Table Of Content

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Sleep Quality Among Undergraduates During Pre-Examination Period

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Abstract

The purpose of the study is to examine the sleep quality of undergraduates during pre-examination period. In addition, the effect of examination stress and sleep quality on academic performance of the undergraduates is also of interest. Questionnaire is used to collect responses from 379 undergraduates regarding perceived stress and sleep quality on the first week of final examination. Pittsburgh Sleep Quality Index (PSQI) is the instruments used in investigating the perceived sleep quality of respondents one month before the test is taken. Perceived Stress Scale (PSS) is used to measure the perceived stress level of the subjects for the past one month. The data dissemination concludes that the overall sleep quality of the undergraduates is poor. Female undergraduates tend to have a slightly better sleep quality than the male undergraduates. The sleep quality shows a weak positive relationship with perceived stress. It is also discovered that sleep quality and perceived stress have no effect on academic performance. The university authority might need to look into the problem of poor sleep quality among undergraduates especially during pre-examination period.

Introduction

A normal human will be spent more than one third of his or her life sleeping (Mansfield, Hillman, Antic, McEvoy & Rajanatram, 2013). Despite sleeping every day since we are born, the biology mechanisms which keep human alert during the day and sleepy at night still remains as mystery in science (Wolf-Meyer, 2010). This is because it is difficult to observe a person's sleeping behavior except in a well-planned clinical study. However, the function of sleep is clear. We sleep to restore our bodies and to ensure our alertness during the daytime. Although sleep is very important, not everyone afford a good night sleep, among them are the university students.

Past study showed that a normal adult need 8 hours of sleep per day on average (U.S. Department of Health and Human Services, 2005). However, based on the study done by Burrus and Graham (2013) in Southeast America, the finance major undergraduates only have 6.5 hours of sleep on the average. The short-term effects of poor sleep quality include decrease in productivity and impaired concentration (Chokroverty, 2010). Moreover, sleep quality of undergraduates is directly associated with their learning abilities. Good sleep quality helps in memory consolidation, learning, critical thinking and making decision which are essential in the classroom and examination (Gilbert & Weaver, 2010).

University students are unique in their sleeping environment and their different sources of pressure compared to the working adult. In order to excel in their study, they are supposed to adopt a consistent sleeping habit to ensure full concentration in the lecture halls. Unfortunately, the life in university often associated with sleep deprivation as they compromise their sleeping quality and quantity for examinations, social life, extra-curricular activities and assignments deadlines. The stress meeting deadlines and striving good results in examinations has caused them to sacrifice their sleeping time in order to complete the tasks given.

Question on "To sleep or to study?" is often asked by university students during examination period. Based on a clinical study done by Joo, Yoon, Koo, Kim and Hong (2012) in Korea on male between 23 years old and 27 years old, the subjects are found to perform poorly in the Continuous Performance Test (CPT) which serves as an indicator of working memory and attention after 24 hours of sleep deprivation. In other words, pulling an all-nighter might lead to the failure to recall what one has studied in the previous night. In addition, a research in China shows that the university students have higher stress level during mid–term and final examination period (Wang et al., 2014).

Sleep quality comprises of sleep duration and subjective sleep quality. Poor quality of sleep does not only take short duration of sleep into account, it is also indicated by unsatisfactory and disturbed sleep perceived by the subjects (Ellis, Walczyk, Buboltz & Felix, 2014). However, longer sleep duration does not guarantee good sleep quality as well. In fact, study by Gildner, Liebert, Kowal, Chatterji and Snodgrass (2014) has shown that long sleeper with sleep hours more than 9 hours daily report poorer cognitive test performance (CTP). The regularity in sleep patterns also play significant role in producing good sleep quality (Sano et al., 2015).

Researches always focus on the consequences of sleep deprivation in children and adolescent only (Gillen O' Neel, Huynh & Fuligni, 2012; Wong, Rowland & Dyson, 2014; Short, Gradisar, Lack & Wright, 2013). As a result, limited studies have been done on university students who represent the niche subset of the adult population. Even if the research is conducted in university, the researchers focus on the undergraduate medical students only as medical students are known to face sleep deprivation and high level of stress due to the difficulty or their examination and practical assessment (Siraj et al., 2014; Ahrberg, Dresler, Niedermaier, Steiger & Genzel, 2012).

Stress is defined as the state when mental equilibrium is challenged after our senses are stimulated. Human body emits adrenaline to prepare for a "fight or flight" situation during a stressful event. Stimuli such as a phone call might cause stress as the body has to decide how to react to the stimuli. Stress can be caused by both internal and external stressor. The internal stressor includes thoughts and attitude while the external stressors are challenges, noise pollution, and etc. Stress caused by examination can be categorized as external stressor. During pre-examination period, the stress level of undergraduate will increase as the final examination often carries the highest weightage in deciding the Grade Point Average. Therefore, it is significant to explore the effect of sleep quality on academic performance during the pre-examination period than in typical days so that the students will realize the importance of stress management in improving the academic performance and thus stop burning mid night oil for examinations.

Academic performance of tertiary students is often indicated by Grade Point Average (GPA) which is the weighted mean of grade points where each grade carrying different points and each course has different weight (Richardson, Bond & Abraham, 2012). The assessment comprises of written examination, oral presentation, quizzes, case study and etc. where written examination during the end of the semester carries the highest weightage. Behavioral measures such as time spent in study show weak correlation with academic performance making GPA a utility measure of academic performance (Richardson et al., 2012). In order to gain a high GPA, university students tend to stay awake during the night before an examination to study.

In conclusion, this research aims to investigate the sleep quality of undergraduates during pre-examination period and factors that associated with it so that undergraduates are acknowledged about their sleeping quality and thus improve their performance in academic.

Relationship between Academic Performance, Sleep Quality and Stress

The workload of the undergraduates increases at the final month of the semester preparing project, presentations and written examination which carry the most weight in their GPA. Hence, they will work under stress meeting deadlines and the stress can affect their sleep quality as well as their learning. This is supported by Ahrberg, Dresler, Niedermaier, Steiger and Genzel (2012) that academic performance is correlated with stress and sleep quality during pre-examination period.

Relationship between Academic Performance and Sleep Quality

GPA can be affected by the course content, credit hour, course load, test-taking ability, personalities and etc. rules out sleep quality as the sole factor that affects it (Hershner & Chervin, 2014). However, Taylor, Vatthauer, Bramoweth, Ruggero and Roane (2013) argue that after controlling all other factors affecting academic performance and assessing the sleep quality using sleep diary, GPA is significant correlated with sleep quality. This is supported by the research in U.S on 16,095 undergraduates where researchers find sleep habits explain majority of the variance in GPA (Wald, Muennig, O' Connell & Garber, 2014). Furthermore, the later the bedtime, the lower the GPA obtained (Galambos, Lascano, Howard & Maggs, 2013). Moreover, students who sleep less than 7 hours per night earn significantly low grades than students who sleep more (Hedges, 2012). Sano et al. (2015) also prove that the high GPA is associated with low score in PSQI when they are detecting the sleep habits, academic performance and mental health of students using mobile phone sensor. Despite many studies find correlation between sleep quality and academic performance, Onder, Beşoluk, Iskender, Masal and Demirhan (2014) did not have sufficient statistical evidence to prove that they are correlated.

Relationship between Stress and Sleep Quality

The recent study by Unger (2016) showed that there is no relationship between sleep quality and perceived stress among undergraduate and graduate students. However, Akerstedt et al. (2012) suggested that stress or worries prior to sleep was the predictor of sleep quality as subjects were anticipating problems of the upcoming day causing them difficulty in falling into sleep. Moreover, the stress that lead to poor sleep quality was no other than the stress caused by academic performance (Gao et al., 2014). Besides that, Galambos et al. (2013) discovered that shorter sleep duration, more sleep disturbances and later rise time are associated with higher level of perceived stress. This is supported by Wang et al. (2014) research where stress was found negatively correlated with sleep duration.

Relationship between Stress and Academic Performance

It is possible that stress affects sleep quality and academic performance independently as study shows undergraduates with better stress management and stress coping strategy can excel in examination thus weaken the association between perceived stress and GPA (Unger, 2016). On the other hand, Richardson et al. (2012) argue that the general stress and academic stress has only weak correlation with GPA after reviewing the studies from the past 13 years.

Most of the studies reported the correlation between stress and sleep quality to be significant. Meanwhile, academic performance of undergraduates is associated with their sleep quality. However, no research has proven that stress affects academic performance and sleep quality simultaneously. In addition, it is difficult to compare all the studies as they have different target population and the study is conducted in different time point.

Methodology

Data Collection

The population of the study is the undergraduates in Universiti Utara Malaysia (UUM) which accommodates more than 20,000 undergraduates. The population is homogeneous as all subjects stay in the university residential halls with similar sleep environment. The residential halls have the same facilities provided to the undergraduates and each of them is assigned a roommate. In addition, the university does not allocate study week in the examination period. All undergraduates have similar examination schedule.

Clustering sampling is used as it is a probability sampling technique where all sampling units have equal chance to be chosen serving the purpose of generalizing about the population. The student residential halls serve as natural clusters with heterogeneous sample similar to the population. Total respondents involved in this study is 379 respondents. The data collection is conducted on the first week of final examination in second semester of 2017/2018. Questionnaire is used to collect responses regarding perceived stress and sleep quality for the past one month while undergraduates are preparing for final examination and projects which carry the highest weight in GPA. Then, the GPA of respondents is obtained after the examination result is released.

Instrument

Sleep quality can be quantified using Sleep Hygience Awareness and Practice Scale (SHAPS), Epworth Sleepiness Scale (ESS), Horne-Ostberg Morningness-Eveningness Scale (MES), Karolinska Sleep Questionnaire, Pittsburgh Sleep Diary, Karolinska Sleep Diary and Pittsburgh Sleep Quality Index (PSQI) (Unger, 2016). Among all the instruments, PSQI is effective in investigating the perceived sleep quality of respondents one month before the test is taken.

Moreover, past studies often assess the relationship between academic performances and sleep quality based on Pittsburgh Sleep Quality Index using Grade Point Average (GPA) as indicator of academic performance (Shaffer et al., 2015; Deliens,

Clarys, Bourdeaudhuij and Deforche, 2013). However, PSQI only measures the sleep quality of the respondents for the past one month when the survey is conducted, ruling out sleep quality as the sole factor of affecting academic performance. To illustrate, the first year students adjusting the new university environment may report a poorer sleep quality if the PSQI test is conducted in the first month of their university life. In addition, it is proved that sleeping diary during pre-examination is the strongest predictor of the most recent academic performance (Genzel et al., 2013). Hence, this study will focus on investigating the sleep quality of undergraduate in the one month before examination period so that the PSQI serves as a better predictor of academic performance.

Stress is usually measured by intensity scale, Depression, Anxiety and Stress Scale (DASS) or Perceived Stress Scale (Cohen, Kamarck & Mermelstein, 1983). Academic stress is the immense negative emotion resulting from academic stressors (Richardson et al., 2012). Perceived Stress Scale (PSS) is suitable to measure the perceived stress level of the subjects for the past one month when the PSS questionnaire is attempted. The self-administered Perceived Stress Scale (PSS) is a better predictor of mental health than the objective stress measure as it directly measures the degree of stress experienced by the subjects (Unger, 2016). It is used in measuring the well-being and mental health in most of the studies (Cohen et al., 1983; Wang et al., 2014). Despite of its accuracy in measuring perceived stress, PSS only valid for 4 weeks to 8 weeks from the day the test is taken (Cohen et al., 1983). Hence, it is not suitable to assess long term perceived stress.

Pittsburgh Sleep Quality Index (PSQI)

PSQI is established by Buysse, Reynolds, Monk, Berman and Kupfer, the researchers from University of Pittsburgh in year 1989. It consists of 19 items with 7 categories in assessing sleep quality. It depicts the subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleeping disturbance, use of sleeping medication and daytime dysfunction of the subjects. Apart from the 19 items, 5 more items are evaluated by the respondents' roommate or bed partner, but it will not be included in the global score and the questionnaire of this study. The scoring methods are summing all the score from 19 items. The global score is ranged between "0" to "21" with "21" indicating severe difficulty in all 7 areas. After calculating the scores, we can classify the respondents with PSQI of more than 5 as poor sleepers.

Perceived Stress Scale (PSS)

PSS is developed by Cohen et al. in year 1983. It comprises of 10 items to measure the level of stress of respondents for the past one month. Example of the questions is "In the last month, how often have you found that you could not cope with all the things that you had to do?" Respondents will be inquired on how frequent for them to feel stress. PSS scores are obtained by reversing responses (e.g., 0 = 4, 1 = 3, 2 = 2, 3 = 1 & 4 = 0) to the four positively stated items (items 4, 5, 7, & 8) and then summing across all scale items. Higher score indicating higher level of perceived stress. A short 4 item scale can be made from questions 2, 4, 5 and 10 of the PSS 10 item scales. However, all items will be used in this study.

Results

Demographics Statistics

The demographics of the respondents are analyzed to obtain a comprehensive view of the respondents. Universiti Utara Malaysia accommodates all undergraduates under 3 colleges which are College of Arts and Sciences (CAS), College of Business (COB) and lastly the College of Law, Government and International Studies (COLGIS). The academic performance of undergraduates is graded using the CGPA and each range of CGPA represent a certain class namely First Class Honour (CGPA 3.67-4.00), Upper Second Class (CGPA 3.00-3.66), Lower Second Class (CGPA 2.00-2.99) and lastly Conditional Pass holder are undergraduates who only gain 1.50-1.99 in CGPA.
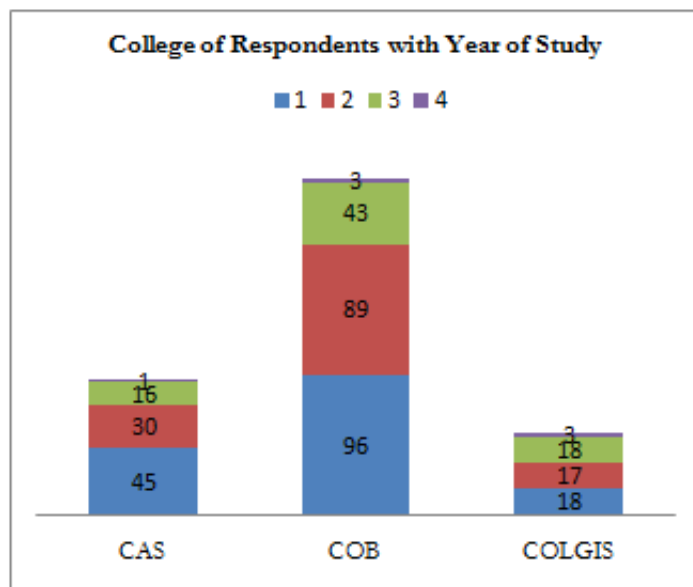
Figure 1.Gender of Respondents
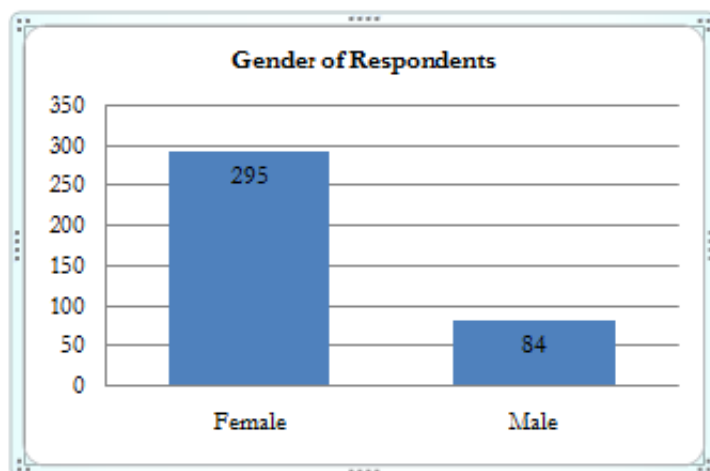
Figure 1.

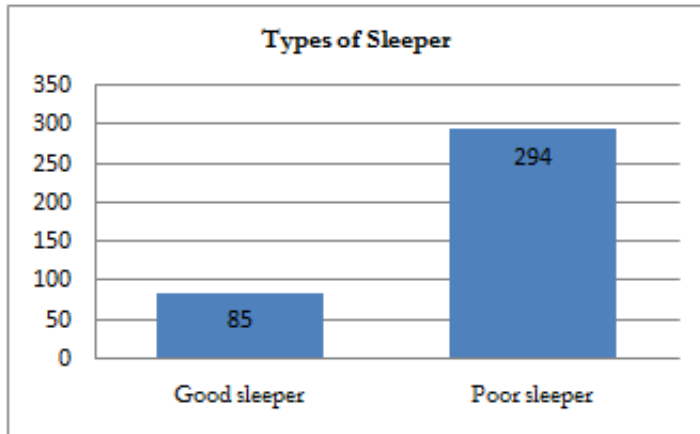**Figure 2**. Academic Performance According to Type of Sleeper
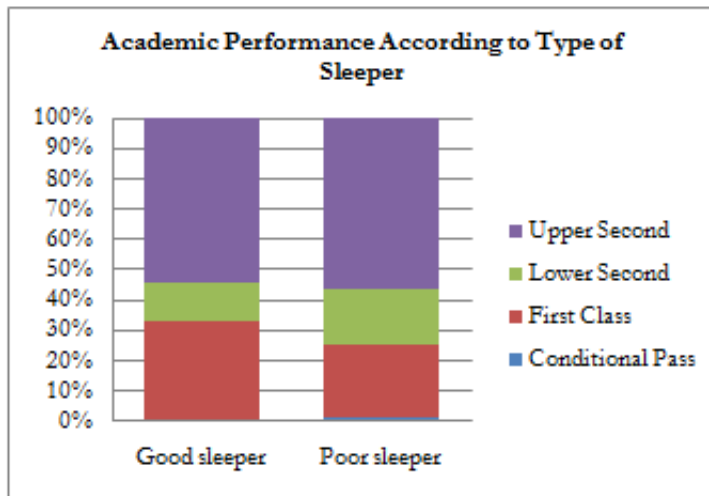
Figure 2.

Figure 3. College of Respondents with Year of Study

Figure 3.

Figure 4. Types of Sleepers

Figure 4.

The female respondents are about 3 times more than the male respondents in this study as shown in Figure 1. This is because only one block of male undergraduates is selected in the simple random sampling process. Majority of the students are from College of Business. The respondents comprise mostly of first year students based on Figure 3. Then, the respondents are divided according to good sleeper and poor sleep based on PSQI score. Those who have PSQI score more than 5 are considered as poor sleepers. There are 77.6% of respondents fall into the category of poor sleeper as depicts in Figure 4. In addition, it is obvious in Figure 2 that there are more percentages of first class honour students among the good sleeper as compared to the poor sleeper group and poor sleeper category has higher percentage of conditional pass students.

Normality Test

Normality tests was conducted to check the distribution of the continuous data. The normality tests used are Shapiro-Wilk, Anderson-Darling, Cramer-von Mises and Kolmogorov-Smirnov. It is necessary to conduct the normality tests using different approaches in order to reach a concrete conclusion. Since all the p-values obtained from all the tests are nearly 0, we reject the null hypothesis that the sample comes from a normal distribution. All the continuous data are not from the Gaussian distribution.

Sleep Quality of Undergraduates during Pre-examination Period

Table 1 Kruskal Wallis Test with Year of Study as Grouping Variable

PSQI	PSS	Sleep Duration
Chi-Square	10.88	2.61
df.	3	3
Asymp. Sig.	.01	.46

Table 1.

Referring to Table 1, the students from different year of study have no difference in term of PSS and sleep duration but they are different in sleep quality (p-value=0.012). Multiple comparison with alpha=0.20 has been made and it is noticed that year 1 and year 2 students are different in term of sleep quality and year 2 and year 3 students are also not identical with respect to sleep quality.

Table 2 Mann-Whitney U Test with Gender as Grouping Variable

PSQI	PSS	Sleep Duration
Mann-Whitney U	10285.50	11053.00

Wilcoxon W	53945.50	14623.00
Z	-2.39	-1.52
Asymp. Sig. (2-tailed)	.02	.13

Table 2.

Based on Table 2, the male and female undergraduates differ in PSQI only. The two groups are the same in term of PSS and sleep duration. This is contrasts with the research conducted among 150 university students before, during and after examination period (Zunhammer, Eichhammer & Busch, 2014) which concluded that there is no difference in PSQI score between male and female across all time points. For further investigate the difference between male and female, a one-tailed test is conducted. The one-tailed Mann-Whitney U test with *p*-value 0.0085 enables us to reject the null hypothesis stating that the median PSQI score of female is greater than the male undergraduates. This indicates that the female students enjoy better sleep quality of sleep than male undergraduates during pre-examination period.

Table 3 Kruskal Wallis Test with College as Grouping Variable

PSQI	PSS	Sleep Duration
Chi-Square	3.40	.17
df.	2	2
Asymp. Sig.	.18	.92

Table 3.

Based on Table 3, all the *p*-value is more than 0.05. Therefore, we cannot reject the null hypothesis that all the samples are from the same distribution. There is no difference among the undergraduates from three colleges in term of PSQI, PSS and sleep duration. Regardless of the colleges and courses taken by the students, they are similar with respect to sleep quality, stress and sleep duration during pre-examination period.

Sleep Duration

Since outliers exists in all the quantitative variables, mean is not suitable to be the measure of central tendency. Hence, median is opted to represent the data. Table 4 shown that the median sleep duration of undergraduates during pre-examination period is 6 hours per day. This is compared to the median sleeping hours of 7 hours of all adults in the United States (Gottlieb et al., 2006). Plus, 7-9 hours of sleep hours is considered normal for an adult. In other words, the undergraduates do not obtain sufficient sleeping hours due to examinations and assignments. The median PSQI score of 7 indicate that more than half of the undergraduates suffering from poor sleep quality. The median PSS score of 20 indicates that the exactly half of the undergraduates have a low or moderate level of perceived stress during pre-examination period. It is also important to notice that the minimum sleep duration is nearly zero hours. This may be a clue showing that some undergraduates suffering from insomnia during pre-examination period or they are used to compromising sleep hours for academic or other purposes.

Table 4 Descriptive Statistics of Quantitative Variables

PSQI GPA Sleep Duration PSS					
N	Valid	379	379	379	379
	Missing	0	0	0	0

Mean		8.06	3.34	5.88	19.78
Median		7.00	3.40	6.00	20.00
Std. Deviation		3.46	.43	2.06	3.95
Range		18	2.79	20.00	29
Minimum		0	1.21	.00	6
Maximum	18	4.00	20.00	35	

Table 4.

Sleep Pattern of Undergraduates

The mode of bedtime falls at 1:00:00 AM. Majority of the UUM undergraduates only go to bed after midnight. Only 14% of them go to be before 12 o'clock in the midnight. The wake-up time is mainly due to the prayer time and the lectures timetable and therefore will not be discussed in the study.

Relationship between PSS and PSQI

PSS and PSQI have a weak positive correlation according to Spearman's Rho of 0.22. The higher the PSS, the higher the PSQI. In other words, the higher the perceived stress of the undergraduates, the lower is the sleep quality since higher PSQI score indicate poorer sleep quality. The result is consistent with the study conducted by Kashani, Eliasson and Vernalis which use Spearman correlation as well in their study (2011).

Table 5 Spearman's Rank Correlation Coefficient between PSQI and PSS

			PSQI	PSS
Spearman's rho	PSQI	Correlation Coefficient	1.00	0.22**
		Sig. (2-tailed)	.	.00
		N	379	379
	PSS	Correlation Coefficient	0.22**	
		Sig. (2-tailed)	0.00	
		N	379	

Table 5.

**Correlation is significant at the 0.01 level (2-tailed).

Effect of PSS and PSQI on Academic Performance

At first, the data is fitted using a linear regression model. However, since the model cannot fulfill the normality assumption of a multiple linear regression model, the ordinal logistics regression which requires less assumption is opted.

Table 6 Test of Parallel Lines[a]

Model	-2 Log-Likelihood	Chi-Square	df	Sig.
Null Hypothesis	536.92			
General	530.53	6.40	4	.17

Table 6.

The null hypothesis states that the location parameters (slope coefficient)

are the same across response categories.

a. Link function: Logit.

The Test of Parallel Lines is used to test the null hypothesis of same slope coefficient across all the categories of our ordinal response variable. Table 6 shows the *p*-value of the test as 0.17 which is larger than 0.05. Therefore, we can conclude that the model fulfills the assumptions of proportional odds assumption and the ordinal regression model is valid.

Table 7 Coefficients of Linear Regression Model[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
B	Std. Error	Beta	Lower Bound	Upper Bound	Tolerance	VIF			
(Constant)	3.24	.11	28.52	0.00	3.02	3.47			
PSQI	-.01	.01	-.12	-2.34	0.02	-.03	-.00	0.93	1.08
PSS	.01	.01	.10	1.94	0.05	.00	.00	0.93	1.08

Table 7.

Apart from proportional odds assumption, it is also very important that the two explanatory variables do not have high correlation to avoid multicollinearity. The multicollinearity is assessed using VIF. According to general rule of thumb, a VIF value of 4 requires further investigation from the researchers. Meanwhile, VIF which is greater than 10 is considered as serious multicollinearity problem. However, after running a linear regression model using PSQI and PSS and the explanatory variables, it is found that the VIF is only 1.08 based on Table 7 for both variables ruling the possibility of multicollinearity. Hence, the ordinal regression model is valid.

Table 8 Ordinal Logistic Regression Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	Df	Sig.
Intercept Only	537.09			
Final	536.92	.17	2	.92

Table 8.

Link function: Logit

Table 9 Goodness-of-Fit

Chi-Square	df	Sig.
Pearson	463.48	484
Deviance	390.24	484

Table 9.

Link function: Logit

Table 10 Pseudo R-Square

Cox and Snell	.000
Nagelkerke	.001
McFadden	.000

Table 10.

Link function: Logit.

Table 11 Parameter Estimates

	95% Confidence Interval

	Estimate	Std. Error
Threshold	[Class=Conditional Pass]	-4.72
[Class=First Class]	-1.18	.52
[Class=Lower Second]	-.41	.52
Location	PSQI	-.01
PSS	-.01	.03

Table 11.

Link function: Logit.

Table 8 shows the value of Likelihood Ratio Chi-square test of 0.17 and *p*-value of 0.92. The Likelihood Ratio Chi-square test examine the null hypothesis that all predictor regression coefficients are equal to zero as complement to the alternative hypothesis that at least one of the predictor regression coefficients is not equal to zero. Since the *p*-value is very high, it is concluded that all predictor regression coefficient is equal to zero. The predictor variables PSS and PSQI have no effect on academic performance. This is further confirmed by the Wald statistics in Table 11. The Wald statistics of the two predictor variables are too small to reject the null hypothesis that all estimates of the model are zero. This result is contrary to the study conducted in Belgium (Baert, Omey, Verhaest & Vermeir, 2015) which discover that sleep quality can affect academic performance.

Conclusion

In conclusion, the sleep quality of the undergraduate in University Utara Malaysia during pre-examination period is poor. Female students have slightly better sleep quality than female students when preparing for examination and assignments. There is no difference in sleep quality among the colleges but students from different year of study have different sleep quality. The PSQI score and the PSS are weak, positively correlated. In other words, the higher the perceived stress, the poorer is the sleep quality. Lastly, it is found that the perceived stress and sleep quality has no effect on academic performance.

Acknowledgement

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