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# Sleep hygiene among veterinary medical students

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**Abstract:**

**OBJECTIVE:** The objective of this study was to better understand veterinary medical students' sleep hygiene and identify the extent to which sleep hygiene behaviors may result in consequences (either positive or negative) for students.

**SAMPLE:** A total of 187 doctor of veterinary medicine (DVM) program students at a large College of Veterinary Medicine in the United States.

**METHODS:** The Epworth Sleep Scale and Daytime Sleepiness Scale were administered to 393 students enrolled in the DVM program.

**RESULTS:** About 55.1% of students reported <7 h of sleep per night, 28.9% reported having trouble sleeping, and 50.3% reported feeling sleepy all day. With respect to sleep quality, 5.3% described it as excellent, 52.4% as good, 34.2% as fair, and 8.0% as poor.

**CONCLUSIONS:** A significant percentage of veterinary medical students exhibit poor sleep hygiene habits that may be detrimental to both their health and academic endeavors.

**Keywords:**

College students, health professions, medical education, quality of life, sleep, sleepiness, veterinary medicine, wellness

## Introduction

Sleep difficulties and deprivation have become one of the chief complaints among college students. Numerous studies have shown students report symptoms that include difficulty falling asleep, problems maintaining sleep, poor sleep quality, early morning awakenings, early morning fatigue and/or sleepiness, and daytime napping.[1-4] In fact, the American College Health Association[5] reported students rank lack of sleep as the second most influential factor (behind stress) for negative academic performance. Research has indicated that 50% of college students experience daytime sleepiness compared to 36% of adults and adolescents,[2] and 70.6% of students receive <8 h sleep per night.[3] Further, several studies have reported that most college students experience 1–3 h of sleep deficit per night during the week and sleep for longer durations on the weekends in an effort to catch up.[3,6]

Undergraduate students, however, are not the only college students struggling with sleep difficulties. Recent research[7] reported 60%–65% of medical students experience excessive daytime sleepiness, receive inadequate levels of sleep, experience poor sleep quality, and suffer from emotional exhaustion. Similarly, studies conducted in the field of veterinary medicine found that 63% of students reported experiencing sleep difficulties, a small portion of which also cited sleep difficulties adversely affected their academic performance,[8] and 60% of veterinary students cited sleep disturbances as a source of stress and 72% claimed feelings of "chronic tiredness."[9] These findings are concerning as these problems are known to have compounding effects and often lead to poor lifestyle behaviors, substance abuse, negligence

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of health, and continued decreases in academic performance.[10]

Sleepiness and sleep deprivation typically result in several unintended consequences for students. For example, studies have found that the consequence of sleep deprivation and daytime sleepiness can result in lower grade point averages, decreased memory, compromised learning, increased risk of academic failure, impaired mood, and increased risk of motor vehicle accidents.[11,12] To combat sleepiness, students often consume caffeine and/or energy drinks which can impair one's ability to fall asleep,[13] thus perpetuating the sleep deprivation cycle. Approximately one-third of individuals 18–24 years old regularly consume energy drinks[14] and many also report an increased use of stimulants[15] as a method to increase concentration and stay awake.[16]

There are many reasons why students may experience daytime sleepiness, but the most common reason is sleep deprivation. Physiological factors such as the circadian rhythm causes many young adults to have a tendency or nocturnal preference to go to bed too late.[17,18] Other factors causing daytime sleepiness may be situational and/or related to the academic environment. For example, "pulling an all-nighter" for an examination and early morning/late night obligations have the potential to negatively impact sleep.[14,15] Finally, the use of electronics before bed, a common behavior for many students, has been found to result in less restful sleep and drowsy driving.[19-22]

Given the numerous negative impacts of sleep deprivation on overall health and academic performance, and the challenging environment of veterinary medical schools, it is necessary to better investigate the sleep patterns and cognitive functioning of veterinary medical students. To date, several studies in veterinary medicine have discussed sleep and its relationship with wellness and academic performance in a cursory manner,[8,9] but no study has systematically investigated veterinary medical students' sleep hygiene and potential strategies for improving this important facet of wellness. Thus, the purpose of this study was to better understand modern veterinary medical students' sleep hygiene and identify the extent to which sleep hygiene behaviors may result in consequences (either positive or negative) for students.

## Methods

### Participants and procedures

An anonymous electronic survey was administered in the fall semester of 2016 to all doctors of veterinary medicine (DVM) program students at a large College of Veterinary Medicine in the United States. The DVM program consists of 393 students spanning four program years (PGYs). A census sampling approach was utilized, as all students were invited to participate in the study. A total of 187 of the 393 students completed the survey resulting in a 47.6% response rate. The median age for participants was 24 years old. A breakdown of student demographic characteristics is presented in Table 1. Results indicate the proportion of students who completed the survey were not statistically significantly different than the larger population with respect to gender, $\chi^2$ (1) = 2.487, $P$ = 0.115, and race/ethnicity, $\chi^2$ (1) = 2.949, $P$ = 0.090. Results, however, did indicate that a greater proportion of 1st year students completed the survey than other class cohorts, $\chi^2$ (3) = 11.388, $P$ = 0.010. The university's Institutional Review Board declared this study (protocol #9359) "Exempt."

### Instruments

Students were administered the Epworth Sleep Scale (ESS),[23] a widely used instrument designed to measure an individual's level of habitual sleepiness during the day. The scale consists of eight items that assesses one's self-reported likelihood of falling asleep given a variety of day-to-day situations. The rating scale consists of four response options: 0 = Would never doze; 1 = Slight chance of dozing; 2 = Moderate chance of dozing; and 3 = High chance of dozing. For the present study, students were asked "For the following items, think of a typical weekday (Mon-Fri) and rate the degree to which you believe you are likely to doze off (fall asleep) given each situation." ESS scores were calculated by summing the scores. Scores ranging from 0 to 10 typically are considered normal, and scores exceeding this range may be indicative of poor sleep quality or potential sleep disorders.[24] The Cronbach's α reliability coefficient was. 825, which constitutes a moderate-to-high magnitude of internal consistency.[25]

Students also were administered the Daytime Sleepiness Scale (DSS), a modified version of the Stanford Sleepiness Scale that often is used in many clinical practices. The DSS is a single, multidimensional item

**Table 1: Demographic characteristics of the sample**

| Variable | *n* (%) |
|---|---|
| Year | |
| 1st year | 72 (38.5) |
| 2nd year | 32 (17.1) |
| 3rd year | 39 (20.9) |
| 4th year | 44 (23.5) |
| Gender | |
| Male | 30 (16.0) |
| Female | 157 (84.0) |
| Race/ethnicity | |
| White | 160 (85.6) |
| Other | 27 (14.4) |

that assesses one's self-reported rating of sleepiness and cognitive functioning. For the present study, students were asked "On a typical weekday, the following statement best describes me:" and presented six specific descriptions of sleepiness and cognitive functioning. Because the DSS is a single item, a reliability coefficient cannot be calculated.

Several supplemental items were included to better understand students' sleep behaviors. For example, students were asked what time they typically go to bed and wake up during the week; how much self-reported sleep they obtain during the week; if they typically have trouble sleeping at night; if they typically are sleepy all day; and how they would rate their typical sleep quality during the week.

### Data analysis

Data analyses were performed using SPSS statistical software. Analyses consisted of calculating a variety of descriptive and inferential (e.g., ANOVA) statistics. All significance testing was conducted with alpha set to 0.05.

## Results

### Epworth sleep scale results

ESS scores ranged from 0 to 24, with a median score of 10 and a mean score of 9.79 (standard deviation = 4.78). The majority of the students, 113 (60.4%), had ESS scores of 10 or less which, using guidelines established by Johns,[23] indicates they are likely obtaining sufficient sleep. However, 68 (36.4%) students had scores which ranged from (10 to 19) which indicates they may be obtaining less than desirable levels of sleep. Further, 6 (3.2%) students had ESS scores >19 which indicates they may be at risk for obtaining extremely low levels of sleep. Figure 1 illustrates the distribution of ESS scores across all participants.

### ESS Scores by program year and gender

Mean and median ESS scores were produced for both PGY and gender variables. ESS scores were consistent across both variables. Mean score comparisons indicated no statistically significant differences exists based on PGY ($P$ = 0.458) or gender ($P$ = 0.513). A complete breakdown of results is presented in Table 2.

### Response frequencies for each ESS item

Table 3 presents the eight items appearing on the ESS and the frequency for which each response option was selected. Results indicate activities in which students were least likely to doze off include sitting and talking to someone (82.9%), and driving a car, while stopped for a few minutes in traffic (81.2%). Students indicated they would have a slight chance of dozing when sitting quietly after a lunch without alcohol (38%), sitting, inactive in a public place (36%), watching TV (34.9%), and sitting and reading (34.2%). Activities with a moderate chance of dozing also included watching TV (34.4%) and sitting and reading (32.6%). Activities with the highest chance of dozing included lying down to rest in the afternoon when circumstance permit (58.3%), when riding as a passenger in a car for an hour without a break (29.9%), and sitting and reading (21.9%).

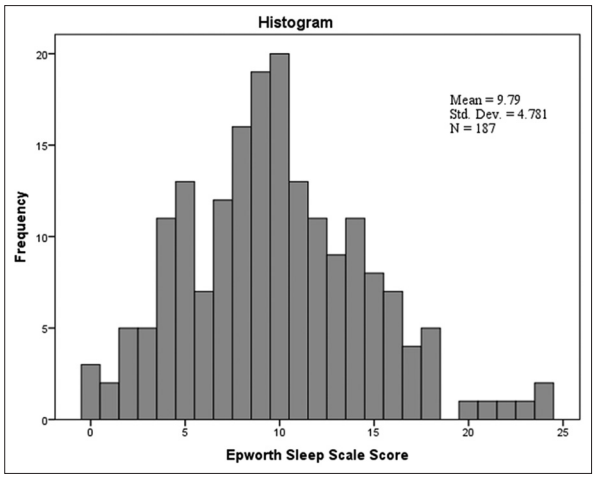


**Figure 1:** Epworth sleep scale scores for all participants

**Table 2: Epworth Sleep Scale scores by program year and gender**

| Variable | *n* | Mean (SD) | Median |
|---|---|---|---|
| Program year | | | |
| 1st year | 72 | 9.53 (5.33) | 9 |
| 2nd year | 32 | 9.13 (3.79) | 9 |
| 3rd year | 39 | 9.74 (4.19) | 10 |
| 4th year | 44 | 10.75 (4.97) | 10 |
| Gender | | | |
| Males | 30 | 9.27 (4.27) | 9 |
| Females | 157 | 9.89 (4.78) | 10 |

SD=Standard deviation

### Daytime sleepiness scale results

Students were asked "On a typical weekday, the following statement best describes me" and asked to select one of six statements. Results indicate most students reported either being awake, able to concentrate, but not quite at peak alertness (47.6%) or a little sleepy, losing interest, but still able to function (24.1%). A full breakdown of results is presented in Table 4.

### Daytime sleepiness scale results by program year and gender

Responses to the DSS were investigated by PGY and gender. Chi-squared tests indicate there were no statistically significant differences based on PGY, $\chi^2$ (15) = 9.579, $P$ = 0.845, or gender, $\chi^2$ (5) = 5.284, $P$ = 0.382. A complete breakdown of results is presented in Table 5.

**Table 3: Frequency of responses for Each Epworth Sleep Scale item**

| Item | Would never doze, *n* (%) | Slight chance of dozing, *n* (%) | Moderate chance of dozing, *n* (%) | High chance of dozing, *n* (%) |
|---|---|---|---|---|
| Sitting and reading | 21 (11.2) | 64 (34.2) | 61 (32.6) | 41 (21.9) |
| Watching TV | 27 (14.5) | 65 (34.9) | 64 (34.4) | 30 (16.1) |
| Sitting, inactive in a public place (e.g., a theater or a meeting) | 71 (38.2) | 67 (36.0) | 28 (15.1) | 20 (10.8) |
| As a passenger in a car for an hour without a break | 30 (16.0) | 54 (28.9) | 47 (25.1) | 56 (29.9) |
| Lying down to rest in the afternoon when circumstances permit | 8 (4.3) | 30 (16.0) | 40 (21.4) | 109 (58.3) |
| Sitting and talking to someone | 155 (82.9) | 26 (13.9) | 3 (1.6) | 3 (1.6) |
| Sitting quietly after a lunch without alcohol | 56 (29.9) | 71 (38.0) | 39 (20.9) | 21 (11.2) |
| In a car, while stopped for a few minutes in traffic | 151 (81.2) | 25 (13.4) | 5 (2.7) | 5 (2.7) |

**Table 4: Participant responses to the Daytime Sleepiness Scale**

| Item | *n* (%) |
|---|---|
| I'm alert, wide awake, and at peak alertness | 8 (4.3) |
| I'm awake, able to concentrate, but not quite at peak alertness | 89 (47.6) |
| I'm awake, but not fully attentive | 35 (18.7) |
| I'm a little sleepy, losing interest, but still able to function | 45 (24.1) |
| I'm sleepy, would prefer to be lying down | 8 (4.3) |
| I'm very sleepy, and having trouble staying awake | 2 (1.1) |

### Supplemental items

Students were asked a series of supplemental items to better understand their sleep behaviors and quality. When asked what time students typically go to bed and wake up during the week, both the median and mode statistics indicated 11:00 p. m. and 7:00 a. m. Students also were asked "On a typical weeknight, I would estimate I get the following amount of sleep…." A total of 103 (55.1%) students reported they obtain <7 h each night and 84 (44.9%) reported they obtain between 7 and 9 h. No student reported receiving more than 9 h per night. In addition, 54 (28.9%) students reported having trouble sleeping and 94 (50.3%) reported feeling sleepy all day. With respect to overall sleep quality, 10 (5.3%) students described it as excellent, 98 (52.4%) as good, 64 (34.2%) as fair, and 15 (8.0%) as poor.

## Discussion

### Substantive findings

The National Sleep Foundation (NSF)[26] recommends adults (18–65) get between 7 and 9 h of sleep per night. Our study presents two measures of sleep adequacy. First, we asked students "On a typical weeknight, I would estimate I get the following amount of sleep" and presented three options for the NSF discrete categories which essentially indicate too much, too little, or an appropriate amount. Specific categories included "<7 h," "between 7 and 9 h," and "more than 9 h." Given this measure, 44.9% of students reported obtaining the recommended sleep levels, whereas 55.1% did not. No student indicated obtaining more than 9 h of sleep. The second measure of sleep adequacy was derived from the ESS. By this measure, 60.4% ($n$ = 113) students likely are obtaining sufficient sleep per ESS score interpretation guidelines, 36.4% ($n$ = 68) may be obtaining less than desirable levels of sleep, and 3.2% ($n$ = 6) of students may be obtaining extremely low levels of sleep. Of course, what is truly "adequate" with respect to sleep may vary across individuals. In any instance, it appears approximately 40%–55% of veterinary medical students are not obtaining adequate levels of sleep.

Aside from sleep quantity, of course, is sleep quality. Here, 28.9% ($n$ = 54) of students reported having trouble sleeping, and 42.2% ($n$ = 79) reported their sleep quality as "fair" or "poor." These likely are telling statistics as it indicates some students who are obtaining inadequate sleep likely are making the effort but experiencing an unsuccessful result. This could be attributed to sleep disorders, caffeine consumption before bed, inconsistent sleeping and waking times, or a host of other factors. Further, disturbed sleep is also closely interrelated with clinical depression and mood disorders,[27,28] another major wellness problem for many veterinary medical students.[29] In addition, research shows that people who are classified as "poor sleepers" report significantly more difficulties functioning during the day, and they also experience greater amounts of tension and depression than people who are "good sleepers."[30] Thus, any effort to improve sleep quality for students should also consider improving other aspects of mental health given the interconnected relationship.

In terms of cognitive functioning as measured by the DSS, only 4.3% ($n$ = 8) of students reported I'm alert, wide awake, and at peak alertness. This finding is discouraging as alertness is critical for effective learning and strong performance. Fortunately, however, approximately 95% of students felt functional despite varying levels of alertness and attentiveness. Alarmingly, 5.4% of students reported they were either very sleepy and having trouble staying awake, or would prefer to be lying down.

Perhaps one of the most interesting aspects of the ESS is the descriptive statistical breakdown presented for each

**Table 5: Daytime Sleepiness Scale results by program year and gender**

| Variable | PGY | | | | Gender | |
|---|---|---|---|---|---|---|
| | 1, *n* (%) | 2, *n* (%) | 3, *n* (%) | 4, *n* (%) | Males, *n* (%) | Females, *n* (%) |
| I'm alert, wide awake, and at peak alertness | 1 (0.5) | 3 (1.6) | 1 (0.5) | 3 (1.6) | 0 (0.0) | 8 (4.3) |
| I'm awake, able to concentrate, but not quite at peak alertness | 37 (19.8) | 13 (7.0) | 18 (9.6) | 21 (11.2) | 18 (9.6) | 71 (38.0) |
| I'm awake, but not fully attentive | 14 (7.5) | 6 (3.2) | 9 (4.8) | 6 (3.2) | 6 (3.2) | 29 (15.5) |
| I'm a little sleepy, losing interest, but still able to function | 16 (8.6) | 9 (4.8) | 8 (4.3) | 12 (6.4) | 4 (2.1) | 41 (21.9) |
| I'm sleepy, would prefer to be lying down | 3 (1.6) | 1 (0.5) | 3 (1.6) | 1 (0.5) | 2 (1.1) | 6 (3.2) |
| I'm very sleepy, and having trouble staying awake | 1 (0.5) | 0 (0.0) | 0 (0.0) | 1 (0.5) | 0 (0.0) | 2 (1.1) |

PGY=Program year

item [Table 3]. While it is understandable that students who experience incredibly busy and stressful schedules may fall asleep (or at the very least have the temptation to fall asleep) in harmless settings (e.g., while watching TV, sitting, and reading), it is very sobering to learn that some students might fall asleep while behind the wheel of a motor vehicle. The 2011 "Sleep in America Poll" found 66% of young adults reported driving while drowsy.[19] Relatedly, a study investigating college students "closest calls" involving motor vehicles found sleepiness to be a major culprit. Specifically, 68% of students reported driving while feeling drowsy and 39% reported to have nearly been involved in an accident between 11 p. m. and 1 a. m., or within the 1st h of driving in the morning.[31] In the present study, approximately 19% of students reported some chance of dozing off behind the wheel, with approximately 5% of these individuals indicating the chances are moderate to high. Although a smaller percentage of our students report significant daytime sleepiness, the potential for driving while drowsy or less alert seems especially real for students who experience late-evening departures from clinics, late-night study sessions at the library, and very early morning starts to get to class or clinical service. Given the extreme dangers associated with a severe lack of sleep, it is critical that veterinary schools remind students of proper sleep hygiene and risks while driving.

## Strategies for improving sleep hygiene and cognitive performance

There is a significant lack of disseminated information about helping young adults acquire the recommended sleep they need, not only to perform well academically, but also to remain healthy.[32] Large-scale educational interventions can be implemented at the university level without singling out individual students, and can be more effective with less side effects than pharmacological interventions.[33] For example, in a sample of 963 college students, the average score on a sleep hygiene questionnaire that discussed daily habits that contribute to sleep quality was only 50%, further supporting the idea that students' poor sleep habits stem from limited knowledge of appropriate sleep methods and habits.[34] A study by Brown[35] educated students about sleep hygiene, the negative impact of caffeine and other stimuli, as well as the influence of poor sleep habits on overall wellbeing, and found that students demonstrated significantly improved sleep quality, reported lower sleep disturbances, and utilized less sleep medication upon completing the educational intervention.

Research also shows that implementing voluntary wellness elective courses within medical education programs have been highly effective and can be a positive influence in teaching students' skills and techniques for self-care and improving overall wellness.[36] Other interventions evidenced to be effective include implementing lecture-based learning opportunities, as well as self-guided online instruction- and simulation-based discussions.[37]

Although increasing students' knowledge of sleep disorders, sleep deprivation, and sleep disturbances has been shown to improve sleep hygiene, other proven methods include providing students with the opportunity for guidance and practice in relaxation techniques. Progressive muscle relaxation, guided imagery, or abdominal breathing, which are known for reducing arousal states that can interfere with sleep are proven strategies to aid in stress reduction and enhancing sleep.[38] Similarly, researchers[39] found that students who focus on alleviating stress and reducing worry through guided mindfulness and meditation practices were able to improve their sleep habits as well. In addition, several studies report that maintaining consistent exercise routines can have a profound impact on sleep, such as better sleep efficiency, falling asleep faster, and sleeping for greater amounts of time compared to those who do not engage in regular exercise.[40] These collective findings suggest students need to be aware not only of how much sleep they should aim for each weeknight, but also educated on wellness techniques that reduce stress, and improve relaxation to properly prepare for a restful sleep.

## Limitations

Perhaps the most significant limitation of the present study involves the self-reported nature of the findings.

A second limitation is it was conducted at a single college of veterinary medicine in the United States. Although it is assumed that veterinary medical students everywhere experience similar stressors and experiences during veterinary training, the extent to which the findings from this study extrapolate to the larger population of veterinary medical students remains unknown.

## Conclusions

At present, there is an absence of research literature that has systematically investigated the sleep hygiene habits of veterinary medical students. This study fills an important void in the literature by exploring this important facet of student health and wellness. Further, this study utilized two instruments that have been well-documented to possess strong psychometric properties to help triangulate the findings and better understand veterinary students' sleep hygiene. Findings from our study indicate a significant percentage of veterinary medical students exhibit poor sleep hygiene habits that may be detrimental to both their health and academic endeavors. We report a number of potential intervention strategies previously evidenced to be effective in other disciplines for promoting good sleep hygiene. We encourage others to use the findings from this study to create targeted intervention strategies that will improve veterinary students' health and academic performance.

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Nil.

### Conflicts of interest
There are no conflicts of interest.

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