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RELATIONSHIP BETWEEN SLEEP QUALITY AND HEALTH RISK BEHAVIORS IN UNDERGRADUATE COLLEGE STUDENTS

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The Sleep Quality Index (SQI) and the Centers for Disease Control's National College Health Risk Survey (NCHRS) were administered to 859 undergraduates at a large southeastern university. Results indicated that 76.6% reported occasional sleep problems and 11.8 % experienced poor sleep quality. Among the problems reported, "general morning tiredness" (82%) and "insomnia" (28%) were the most common. Certain health risk behaviors appear to be associated with poor sleep quality including fighting, suicide ideation, smoking, and alcohol use. Implications and limitations of the study are identified.

Recently, the impact of insufficient sleep has been identified as a significant public health challenge in the United States. It is currently estimated that 10% of the American population experience chronic insomnia and more than one-quarter report occasionally not getting enough sleep. Insufficient sleep has been linked to a number of chronic disease states and has been identified as a significant contributor to both occupational and traffic accidents. (Division of Adult and Community Health, National Center for Chronic Disease Prevention and Health Promotion, 2008). Lack of sleep has also been linked to behavioral health risk factors. Data from the National Household Interview Study indicate that in adults aged 18-44 those who reported sleeping less than six hours per night were more likely to smoke and to have five or more drinks of alcohol in one day (Schoenborn & Adams, 2008).

Mirroring the broader population, the quantity and quality of college student sleep have changed dramatically over the past several decades. From 1969 to 2001, the mean hours of sleep reported by college students dropped from 7.75 hours per night to 6.65 hours (Hicks, Fernandez, & Pellegrini, 2001a). Dissatisfaction with sleep rose from 24% to 71% between 1978 and 2001 and in 1992 two-thirds (68.3%) of college students reported sleep problems (Hicks, Fernandez, & Pellegrini, 2001b). In 2001, Buboltz and colleagues (Buboltz, Brown, & Soper, 2001) found that 73% of college students studied reported some form of sleep disturbance, with women reporting more problems than men.

While college students are certainly prone to the same risks associated with poor sleep in the general population, researchers have explored the specific effects of sleep difficulties on the lives of college students. This research has shown that college students with poor sleep are prone to a number of undesirable outcomes. Diminished sleep quality has been associated with anxiety, depression, and

stress (Jensen, 2003; Carney, Edinger, Meyer, et al., 2006). Interrelated with these issues is the positive relationship between sleep quality and academic performance (Kelly, Kelly, & Clanton, 2001; Tsai, & Li, 2004; Campos-Morales, Valencia-Flores, Castaño-Meneses, Castañeda-Figueiras, & Martínez-Guerrero, 2005; Becker, Adams, Orr, & Quilter, 2008).

With regard to sleep research, college students are a special group because the campus culture presents many unique sleep-related challenges. These can include parties, stress, and work coupled with the communal living arrangements typically associated with dormitories and other student-focused housing (Buboltz, Soper, Brown, & Jenkins, 2002; Jensen, 2003). Sleep issues may be associated with other student risk behaviors related to voluntary lifestyle choices including drinking patterns (Wechsler, Kelley, Weitzman, San Giovanni, & Seibring, 2000) sexual activities (Clemens, Engler, & Chinn, 2004) and other lifestyle choices such as physical activity and working (Trockel, Barnes, & Egget, 2000). In a more general context, sleep length has been shown to be related to life satisfaction (Kelly, 2004) and sleep quality to several measures of health and well being (Pilcher & Ott, 1998).

Sleep is interrelated to each of these issues and it has been found to be amendable to successful interventions (Buboltz, et al., 2002). Good quality sleep, in itself, is immediately reinforcing and can also serve as an enabling resource for students (Buboltz. et al., 2002; Trockel, Barnes, & Egget, 2000), suggesting that better sleep could have a significant impact on the well being of college students. The purpose of this study was to determine the prevalence of poor sleep quality among undergraduate college students, to examine certain behavioral factors associated with sleep quality, and to explore the relationship between sleep quality and certain behaviors generally accepted as health risk factors for college students.

Method

Participants

The sample for this study consisted undergraduates from a public university in the southeast. Subjects were enrolled in a personal health course required for graduation. Participation was voluntary and anonymous. The survey was administered online and participating students completed it outside of class at their own convenience. Participants received extra credit for taking the survey by presenting their instructor a "receipt" that was produced when responses were submitted. Of the 1596 students enrolled in the course, 859 (53.8%) participated in the survey.

More than two-thirds of the subjects were female (70%, n=596). Freshmen accounted for the largest percentage of the sample (70%, n=596) while 18% were sophomores (n=157), 9% juniors (n=74) and 3% seniors (n=26). Most of the respondents were white (77%, n=655), 16% were African American (n=139), and the remaining 8% were other races (n=60). The reported ethnicity of the sample was similar to that of the university's undergraduate enrollment of the same period (77.9% white, 16.8% African American and 5.3% "other") (East Carolina Uni-

versity, 2007). The class distribution of the sample was consistent with the usual enrollment of this course that is typically about 80% freshmen and sophomores.

Measures

A 100-item survey instrument based on the CDC's National College Health Risk Survey (NCHRS) (Centers for Disease Control, 1997) was made available online to all students enrolled in a required personal health class. The NCHRS items explore six categories of priority health-risk behaviors among youth and young adults: behaviors that contribute to unintentional and intentional injuries, tobacco use, alcohol and other drug use, sexual behaviors, unhealthy dietary behaviors, and physical inactivity.

The findings reported here were based on the responses from the NCHRS items and the Sleep Quality Index (SQI), an eight-item self-report inventory of general sleep difficulties (Urponen, Partinen, Vuori, & Hasan, 1991). The SQI items were added to the NCHRS for the April 2006 administration of the survey. The combined instrument received approval by the Institutional Review Board at East Carolina University.

The SQI consists of eight items with three response categories weighted 0, 1, or 2, with 2 indicating the most common or severe symptom. SQI developers report that summed scores on the eight items provide a total sleep quality score. They categorize sleep quality based on scale scores as follows: 0-1 = good sleep quality, 2-8 = occasional sleep difficulties, and 9-16 = poor sleep quality. A Cronbach's alpha of .73 for men and .75 for women indicates an acceptable internal consistency of the SQI. Support for the validity of the scale is provided by the significant positive relationship between sleep quality score and subjective health reported by Urponen, Partinen, Vuori, & Hasan (1991).

Results

The Sleep Quality Index scores for the 859 respondents indicated that 6.3% reported very good sleep quality (a score of 0-1), 76.6% indicated occasional sleep problems (a score of 2 – 8) and 11.8% reported poor sleep quality (a score of 9 – 16). These findings were similar to those of Buboltz, et al. (2002). They reported 11%, 73%, and 15% of college student's scores fell into the three respective categories. Similarities also exist between our findings and Bublotz et al. (2002) with respect to the frequency of responses to most of the individual SQI items. Table 1 summarizes those similarities.

Table 1
Comparative Response Percentage to Individual Sleep Quality Index Items

Item	Current Study	Buboltz
Took more than 30 minute to fall asleep	18%	20%
Insomnia in last 3 months	28%	25%
Difficulty falling asleep 3 or more days/week	11%	12%
Disturbed sleep 3 or more days/week	11%	15%
Nocturnal awakenings 3 or more days/week	13%	14%
Awakened too early 3 or more days/week	11%	14%
General morning tiredness	82%	54%
Use sleep medication at least once/week for in past 3 weeks	2.0%	1.0%

Our results indicated that sleep quality (mean SQI scores) was associated with several health risk behaviors including physical aggression, suicide ideation, smoking, alcohol and marijuana use and physical inactivity. Students were asked if they experienced a physical fight during the twelve months preceding survey administration. For our analysis the eight response categories to this item were collapsed to two; "yes" ($n = 74$) and "no" ($n = 776$). Mean SQI scores were significantly higher (F (1, 848) = 4.73, $p = .03$) for those who reported experiencing a fight ($M = 6.66$, $SD = 3.12$) than those who did not ($M = 5.86$, $SD = 3.04$) report fighting.

Sixty students (7.0 %) reported that they had seriously considered suicide in the twelve months prior to completing the survey. These students' SQI score ($M = 7.73$, $SD = 2.98$) were significantly higher (F (1, 847) = 11.73, $p < .001$) than students not reporting having considered suicide ($n = 788$, $M = 5.78$, $SD = 3.02$).

The survey item assessing smoking behavior has seven categories. For our analysis these categories were collapsed resulting in respondents being classified as (a) non-smokers ($n = 568$), (b) those who smoked one or fewer cigarettes per day ($n = 102$) and (c) those smoking more than one cigarette per day ($n = 180$). ANOVA of mean SQI scores indicated that significant differences did exist between the scores (F (2, 847) = 6.53, $p = .002$). Post-hoc analysis (Tukey HSD) revealed that the SQI for non-smokers ($M = 5.67$, $SD = 3.01$) was significantly lower than both the one or fewer cigarette per day group ($M = 6.62$, $SD = 3.28$) and the more than one cigarette per day group ($M = 6.36$, $SD = 3.00$).

To ascertain the constancy of alcohol consumption, students were asked to indicate on how many of the 30 days prior to the survey administration they consumed at least one drink of alcohol. Seven response categories ranged from no days to all 30 days. ANOVA performed on the mean SQI scores within each category indicated that significant differences existed (F (6,843) = 2.85, $p = .009$). Post-hoc analysis (Tukey HSD) revealed that non-drinkers ($n = 218$, $M = 5.50$, $SD = 3.14$) had a significantly lower SQI score (thus better sleep quality) than those reporting alcohol use on 20 to 29 days ($n = 35$, $M = 7.23$, $SD = 2.87$).

Students were also asked how many times in the 30 days prior to the survey they had used marijuana. There were six response categories ranging from none to 40 or more times. Mean SQI scores did not vary significantly as a function marijuana use (F (5, 844) = .453, $p = .811$).

We also examined two behavioral factors that have been shown to be associated with sleep quality; exercise patterns and work (Trockel et al, 2005). Students were asked to report how many days in the week preceding survey administration that they exercised vigorously or participated in sports activity for at least 20 minutes. There was no relationship found between exercise frequency and mean SQI scores (F (7, 842) = 0.95, $p = .464$). Students categorized their work experience by selecting one of seven categories ranging from no hours worked to more than 40. ANOVA did reveal significant between group differences (F (7, 826) = 3.16, $p = .003$). Post-hoc pairwise comparisons

showed a single significant difference with those reporting working zero hours (n = 530, $M = 6.18$, $SD = 3.07$) having higher mean SQI scores than those reporting working one to nine hours ($n = 89$, $M = 5.01$, $SD = 2.75$).

Discussion

Our research supports results from previous studies indicating that many college students report at least occasional sleep disturbance. In our study almost 12% could be classified as experiencing poor sleep quality as measured by the SQI. Among the problems reported, "general morning tiredness" (82%) and "insomnia" (28%) were the most common.

Certain health risk behaviors appear to be associated with poor sleep quality. These include fighting, suicide ideation and smoking, and alcohol use. Our finding that sleep quality is related to suicide ideation is consistent with results reported by Bernert who found that poor sleep quality predicted elevated suicidal symptoms even after controlling for depression in a sample of 322 college undergraduates between 19 and 24 years of age (American Academy of Sleep Medicine, 2008). Similar to our findings, Liu found significant relationships between sleep quality and both smoking and alcohol use in large sample of Chinese adolescents. The author suggested that education related to sleep hygiene might be indicated as a measure to prevent adolescent substance abuse (American Academy of Sleep Medicine, 2007). These recommendations must be tempered, however, by the recognition that the cause/effect relationship between both alcohol and tobacco use is complicated by the psychoactive properties of the drugs. This fact is reinforced by recent research findings of Punjabi (American College of Chest Physicians, 2008) comparing the sleep patterns of 'healthy' smokers (the authors noted the difficulty and care taken to recruit smokers without the comorbidities typically associated with smoking) and non-smokers. In this study 22.0% of non-smokers reported restful sleep compared to only 5.0% of smokers.

While there is only limited evidence that instructional programs designed to improve the sleep quality of college students can be effective (Brown, Buboltz, & Soper, 2002; Brown, Buboltz, & Soper, 2006), the growing recognition of the importance of sleep in maintaining overall health suggests that campus based programs to address this issue are worth further exploration. To be effective, such initiatives will likely need to include both environmental and instructional program initiatives. A comprehensive approach to the problem might include (1) a sleep hygiene program similar to the STEP program developed by Brown et al. (2006) integrated in a comprehensive personal health or as part of general freshman orientation programs, (2) institution of university policies that support better sleep habits including quiet hours and noise ordinances and (3) working with those responsible for student housing to design spaces that are conducive to sleep.

Limitations

The data should be interpreted cautiously. The convenience sample of 859 respondents is not representative of the 17.4 million U.S. college students (U.S.

Bureau of the Census, 2007). More importantly, like other research relating sleep experience to other variables, our research is correlational. The relationships between sleep experience, health-related behaviors and general health indices such as well-being and life satisfaction are certainly complex and non-linear. Prospective, longitudinal follow-up methods are required to more thoroughly examine the nature of these relationships. Finally, subsequent research should move beyond the exploratory analysis of these data to multivariate analysis to develop a more complete and accurate understanding of the sleep behavior of women and men.

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