





Prevalence and factors associated with excessive daytime sleepiness among Malaysian medical students

Wan Bazilah Wan Mohamad Sobri¹ , Nyi Nyi Naing² , Nadiah Wan-Arfah^{3*} , Sarimah Abdullah⁴ ,
Vetriselvan Subramaniyan^{5,6} , Ling Shing Wong^{7**} , Siddharthan Selvaraj⁸ 

¹ UniKL Business School, Universiti Kuala Lumpur 1016, Jalan Sultan Ismail, 50250 Kuala Lumpur, MALAYSIA

² Faculty of Medicine, Universiti Sultan Zainal Abidin, Kuala Terengganu, Terengganu, MALAYSIA

³ Faculty of Health Sciences, Universiti Sultan Zainal Abidin, Kuala Terengganu, Terengganu, MALAYSIA

⁴ Unit of Biostatistics and Research Methodology, School of Medical Sciences, Universiti Sains Malaysia, Kubang Kerian, Kelantan, MALAYSIA

⁵ Department of Pharmacology, Jeffrey Cheah School of Medicine and Health Sciences, Monash University, Subang Jaya, Selangor, MALAYSIA

⁶ School of Bioengineering and Biosciences, Lovely Professional University, Phagwara, Punjab, INDIA

⁷ Faculty of Health and Life Sciences, INTI International University, Nilai, Negeri Sembilan, MALAYSIA

⁸ Faculty of Dentistry, AIMST University, Bedong, Kedah, MALAYSIA

*Corresponding Author: wanwaj@uniswa.edu.my

**Corresponding Author: lingshing.wong@newinti.edu.my

Citation: Mohamad Sobri WBW, Naing NN, Wan-Arfah N, Abdullah S, Subramaniyan V, Wong LS, Selvaraj S. Prevalence and factors associated with excessive daytime sleepiness among Malaysian medical students. *Electron J Gen Med.* 2024;21(2):em571. <https://doi.org/10.29333/ejgm/14198>

ARTICLE INFO

Received: 08 Aug. 2023

Accepted: 14 Dec. 2023

ABSTRACT

The purpose of our study was to ascertain the frequency of excessive daytime sleepiness (EDS) amongst medical students as well as the contributing variables. In Kelantan, Malaysia, at the School of Medical Sciences of Universiti Sains Malaysia, a cross-sectional research study was carried out. The Epworth drowsiness scale was used to gauge the degree of daytime drowsiness, and the depression, anxiety, and stress scale was used to gauge the degree of depression, anxiety, and stress. The related factors of EDS were analyzed using ordinal logistic regression. 311 individuals, or 84.5% of the total, submitted the questionnaire out of 368. 42.7% of people had EDS (95% CI: 0.52, 0.70). The associated factors of EDS included year of study (adjusted odds ratio [AOR]=0.55 [95% confidence interval [CI]: 0.33, 0.91]), race (Chinese) (AOR=0.58 [95% CI: 0.32, 0.97]), anxiety level (mild) (AOR=2.68 [95% CI: 1.26, 5.68]), anxiety level (moderate) (AOR=3.70 [95% CI: 1.76, 7.75]), anxiety level (severe) (AOR=4.76 [95% CI: 1.06, 21.42]), stress level (mild) (AOR=3.37 [95% CI: 1.47, 7.30]) and stress level (moderate) (AOR=5.42 [95% CI: 2.05, 14.35]). As for conclusion, associated factors such as year of study, race, anxiety and stress level were significantly found to be associated with EDS among medical students.

Keywords: excessive daytime sleepiness, excessive somnolence disorder, human health, medical students, ordinal logistic regression

INTRODUCTION

One of the main indicators of the obstructive sleep apnea syndrome is excessive daytime drowsiness, or excessive daytime sleepiness (EDS). Almost everyone has experienced sleepiness, an ill-defined symptom, at some point in their life. When it disturbs day-to-day activities, it becomes an issue. The two main causes of daytime drowsiness are sleep disorders, such as idiopathic hypersomnia, narcolepsy, and sleep-disordered breathing, and lifestyle variables, such as medication side effects and sleep deprivation [1, 2]. EDS among undergraduate medical students could be caused by many associated factors such as stress having from learning environment or personal problems, feel anxiety and depressed, habits like smoking and drinking alcohol, over-drinking caffeine and lack of exercises and others [3].

The other associated factors that might influence the medical students in having daytime sleepiness are their socio-demographic such as gender, age, year of study, body mass

index (BMI) status, parent's marital status, parent's occupation, and others [2, 3]. In the 1989, Allan Hobson wrote, "more has been learned about sleep in the past 60 years than in the preceding 6,000". Although sleep and sleep disturbance have been commonly happened to every human since the beginning of recorded time, it was not until the 19th century that the beginning of understanding about why humans sleep and what happens if humans do not begin to emerge [4, 5].

In the 1920s, Nathaniel undertook the sleep deprivation experiments and had begun to explore the consequences of sleepiness [6]. In the same decade, Hans Berger began recording the brain electrical activity and noticed that the striking differences between waking and sleeping electroencephalograms of humans. Understanding the causes and effects drowsiness has lately taken center stage in "sleep medicine," owing to fast advances in the knowledge, for example, narcolepsy and improved technologies for measuring drowsiness in people [7, 8].

In many sleep disorders cases, including sleep apnea, narcolepsy, and restless legs syndrome have a genetic

component that affects the quality of life of an individual. The population-based Finnish twin study of over 12,000 people yielded an estimate that about one-third of sleepiness is genetic [9]. Using the rat model, Franken and his colleagues have calculated that slow-wave sleep need is under genetic control [10].

Given that sleepiness is the ability or tendency to fall asleep, environmental influences need to be considered. For example, activities, bright lights, noises, temperatures, postures, and stresses can prevent or delay sleep onset in human who is truly sleepy [11]. Regarding behavior and postures, the Epworth sleepiness scale (ESS) has been used to measure the sleepiness in humans and concluded that lying down to rest in the afternoon and watching television are the most sleep promoting rather than sitting and talking with someone and in a car stopped for traffic [12]. In many surveys, women have a greater need for sleep than man. Women were reported to spend more time in bed than do men, and they have more sleep problems, including inadequate sleep time and insomnia. However, in older people, "non-complaining" humans, women sleep better than men [13]. Both quality and quantity of human sleep decrease with increase in age [14, 15].

It is crucial and required to identify the relevant causes and cure the drowsiness problem to enhance the quality of learning and social life of undergraduate medical students, as well as to lower the chance of developing sleeping problems. Finally, there is little evidence in medical literature on the variables linked with excessive daytime drowsiness among Malaysian medical students. Our study would pave a way for understanding the root causes of EDS among Malaysian medical students to find a solution for EDS and help them to enhance their academic performance and quality of life.

MATERIALS & METHODS

Study Design & Participants

A cross-sectional study was conducted in School of Medical Sciences, Universiti Sains Malaysia, Kelantan, Malaysia. Medical students were included in the study. The minimum required sample size was calculated by using power and sample size software. It was determined based on variable gender with requirements for level of significance (α) of 0.05 and with pre-determined power ($1-\beta$) of 0.90. The probability of male group (P_0) of 0.106 was obtained from literature [16]. The probability of female group (P_1) of 0.256 was determined by the researcher based on expert opinion. Predetermined sample size was 336 after adding 10.0% of non-response participants.

Non-probability sampling was applied as predetermined sample size was approximately to the total number of year two and three medical students. Therefore, researchers decided to take all the medical students' year two and three, which was 368 to participate in this study.

Study Factors & Outcome

An ESS questionnaire was used to measure the level of daytime sleepiness among undergraduate medical students. ESS questionnaire was based on a four-point scale (zero-three), the usual chances of dozing off or falling asleep in eight different situations or activities that most people engage in as part of their daily lives [17]. There were three ordinal outcomes, which were normal, average sleepy and excessively sleepy. The

total score was based on a scale of zero to 24. The total scores of zero-seven was considered normal, eight-nine was average sleepy, and 10-24 was considered as excessively sleepy. ESS questionnaire was a standardized questionnaire with high level of internal consistency between the eight items in ESS as measured by Cronbach's alpha, ranging from 0.74 to 0.88 [17].

The depression, anxiety, and stress scale (DASS) questionnaire was a set of three self-report scales designed to measure the depression, anxiety, and stress among the medical students. Each of the three DASS scales contains 14 items, divided into subscales of two-five items with similar content. DASS questionnaire was a standardized questionnaire with high level of internal consistency between the 42-items in DASS for each scale were depression domain 0.91; anxiety domain 0.84, and stress domain 0.90 with Cronbach's alpha, 0.97, 0.92, and 0.95, respectively [18].

Statistical Analysis

Data was analyzed using statistical program for social science version 20 and STATA/SE version 11. Associations between ESS score and associated factors were analyzed using ordinal logistic regression. The data was first analyzed using descriptive statistics to give an overview of the distribution of the data.

Univariable analysis was performed to screen for important independent variables. The next step was variables selection. Variables with p-value more than 0.25, which were clinically important, or literature proven important were selected. The linearity for continuous variable was not performed as there was not any significant continuous variable in the model. Multicollinearity and interaction were checked and were unlikely [16].

The assumptions for ordinal logistic regression, which are the similarity between proportional model and unconstrained baseline logit assumption, proportional odds assumption and parallel regression assumption were fulfilled. Then, the overall fit of the model was performed with Hosmer-Lemeshow test, Pearson Chi-square test, overall, correctly classified percentage and area under ROC curve.

For regression diagnostics for outliers and influential, every binary logit models were analyzed to check and determine the outliers and influential that may occur in each of the models. There were several outliers were identified in every scatter plots. All these covariate patterns were checked the percent changes in regression if more than 20.0%.

As for the remedial measures, the model with and without outliers were compared based on the changes of regression coefficient. After considering biological importance and statistical significance, the researchers decided to keep the full model with some influential covariate patterns. The final model was presented as regression coefficient, adjusted odds ratio and its 95% confidence interval (CI) and p-value.

RESULTS

There were 368 medical students, comprising 176 from year two and 192 from year three, respectively. Only 311 of undergraduate medical students returned the questionnaires with the response rate of 84.5%. Around 178 (57.2%) (95% CI: 0.51, 0.63) students had normal EDS, while the other 76 (24.4%)

Table 1. Socio-demographic profile of participants according to daytime sleepiness severity (n=311)

Variable	EDS level (n [%])		
	Normal	Average sleepiness	Excessive sleepiness
Gender			
Male	61 (34.27)	23 (30.26)	13 (22.81)
Female	117 (65.73)	53 (69.74)	44 (77.19)
Age (years)	21.51 (0.91)	21.34 (0.99)	21.14 (1.09)
Resident			
Urban	119 (66.85)	48 (63.16)	30 (52.63)
Rural	59 (33.15)	28 (36.84)	27 (47.37)
Race			
Malay	97 (54.49)	53 (69.74)	43 (75.44)
Chinese	66 (37.08)	20 (26.32)	11 (19.30)
Indian	13 (7.30)	2 (2.63)	2 (3.51)
Others	2 (1.12)	1 (1.32)	1 (1.75)
Parent marital status			
Single	50 (28.09)	15 (19.74)	14 (24.56)
Married	125 (70.22)	59 (77.63)	43 (75.44)
Divorced	3 (1.69)	2 (2.63)	0 (0.00)
Year of study			
Year two	84 (47.19)	50 (65.79)	33 (57.89)
Year three	94 (52.81)	26 (34.21)	24 (42.11)
Parents' occupation			
Government	82 (46.07)	38 (50.00)	29 (50.88)
Private	48 (26.97)	23 (30.26)	13 (22.81)
Self-employee	48 (26.97)	15 (19.74)	15 (26.32)
Parents' income			
<RM2000	49 (27.53)	23 (30.26)	17 (29.82)
RM2,000-RM5,000	79 (44.38)	30 (39.47)	23 (40.35)
≥RM5,000	50 (28.09)	23 (30.26)	17 (29.82)

Table 2. Health behavior characteristics of participants according to daytime sleepiness severity (n=311)

Variable	EDS level (n [%])		
	Normal	Average sleepiness	Excessive sleepiness
Alcohol drinking status			
No	172 (96.63)	73 (96.05)	53 (92.98)
Yes	6 (3.37)	3 (3.95)	4 (7.02)
Smoking status			
No	176 (98.88)	74 (97.37)	53 (92.98)
Yes	2 (1.12)	2 (2.63)	4 (7.02)
Physical activity			
No activity	77 (43.26)	35 (46.05)	27 (47.37)
Moderate	101 (56.74)	41 (53.95)	30 (52.63)
Caffeine drinking status			
<2mugs/day	155 (87.08)	59 (77.63)	47 (82.46)
≥2mugs/day	23 (12.92)	17 (22.37)	10 (17.54)

(95% CI: 0.20, 0.29) and 57 (18.3%) (95% CI: 0.14, 0.23) students had average and excessive sleepiness, respectively.

Table 1 describes the socio-demographic characteristics ESS scores of the participants. There were 97 (31.0%) male students. Majority of students were Malays (62.1%) and the mean age of students was 21.4. Approximately 149 (48.0%) students with parents worked in the government sector.

Nearly 29% of students with parent's income earned less than RM2,000 per-month. Based on our study findings female students (77.0%), students from urban area (53.0%), Malay (75.0%), with married parents (75.0%), year 2 (58.0%), parents working in government (51.0%) with income between RM2,000-RM5,000 (40.0%) experienced excessive sleepiness when compared to the other participants.

Table 3. Co-morbidities characteristics of participants according to daytime sleepiness severity (n=311)

Variable	EDS level (n [%])		
	Normal	Average sleepiness	Excessive sleepiness
BMI status			
Normal	116 (65.17)	54 (71.05)	48 (84.21)
Underweight	38 (21.35)	13 (22.37)	6 (10.53)
Overweight	15 (8.43)	4 (5.26)	3 (5.26)
Obese	9 (5.06)	1 (1.32)	0 (0.00)
Asthma status			
No	169 (94.94)	71 (93.42)	55 (96.49)
Yes	9 (5.06)	5 (6.58)	2 (3.51)
Depression level			
Normal	169 (94.94)	64 (84.21)	40 (70.18)
Mild	4 (2.25)	6 (7.89)	10 (17.54)
Moderate	2 (1.12)	3 (3.95)	3 (5.26)
Severe	1 (0.56)	3 (3.95)	1 (1.75)
Extremely severe	2 (1.12)	0 (0.00)	3 (5.26)
Anxiety level			
Normal	156 (87.64)	43 (56.58)	29 (50.88)
Mild	7 (3.93)	14 (18.42)	8 (14.04)
Moderate	9 (5.06)	14 (18.42)	9 (15.79)
Severe	2 (1.12)	3 (3.95)	5 (8.77)
Extremely severe	4 (2.25)	2 (2.63)	6 (10.53)
Stress level			
Normal	165 (92.70)	57 (75.00)	31 (54.39)
Mild	7 (3.93)	9 (11.84)	9 (15.79)
Moderate	3 (1.69)	9 (11.84)	12 (21.05)
Severe	3 (1.69)	1 (1.32)	5 (8.77)
Extremely severe	0 (0.00)	0 (0.00)	0 (0.00)

Health behavior characteristics of the students were shown in **Table 2**. Majority 97.0% of the students did not drink alcohol and were non-smokers, 99.0% of them had normal EDS and there were only two students who smoked had normal EDS. Most of the students with normal EDS were nearly 101 (57.0%) involved in physical activity while the percentage of students who drank caffeine less than two mugs per day whether they had normal EDS, average sleepiness and excessive sleepiness were 87.0%, 78.0%, and 82.0%, respectively.

Table 3 describes the co-morbidities characteristics. For obese students, only 5.0% of them had normal EDS, 7% had average sleepiness and none had excessive sleepiness.

For those with severe depression were nearly 1.0% had normal EDS, 4.0% had average sleepiness and 2.0% had excessive sleepiness. Nearly two students with severe anxiety had normal EDS, only three had average sleepiness and five of them had excessive sleepiness. Students with severe stress were nearly 9.0% had excessive sleepiness, 2.0% of them had normal EDS, and only 1.0% had average sleepiness.

According to the study's findings, EDS in medical students was linked to four different factors. The year of study was one of the associated factors with EDS (adjusted odds ratio [AOR]=0.55 [95% CI: 0.33, 0.91]), race (Chinese) AORs for the following levels of anxiety: (AOR=0.58 [95% CI: 0.32, 0.97]), mild anxiety (AOR=2.68 [95% CI: 1.26, 5.68]), moderate anxiety (AOR=3.70 [95% CI: 1.76, 7.75]), severe anxiety (AOR=4.76 [95% CI: 1.06, 21.42]), mild stress (AOR=3.37 [95% CI: 1.47, 7.30]) as well as moderate stress level (AOR=5.42 [95% CI: 2.05, 14.35]).

Table 4 showed the final model of the study. The associated factors of EDS included year of study, race (Chinese), anxiety level and stress level. Backward stepwise ordinal logistic regression was applied. Multicollinearity and

Table 4. Associated factors of daytime sleepiness severity among medical students in Universiti Sains Malaysia (n=311)

Variable	Regression coefficient (b)	AOR (95% CI)	p-value
Year of study			
Year two	0	1	
Year three	-0.59	0.55 (0.33, 0.91)	0.021
Race			
Malay	0	1	
Chinese	-0.59	0.56 (0.32, 0.97)	0.039
Indian	-0.86	0.42 (0.13, 1.42)	0.164
Others	0.43	1.54 (0.19, 12.37)	0.684
Anxiety level			
Normal	0	1	
Mild	0.98	2.67 (1.26, 5.68)	0.010
Moderate	1.31	3.70 (1.76, 7.75)	<0.001
Severe	1.56	4.76 (1.06, 21.42)	0.042
Extremely severe	0.72	2.05 (0.36, 11.86)	0.421
Stress level			
Normal	0	1	
Mild	1.22	3.37 (1.47, 7.30)	0.004
Moderate	1.69	5.42 (2.05, 14.35)	0.001
Severe	1.08	2.94 (0.39, 22.04)	0.293

interaction were unlikely. Assumptions of similarity between proportional model and unconstrained baseline logit, proportional odds assumption and parallel regression assumptions were checked and found satisfactory.

Overall fit of the model was checked and reported to be Hosmer-Lemeshow test (first model: p-value=0.646, second model: p-value=0.525), Pearson Chi-square (first model: p-value=0.107, second model: p-value=0.741), correctly classified percentage (first model: 77.2%, second model: 81.9%) and area under ROC curve (first model: 0.775, second model: 0.723). Regression diagnostic was performed, and the influential outliers were identified by checking percent changes in regression coefficient set at 20.0%.

DISCUSSION

According to the results, 42.7% of Universiti Sains Malaysia medical students had EDS. To be more specific, the prevalence for the daytime sleepiness severity was 24.4% for average daytime sleepiness and 18.3% EDS. While for medical students with normal EDS was 57.2%. These results indicated that half of the total participants were normal EDS.

Similar finding in previous study conducted among college students in Massachusetts, carried out the college students aged 17 to 24 years from an urban. The cross-sectional online survey was used in this study. Multiple regression analysis was applied to determine the predictors of poor sleep quality. This result indicated significant levels of daytime sleepiness. While 75.0% of the college students reported feeling dragged out, tired, or sleepy once a week or more and 15.0% reported falling asleep in class once a week or more [9, 19].

Also, similar findings in previous study conducted among Canadian students. In 1998-1999, 2201 high school students in Ontario's Hamilton Wentworth District School Board and Near North District School Board participated in a cross-sectional survey. The results revealed that 70.0% of the students had less than 8.5 hours weeknight sleeps. ESS scores more than 10 was reported by 42.0% of the Grand Erie students and 41.0% of the Hamilton Wentworth students [20].

Different finding was revealed from the previous study done in Taiwan among 656 adolescents aged 13-18 years old. There were 357 (54.0%) reported that they slept less than the suggested six-eight hours on schooldays. 74.0% of high school students reported inadequate sleep and might cause daytime sleepiness [21]. Another study found that 44.2% of high school adolescents in Chile had sleeping disorders that were associated with environmental conditions (e.g., excessive room temperature) and health behaviors (e.g., watching TV before sleep), these findings were closer to our study findings [22, 23].

Another previous study was done in Korea to determine the associated factors of EDS. The multivariate logistic analysis was applied to determine the associated factors of EDS. These findings demonstrated the association between EDS and sociodemographic, physiological, clinical, and sleep-related parameters, as well as age, regular exercise, education, persistent snoring, waking up feeling groggy, reported inadequate sleep, and crawling sensations in the legs. The risk of EDS was greater in those in the highest percentile group of exercise (95% CI: 1.18, 2.73), compared to those in the lowest percentile group. Compared to non-snorers, those who snore regularly had a greater (95% CI: 1.13, 2.00) chance of developing EDS. The risk of EDS was also raised by perceived sleep deprivation and a crawling sensation in the legs, according to some research results that concurred with the present research [24].

Based on our study findings it has been well documented that there is a strong correlation between EDS and various factors that alter a student's day to day activities, our study findings were in line with various studies [20-24] that showed that EDS is one of a major factor that influence a student's performance in academics and quality of life.

Limitations of Study

A limited sample size might restrict findings' generalizability to a wider population. It may not adequately represent the variety of the population, perhaps leading to biases in our study results and our study participants' replies may be influenced by how questions are framed or the context in which they are posed, resulting in skewed findings.

CONCLUSIONS

As conclusion, the findings of this study revealed that the participants who had anxiety and stress potentially to have EDS. Therefore, to reduce EDS among medical students, anxiety and stress could be treated.

Strengthening public health in university and health campaign is very important to increase student's knowledge about EDS and sleeping disorders. Besides, further studies are recommended to include medical students in every different level of groups. Preferably for the results to represent all level groups of undergraduate medical students in Malaysia. It can be achieved by conducting multi-centered in medical universities in Malaysia. In addition, there will be more research studies about daytime sleepiness and sleep disorders in Malaysia.

Author contributions: All authors have sufficiently contributed to the study and agreed with the results and conclusions.

Funding: No funding source is reported for this study.

Ethical statement: The authors stated that the study protocol was approved by the Human Research Ethics Committee, Universiti Sains Malaysia on 19 November 2012 (Approval number: USMKK/PPP/JEPeM[256.4(2.3)]). The data was kept confidential and informed written consent was received from the participants who were kept anonymous.

Declaration of interest: No conflict of interest is declared by authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

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