence interval. \( R^2 = 0.05 \) (Hosmer and Lemeshow), 0.06 (Cox and Snell), 0.08 (Nagelkerke). Model \( \chi^2 \) (8) = 1.63, \( P > .05 \).
programs and services. For example, planners should include information on sleep quality in student programs that address stress management, general health issues, and alcohol use.

Unfortunately, there is limited evidence on effective interventions to improve college students’ sleep quality, and we strongly encourage researchers to conduct further study. Investigators have explored how expressive writing, white noise, mindfulness, music, and face-to-face and Internet delivery of sleep education affect college students’ sleep quality. We urge caution in generalizing from many of these studies due to small sample sizes, limited or no control groups, and short duration of follow-up.

As further evidence emerges, we encourage college/university educators and leaders to utilize available resources from associations (e.g., American College Health Association, American Association of Sleep Medicine, Society of Behavioral Sleep Medicine, and National Sleep Foundation) and health professionals to assess and improve students’ sleep quality. Programmatic strategies that may address students’ sleep quality include assessing and improving sleep health knowledge, self-help information and tools, on-campus sleep environments, academic and activity scheduling, and sleep disorder services.

It is important that educators and advisors are able to recognize students with sleep problems. In addition to sleep health education for all students, campus personnel from administrators to faculty advisors need to understand the importance of assessing sleep quality in students who seek help for non-sleep-related problems. The first step is simply to ask. Does the student have a sleep problem? How is the problem affecting the student? It is particularly important to assess sleep quality in students experiencing substantial stress or poor general health, such as those who present for academic counseling, health, and psychological counseling services. The next step is to refer the student to health care or counseling providers trained to treat sleep issues. This population of at-risk students is highly likely to benefit from brief behavioral therapy to improve their sleep quality. A third step is to gain knowledge of the types of assessments that students may encounter with trained sleep providers so that the students will be less anxious about seeking help. Improving the sleep quality of students on college campuses is highly likely to enhance academic performance and long-term quality of life.

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**References**


