

# Prevalence and predictors of poor sleep quality among secondary school students in Gombak District, Selangor

**Appanna Kesintha, MSc<sup>1</sup>, Lekhraj Rampal, MBBS, DrPH<sup>1</sup>, Sherina Mohd Sidik, MBBS, PhD<sup>2</sup>, Kalaiselvam Thevandran, MD, MRCP<sup>3</sup>**

<sup>1</sup>Department of Community Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, <sup>2</sup>Department of Psychiatry, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, <sup>3</sup>Department of Medicine, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia

## ABSTRACT

**Introduction:** Poor sleep quality among adolescents is becoming a major worldwide concern and is widely recognized as a significant public health issue. **Objectives:** To determine the prevalence and predictors of poor sleep quality among secondary school students in Gombak District, Selangor.

**Methods:** A cross-sectional study was conducted in Gombak District. The sample size was 1,092 based on two group comparison formula. Students were selected using sampling with probability to proportionate to size. Self-administered pretested questionnaires were used to collect the data. The data were analysed using the Statistical Package for Social Sciences (SPSS) version 22. Chi-square or Fisher's exact test was performed to determine the association between individual categorical variables and sleep quality. Variables with p-value <0.25 were selected to be subjected into multivariate logistic regression to determine the predictors.

**Results:** The response rate was 93.0%. The prevalence of poor sleep quality was 24.0% (95% CI = 21.5, 26.6). Based on the analysis of simple logistic regression seven variables that were significantly associated with poor sleep quality were age, gender, marital status of parents, depression, anxiety, stress and academic performance found fit in the model. Multivariate logistic analysis showed that the significant predictors of poor sleep quality were age, marital status of parents, depression, anxiety, stress and academic performance. Factors that were not statistically significant were gender, religion, ethnicity, parent's educational level and family income.

**Conclusions:** Prevalence of poor sleep quality among adolescents is high. The predictors of poor sleep quality are age, marital status of parents, depression, anxiety, stress and academic performance.

## KEY WORDS:

*Poor sleep quality, depression, anxiety, stress, academic performance, prevalence, predictors*

## INTRODUCTION

Adolescents need a good quality of sleep as it is a critical component of both mental and physical health for an adolescent. Good quality of sleep helps in cognitive restitution, memory consolidation, learning, decision making and processing of an individual.<sup>1,2</sup> The current recommended sleep duration required for adolescents is between eight to ten hours of sleep per night in order for them to function at their very best.<sup>3</sup>

Poor sleep quality among adolescents aged between 10-19 years old is becoming a major worldwide concern.<sup>4</sup> The transition period from childhood to adolescents mostly happens during their schooling environment. It is during this transition period that changes will occur in the biological, physical and psychological aspects of adolescence.<sup>5,6</sup> This period is the point where adolescents suffer from increasing pressures' from school, family, social and even the environmental that which indirectly contribute towards the delay in sleep timing together with the change in the intrinsic regulation of both circadian and homeostatic processes causing poor sleep quality.<sup>6,7</sup>

Currently, the sleep duration was found to decrease with age and the highest prevalence of poor sleep quality was found to occur among older adolescents. The prevalence of poor sleep quality among children and adolescents is high and varies from 10% to 40% worldwide.<sup>5,8,9</sup> In China a study by Xu et al.<sup>9</sup> reported highest prevalence of poor sleep quality was found between age group of 16 to 20 year old which was 18.6%, followed by 21 to 25 year old was 17.1% and among 10 to 15 year old was 15.2%. In Shanghai, a study among children and adolescents reported that the mean age of insufficient sleep begins at 11.5 years, females slept less and gets into bed late (p<0.001).<sup>7</sup> A meta-analysis study among adolescents stated that sleep time was found to decline with age at an estimation of 14 minutes per day with per year of age on school days and 7 minutes per night with per year of age on non-schooling days.<sup>10</sup> Studies have also shown that adolescents sleep approximately 1.5 hours longer on weekends as compared to weekdays.<sup>11,12</sup> In Malaysia, there have been no studies done among adolescents at secondary school on sleep quality. However, there is one study reported among children at the age group of 6 to 12 years old, found

This article was accepted: 26 December 2017

Corresponding Author: Prof. Datuk Dr. Lekhraj Rampal  
Email: lekhraj@upm.edu.my, dr\_rampal1@hotmail.com

41.5% of insufficient sleep per night with increasing age.<sup>13</sup> Thus, this study focuses on among adolescents at secondary school students.

Important risk factors associated with poor sleep quality among adolescents in secondary schools include socio-economic status of family, educational background of parents, and family structure.<sup>14-15</sup> Apart from that, inadequate amount of sleep among adolescents at secondary school has been associated with daytime sleepiness, poor academic performance at school.<sup>16</sup> Psychological correlates such as stress, anxiety and depression are the essential points that need to be taken into consideration as they give serious contribution to poor sleep quality among adolescents in secondary schools.<sup>9,7,18</sup>

This study aimed to determine the prevalence and the predictors of poor sleep quality among secondary school students in Gombak District, Selangor. The findings from this study will add new knowledge in the respective field and will provide useful information for the government or policy makers in terms of planning an intervention or a campaign targeting the secondary school students by focusing on the significant predictors of poor sleep quality of this study. Hence, it will give a wake-up call for better health and well-being for the future generation.

## MATERIALS AND METHODS

### *Study Location, Study Design, and Study Duration*

This cross-sectional study was conducted between July 2015 and September 2015 among secondary school students in Gombak district, Selangor. The list of all government secondary schools in Gombak district had been used as a sampling frame. Only form 1, form 2, and form 4 secondary school students regardless of their age with a Malaysian Nationality were involved in this study. On the other hand, as instructed by Ministry of Education, Malaysia, Form 3 and Form 5 students were not included in this study because they were taking major examination such as PTS 3 and SPM and students who were on medical leave during the data collection were excluded from this study.

### *Sample Size*

The sample size was estimated by using a two proportion formula for hypothesis testing.<sup>19</sup> A total of 1092 respondents was required in this study after being adjusted for a design effect of 1.9,<sup>21</sup> estimated response rate of 70%, and 90% of eligibility.

### *Sampling Method*

The sampling technique used for the selection of schools in this study was probability proportionate to size.<sup>20</sup> The schools were selected and all the students in form 1, form 2, and form 4 in the selected schools were invited to participate in this study.

### *Study Variables*

The dependent variable in this study was poor sleep quality. The independent variables were socio-demographic characteristics (age, gender, religion, ethnicity, monthly

income of the family, parent's educational status, and marital status of parents), psychological factors (depression, anxiety, and stress), and academic performance (grade percentage of the student of midterm examination).

### *Study Instruments and Data Collections*

A validated English and Malay version questionnaire was used in this study for data collection. The questionnaire consisted of four sections. In Section A of the questionnaire, information's on characteristics of respondents such as age, gender, religion, ethnicity, family monthly income, parent's educational level, and marital status of parents was collected. Section B of the questionnaire asked on the respondent's sleep quality which was adapted from Pittsburgh Sleep Quality Index (PSQI) questionnaires.<sup>22</sup> PSQI questionnaire consisting of 19-items of the self-report measure designed to measure subjective distress with sleep quality over the past month. It is a self-rated questionnaire distinguishing "poor" from "good" sleep by measuring seven areas. These areas include subjective sleep quality (one item), sleep latency (two items), sleep duration (one item), habitual sleep efficiency (three items), sleep disturbances (nine items), use of sleeping medication (one item), and daytime dysfunction (two items) as they relate to sleep with response in Likert scale (0=no difficulty, 1=mild difficulty, 2= moderate difficulty and 3= severe difficulty). These areas are then totalled to yield a global PSQI score ( $\leq 5$ =good sleep quality,  $>5$ =poor sleep quality). Section C of the questionnaire gathered information on psychological factors (depression, anxiety and stress) which was adapted from Depression, Anxiety, and Stress (DASS-21) questionnaire.<sup>23-24</sup> The DASS-21 questionnaire comprised of 21 items. Each item belongs to one of the scales and the scores for each scale are added up and multiplied by 2. However, the DASS-21 questionnaire has 14 reversed items and scores of those items were reversed before the final score of severity was obtained. Section D consisted of information on academic performance. The Grade Percentage of Student (GPS) from midterm examination was extracted from each student's progress report under the supervision of the teacher in charge to analyze their academic performance. Data collection was conducted from class to class and the teachers were not allowed to be in the class in order to ensure the students answer honestly and to avoid information bias.

The questionnaires were pre-tested among 80 students who were randomly selected from a secondary school in Gombak district which was not selected in the main study. Dual language, Malay and English versions questionnaires were self-administered by selected students and tested for content validity, face validity and reliability of the instrument. In order to ensure the reliability of the questionnaire, internal consistency was tested using Cronbach's Alpha on each factor. The results show the Cronbach's Alpha ranged from 0.73 to 0.89.

### *Definition of Terms*

Poor sleep quality was defined as respondents who did not have the satisfaction of the sleep experience, integrating aspects of sleep initiation, sleep maintenance, sleep quantity and refreshment upon awakening.<sup>25</sup>

### Data Analysis

The data were analyzed using the International Business Machine Statistical Package for Social Sciences (IBM SPSS) version 22. Normality of the continuous numerical data was checked using Kolmogorov-Smirnov test of normality and graphically. Once the data had been checked for any error in the data entry, univariate analyses were conducted. Descriptive analysis was performed, the frequency and percentage values were used to summarize the categorical data and for numerical data, the result was presented using measure of central tendency and dispersion. All numerical data were categorized for further data analysis.

Chi-square or Fisher's exact test was performed to determine the association between individual independent categorical variables and the outcome (poor sleep quality). Crude odds ratio and 95% CI were determined using simple logistic regression. The level of significance was set at 0.05. Variables with a p-value of less than 0.25 from the simple logistic regression were subjected to multivariate binary logistic regression. This p-value of less than 0.25 was recommended by Hosmer and Lemeshow<sup>26</sup> because they discovered that the use of traditional level p-value of less than 0.05 often fails to identify some variables that are known to be important.

Multivariate binary logistic regression was used to determine the independent factors associated with poor sleep quality. The variable selection was determined using backward and forward likelihood ratio (LR) stepwise selection methods. The forward LR and backward LR selected 7 similar significant variables. The variables in the model were tested for the assumption of logistic regression analysis (model fit, classification table, multicollinearity, the receiver operating characteristic (ROC) curve, and interaction). The model found fits well, where the Hosmer-Lemeshow test showed that there was no significant difference ( $p=0.406$ ) between the observed probability and the expected probability. The results of this multiple logistic regression analysis were expressed as adjusted odds ratios with 95% confidence intervals. The final model was obtained by using the enter method.

### Ethical Approval

Ethical approval for this study was obtained from the Ethics Committee for Research Involving Human Subjects, University Putra Malaysia (UPM/TNCPI/RMC/IACUC/1.4.18.1/F1). Besides that, permission from the Ministry of Education of Selangor, Ministry of Education of Malaysia, and the principals of selected secondary schools in Gombak district had been obtained before the commencement of the study.

## RESULTS

### Response Rate

Out of 1,092 students who were selected, 1,016 participated and completed the questionnaire in this study, giving an overall response rate of 93.0%. The remaining 76 (7.0%) students were excluded because they were absent throughout the period of the survey or refused to participate or never returned the consent forms.

### Characteristics of Respondents

Table I shows the characteristics of the secondary school students who participated in this study. In this study, more than half of the respondents were males (60.1%). Most of the respondents were Malay (68.6%) and Islam (73.0%). Majority of the respondents (88.9%) had a family income of RM3,000.00 and above. Majority of respondents have fathers (88.7%) and mothers (78.7%) with a secondary or tertiary level of education background and majority parents of respondents (85.1%) were married while the rest 14.9% were divorced and widowed.

The distribution of respondents according to psychological factor indicated more than half of the respondents, 541 (53.3%) were categorized as having no depression. Out of the 1,016 respondents, 306 (30.1%) had a mild level of depression. This is followed by 163 respondents (16.0%) who were reported with a moderate level of depression. Only, 6 (0.6%) of respondents appeared to have a severe level of depression. No respondents reported with the extremely severe level of depression. Besides that, nearly half of the respondents 482 (47.4%) were categorized as having no anxiety. Out of 1,016 respondents, 275 (27.1%) had a mild level of anxiety, followed by 206 (20.3%) reported with a moderate level of anxiety. Only, 53 (5.2%) of respondents appeared with a severe level of anxiety. No respondents were reported with the extremely severe level of anxiety. More than half of the respondents 510 (50.2%) were categorized having no stress. Out of 1,016 respondents, 204 (20.1%) had a moderate level of stress, followed by 198 (19.5%) appeared with a mild level of stress and 100 (9.8%) appeared with a severe level of stress. Only, 4 (0.4%) of respondents appeared with the extremely severe level of stress.

The distribution of respondents based on academic performance indicated that most of the respondents (31.4%) scored well in their examination. Out of 1,016 respondents, 239 (23.5%) scored average in their examination and 269 (26.5%) scored poor in their examination. Only 189 (18.6%) scored excellent in their examination.

### Sleep quality elements

Table II shows the distribution of respondents by the sleep quality elements and a total global score of Pittsburgh Sleep Quality Index (PSQI). Seven elements of sleep quality were measured. The majority (86.5%) of the respondents reported had very good and fairly good subjective sleep quality. Out of 1,016 respondents, 107 (10.5%) reported with fairly bad subjective sleep quality. Only 3.0% ( $n=30$ ) of the respondents had very bad subjective sleep quality. Nearly half of the respondents, ( $n=466$ , 45.9%) had sleep latency that was between 16 to 30 minutes while 231 (22.7%) of the respondents reported having sleep latency was between 31 to 60 minutes, and 319 (31.4%) had sleep latency less than 15 minutes. More than half ( $n=658$ , 64.8%) of the respondents had sleep duration that was more than 7 hours per day. Out of 1,016 respondents, 200 (19.7%) had sleep duration between 6 to 7 hours per day while 123 (12.1) had sleep duration between 5 to 6 hours per day. Only 3.4% of respondents had sleep duration that was less than five hours. All respondents reported with the highest efficiency of habitual sleep. A majority (84.2%) of the respondents

Table I: Characteristics of secondary school students (n=1016)

Sociodemographic characteristics	N	%
Age		
<13	103	10.1
13 to <14	272	26.8
14 to <15	303	29.8
15 to <16	86	8.5
16 to <17	252	24.8
Gender		
Male	611	60.1
Female	405	39.9
Ethnicity		
Malay	697	68.6
Chinese	126	12.4
Indian	170	16.7
Others	23	2.3
Religion		
Islam	742	73.0
Buddha	109	10.7
Christian	9	0.9
Hindu	137	13.5
Others	19	1.9
Monthly income (n=1008)		
< RM1500	16	1.6
RM1500-RM3000	96	9.5
> RM 3000	896	88.9
Education level of father		
No formal education	14	1.4
Primary school	101	9.9
Secondary school	565	55.6
Tertiary (College/University)	336	33.1
Education level of mother		
No formal education	38	3.7
Primary school	179	17.6
Secondary school	627	61.8
Tertiary (College/University)	172	16.9
Marital status of parents		
Married	865	85.1
Divorce/Widow/Widower	151	14.9
Depression		
Normal	541	53.3
Mild	306	30.1
Moderate	163	16.0
Severe	6	0.6
Extremely severe	0	0.0
Anxiety		
Normal	482	47.4
Mild	275	27.1
Moderate	206	20.3
Severe	53	5.2
Extremely severe	0	0.0
Stress		
No	510	50.2
Mild	198	19.5
Moderate	204	20.1
Severe	100	9.8
Extremely severe	4	0.4
Grade percentage of students (GPS)		
Excellent	189	18.6
Good	319	31.4
Average	239	23.5
Poor	269	26.5

Table II: Distribution of respondent by sleep quality elements (n=1016)

Elements of sleep quality	N	%
Subjective sleep quality		
Very good	396	39.0
Fairly good	483	47.5
Fairly bad	107	10.5
Very bad	30	3.0
Sleep latency (minutes)		
≤ 15	319	31.4
16-30	466	45.9
31-60	231	22.7
Sleep duration (hours)		
> 7	658	64.8
6-7	200	19.7
5-6	123	12.1
< 5	35	3.4
Habitual sleep efficiency (%)		
> 85	1016	100.0
75%-85	0	0.0
65%-75	0	0.0
<65	0	0.0
Sleep disturbance		
None	154	15.2
Mild	856	84.2
Moderate	6	0.6
Severe	0	0.0
Use of sleep medication		
None	1016	100.0
Mild	0	0.0
Moderate	0	0.0
Severe	0	0.0
Daytime dysfunction		
None	663	65.3
Mild	329	32.3
Moderate	24	2.4
Severe	0	0.0
Total PSQI Global score		
≤ 5 (Good sleep quality)	772	76.0
> 5 (Poor sleep quality)	244	24.0

reported with mild sleep disturbance while 154 (15.2%) of the respondents reported no sleep disturbance. A very small number of the respondents (n=6, 0.6%) reported with moderate sleep disturbance. None of the respondents used any sleep medication to initiate sleep. More than half (65.3%) of the respondents reported with no daytime dysfunction while 329 (32.3%) appeared with mild daytime dysfunction. Only 2.4% of the respondents appeared with moderate daytime dysfunction. A majority (76.0%) of the respondents reported with good sleep quality and only 24.0% reported with poor sleep quality.

#### Prevalence of poor sleep quality

Table III shows the prevalence of poor sleep quality by age, gender, ethnicity, religion, monthly income of the family, educational level of parents, and marital status of parents. The prevalence of poor sleep quality was found to be highest among age group of 16 to <17 years respondents 34.1%, followed by 15 to <16 years respondents 27.9%, 14 to <15 years 21.5% and similarly lowest prevalence 18.4% were found among age group of 13 to <14 years respondents and <13 years respondents respectively. The highest prevalence of poor sleep quality was observed among female respondents which was 28.1% as compared to male respondents 21.3%.

Based on ethnicity, Indian respondents appeared with highest prevalence of poor sleep quality 25.3%, followed by Malays 24.1% and Chinese 23.0%. As for religions, Christians were reported to have the highest prevalence of poor sleep quality 44.4%, followed by Buddhist with a prevalence of 24.8%, Islam with a prevalence of 24.1%. Hindus were reported with the lowest prevalence of poor sleep quality 22.6%.

Besides, the prevalence of poor sleep quality was found to be higher in the low-income group. Those with income of less than RM1,500.00 had the highest prevalence of poor sleep quality 31.3%. Based on parents educational background, the prevalence of poor sleep quality of the respondents was higher among fathers with no formal education (21.4%) and mothers with secondary level of education (26.6%). Based on the marital status of parents, the highest prevalence of poor sleep quality was among divorced or widow (60.9%) as compared to married 17.6%.

#### Factors associated with poor sleep quality

Table IV shows the factors associated with poor sleep quality. The results show that there was a significant association between poor sleep quality and age ( $\chi^2=22.40$ ,  $df=4$ ,  $p<0.001$ ),



Table III: Prevalence of poor sleep quality by socio-demographic factors

Socio-demographic	Sleep quality			
	Poor		Good	
	N	(%)	N	(%)
Overall prevalence (n=1016)	244	(24.0)	772	(76.0)
Age				
<13	19	(18.4)	84	(81.6)
13 to <14	50	(18.4)	222	(81.6)
14 to <15	65	(21.5)	238	(78.5)
15 to <16	24	(27.9)	62	(72.1)
16 to <17	86	(34.1)	166	(65.9)
Gender				
Male	130	(21.3)	481	(78.7)
Female	114	(28.1)	291	(71.9)
Ethnicity				
Malay	168	(24.1)	529	(75.9)
Chinese	29	(23.0)	97	(77.0)
Indian	43	(25.3)	127	(74.7)
Others	4	(17.4)	19	(82.6)
Religion				
Islam	179	(24.1)	563	(75.9)
Buddha	27	(24.8)	82	(75.2)
Christian	4	(44.4)	5	(55.6)
Hindu	31	(22.6)	106	(77.4)
Others	3	(15.8)	16	(84.2)
Family income (n=1008)				
< RM1500	5	(31.3)	11	(68.8)
RM1500-RM3000	29	(30.2)	67	(69.8)
>RM3000	208	(23.2)	688	(76.8)
Father's education level				
No formal education	4	(28.6)	10	(71.4)
Primary education	25	(24.8)	76	(75.2)
Secondary education	146	(25.8)	419	(74.2)
Tertiary education	69	(20.5)	267	(79.5)
Mother's educational level				
No formal education	7	(18.4)	31	(81.6)
Primary Education	33	(18.4)	146	(81.6)
Secondary education	167	(26.6)	460	(73.4)
Tertiary education	37	(21.5)	135	(78.5)
Marital status of parents				
Married	152	(17.6)	713	(82.4)
Divorced/Widow/Widower	92	(60.9)	59	(39.1)

gender ( $\chi^2= 6.30$ ,  $df=1$   $p=0.012$ ) and marital status of parents ( $\chi^2= 132.42$ ,  $df=1$ ,  $p<0.001$ ). Besides, the result also shows that there was significant association between poor sleep quality and depression ( $\chi^2 = 159.96$ ,  $df=1$ ,  $p<0.001$ ); anxiety ( $\chi^2 = 186.11$ ,  $df=1$ ,  $p<0.001$ ) and stress ( $\chi^2 = 139.74$ ,  $df=1$ ,  $p<0.001$ ). The percentage of poor sleep quality was highest among respondents reported with depression, anxiety and stress. The result also revealed that there was a significant association between poor sleep quality and academic performance ( $\chi^2 = 172.19$ ,  $df=2$ ,  $p<0.001$ ) of the respondents. The percentages of poor sleep quality increase as the academic performance of the respondent's decreases.

#### Predictors of Poor Sleep Quality

There were twelve variables in this study. In the chi-square analysis, 7 out of 12 variables had a p-value less than 0.25. However, in the multivariate analyses, only 6 out of 7 variables were identified as independent factors for poor sleep quality. Table V shows adjusted odds ratio for 6 variables from multivariate binary logistic regression.

The predictors of poor sleep quality were 16 to <17 years-old (adjusted OR=3.10, 95% CI= 1.19, 8.05,  $p=0.02$ ), respondents with 'divorced' or 'widow' parents (adjusted OR=6.21, 95% CI =3.63, 10.29,  $p<0.001$ ), depression (adjusted OR=5.42, 95% CI = 3.45, 8.54,  $p<0.001$ ), anxiety (adjusted OR=8.68, 95% CI= 5.13, 14.71,  $p=0.001$ ), stress (adjusted OR=4.27, 95% CI=2.70, 6.77,  $p<0.001$ ), and academic performance of respondents scored 'average' in examination (adjusted OR=3.67, 95% CI = 2.14, 6.39,  $p<0.001$ ), and 'poor' in examination (adjusted OR=5.83, 95% CI= 3.43, 10.02,  $p<0.001$ ).

#### DISCUSSION

The prevalence of poor sleep quality in secondary school students in Gombak district was 24.0%. This figure was lower than the studies reported in China by Xu et al.<sup>9</sup> which was 28.8% and by Zhou et al.<sup>27</sup> which was 25.7%. Similarly, this prevalence was also lower than a study reported in Brazil by Gomesa et al.<sup>28</sup> was 28.2%. This may be due to the majority of the respondents in this study with the background of stable socioeconomic status. However, the prevalence of this study is much higher than reported by Chung and Cheong<sup>4</sup> which

Table IV: Factors associated with poor sleep quality (n=1016)

Factors	Sleep quality				Total		$\chi^2$	df	p-value
	Poor		Good						
	N	(%)	N	(%)					
Age (years)							22.40	4	< 0.001*
<13	19	(18.4)	84	(81.6)	103	(100.0)			
13 to <14	50	(18.4)	222	(81.6)	272	(100.0)			
14 to <15	65	(21.5)	238	(78.5)	303	(100.0)			
15 to <16	24	(27.9)	62	(72.1)	86	(100.0)			
16 to <17	86	(34.1)	166	(65.9)	252	(100.0)			
Total	244	(24.0)	772	(76.0)	1016	(100.0)			
Gender									
				6.30	1	0.012*			
Male	130	(21.3)	481	(78.7)	611	(100.0)			
Female	114	(28.1)	291	(71.9)	405	(100.0)			
Total	244	(24.0)	772	(76.0)	1016	(100.0)			
Ethnicity									
				0.78	3	0.855			
Malay	168	(24.1)	529	(75.9)	697	(100.0)			
Chinese	29	(23.0)	97	(77.0)	126	(100.0)			
Indian	43	(25.3)	127	(74.7)	170	(100.0)			
Others	4	(17.4)	19	(82.6)	23	(100.0)			
Total	244	(24.0)	772	(76.0)	1016	(100.0)			
Religion									
				2.95	4	0.567			
Islam	179	(24.1)	563	(75.9)	742	(100.0)			
Buddha	27	(24.8)	82	(75.2)	109	(100.0)			
Christian	4	(44.4)	5	(55.6)	9	(100.0)			
Hindu	31	(22.6)	106	(77.4)	137	(100.0)			
Others	3	(15.8)	16	(84.2)	19	(100.0)			
Total	244	(24.0)	772	(76.0)	1016	(100.0)			
Family income (n=1008)									
						2.79	2	0.248	
< RM1500	5	(31.3)	11	(68.8)	16	(100.0)			
RM1500-RM3000	29	(30.2)	67	(69.8)	96	(100.0)			
>RM3000	208	(23.2)	688	(76.8)	896	(100.0)			
Total	244	(24.0)	766	(76.0)	1016	(100.0)			
Father's educ. level									
							3.45	3	0.327
No formal educ	4	(28.6)	10	(71.4)	14	(100.0)			
Primary educ	25	(24.8)	76	(75.2)	101	(100.0)			
Secondary educ	146	(25.8)	419	(74.2)	565	(100.0)			
Tertiary educ	69	(20.5)	267	(79.5)	336	(100.0)			
Total	244	(24.0)	772	(76.0)	1016	(100.0)			
Mother's educ.level									
							6.65	3	0.084
No formal educ	7	(18.4)	31	(81.6)	38	(100.0)			
Primary educ	33	(18.4)	146	(81.6)	179	(100.0)			
Secondary educ	167	(26.6)	460	(73.4)	627	(100.0)			
Tertiary educ	37	(21.5)	135	(78.5)	172	(100.0)			
Total	244	(24.0)	772	(76.0)	1016	(100.0)			
Marital status of parents									
							132.42	1	<0.001*
Married	152	(17.6)	713	(82.4)	865	(100.0)			
Divorced/Widow	92	(60.9)	59	(39.1)	151	(100.0)			
Depression									
							159.96	1	<0.001*
Yes	200	(42.1)	275	(57.9)	475	(100.0)			
No	44	(8.1)	497	(91.9)	541	(100.0)			
Total	244	(24.0)	772	(76.0)	1016	(100.0)			
Anxiety									
							186.11	1	<0.001*
Yes	221	(41.4)	313	(58.6)	534	(100.0)			
No	23	(4.8)	459	(95.2)	482	(100.0)			
Total	244	(24.0)	772	(76.0)	1016	(100.0)			
Stress									
							139.74	1	<0.001*
Yes	202	(39.9)	304	(60.1)	506	(100.0)			
No	42	(8.2)	468	(91.8)	510	(100.0)			
Total	244	(24.0)	772	(76.0)	1016	(100.0)			
Academic performance (GPS)									
							172.19	2	<0.001*
Excellent/Good	35	(6.9)	473	(93.1)	79	(100.0)			
Average	84	(35.1)	155	(64.9)	249	(100.0)			
Poor	125	(46.5)	144	(53.5)	285	(100.0)			
Total	244	(24.0)	776	(76.0)	1016	(100.0)			

Note: (\*) =Significant, p &lt; 0.05

**Table V: Multiple logistic regression analysis of predictor of poor sleep quality**

Variables	B coefficient	Standard error	Adjusted OR	95%CI	p -value
Age					
12 to <13			1.00		
13 to <14	0.64	0.43	0.95	0.40, 2.18	0.882
14 to <15	0.25	0.42	1.29	0.57, 4.77	0.541
15 to <16	0.51	0.54	1.65	0.58, 4.77	0.341
16 to <17	1.13	0.49	3.10	1.19, 8.05	0.020*
Gender					
Male			1.00		
Female	0.35	0.31	0.71	0.38, 1.31	0.269
Marital status of parents					
Married			1.00		
Divorced/Widow	1.81	0.27	6.12	3.63, 10.29	<0.001*
Depression					
Yes	1.69	0.23	5.42	3.45, 8.54	<0.001*
No			1.00		
Anxiety					
Yes	2.16	0.27	8.68	5.13, 14.71	<0.001*
No			1.00		
Stress					
Yes	1.45	0.23	4.27	2.70, 6.77	<0.001*
No			1.00		
Academic performance					
Excellent/Good			1.00		
Average	1.31	0.28	3.67	2.14, 6.39	<0.001*
Poor	1.76	0.27	5.83	3.43, 10.02	<0.001*

Note: (\*)-Significant at p < 0.05

was 19.1% and 18.8% by Liu, Zhao, and Buysse<sup>29</sup> in China. Similarly, the prevalence of this study is much higher than reported by Bryne 30 in South Texas, which was 12.8%.

This study also revealed that there was variation in the prevalence of poor sleep quality with age. There is a significant association between age and poor sleep quality among secondary level school students. This finding was similar to the previous studies. 7,9,28,31 Xu et al.<sup>9</sup> also reported that as the age increases, the chances of getting poor sleep quality was 1.5 times higher among 16 to 20 years students as compared to <16 years students. This may be due to the majority of the older adolescents who finds it hard to fall asleep and had more sleep disturbance. Furthermore, older adolescent facing much more study load and highly pressurized by their parents for academic success in order to enter better universities.<sup>7</sup>

The findings from this study have identified the prevalence of poor sleep quality differed between gender, with females having a higher prevalence of poor sleep quality as compared to males. However, in multivariate analysis, significant association were not observed between gender and poor sleep quality after adjusted for other variables. Similarly, a study by Xu et al.<sup>9</sup> reported there is no significant association between gender and poor sleep quality. Another study by Gomesa et al.<sup>28</sup> also revealed the same finding that gender and poor sleep quality were not significantly associated. Instead, the prevalence of sleep quality was higher among males as compared to females as reported by Zhou et al.<sup>27</sup> and Liu, Zhao, and Buysse.<sup>29</sup> However, these differences may be due the inconsistency of the present sample scale and the place, which suggested further researcher consider bigger samples.<sup>9</sup>

Our current study showed that the prevalence of poor sleep quality differed between the ethnic groups. Indians had the highest prevalence, followed by Malays and then Chinese. However, no significant association was observed between ethnicity and poor sleep quality. Since there is no study done among adolescents in Malaysia, the result was not able to be compared. However, a study among the elderly population in Malaysia reported that highest prevalence was also found among Indian population, followed by Malay and Chinese and no significant association were found with poor sleep quality.<sup>32</sup> In contrast, another study among nurses in Malaysia reported a significant association between ethnicity and sleep quality (p=0.002) and highest prevalence was among Chinese, followed by Indians and Malays.<sup>33</sup> The difference in the result between two studies may due to the different sample group. Therefore, it is not possible to conclude which ethnic groups have the highest prevalence of poor sleep quality.

This study has identified that the prevalence of poor sleep quality was higher in the low-income group. Even though there was variation in the prevalence, no significant association was found between sleep quality and monthly income of family among secondary level school students. This finding contradicts from the previous studies reported that there is a significant association between monthly income of family and sleep quality of children and adolescents.<sup>34-35</sup> Adolescents with low monthly income of family reported the chances of getting poor sleep quality is 3.5 times as compared to high monthly income of the family.<sup>36</sup> The non-significant association in this study may be due to most of the respondents are unsure about the family monthly income.



In this study, Father's and mother's education level were found to be not associated with poor sleep quality of secondary level school students. Respondents with a father who does not have formal education and mother with secondary level education were found to be the highest prevalence of poor sleep quality in this study. In contrast, studies have reported that poor sleep quality was significantly associated with the educational level of parents.<sup>34,36</sup> They also found parents less than high school education reported with short sleep duration of adolescents. Stamatakis et al.<sup>34</sup> reported that parents with less than high school education increased almost 2 times the chances of getting poor sleep quality among adolescents. This may be due to the parents with minimal education background had poor knowledge on sleep health.

There is a significant association between poor sleep quality and marital status of parents among the respondents. Similarly, Xu et al.<sup>9</sup> and Troxel et al.<sup>37</sup> supported the above findings that there is a significant association between sleep quality of adolescents and marital status of parents. This may be due to adolescents from single-parent having a higher rate of sleep problems because of the insecurities of the home environment.

Our study also revealed there is a significant association between depression and poor sleep quality among secondary school students. Previous studies also reported similar finding that adolescents with depression significantly induce poor sleep quality in them. 9,38 Besides, this study also revealed that there is a significant association between anxiety and poor sleep quality. A similar finding of the significant association between anxiety and poor sleep quality was found among adolescents in China by Xu et al.<sup>9</sup> and also among American adolescents by Alfano, Ginsburg & Kingery.<sup>39</sup> The study also found there is significant association found between stress and poor sleep quality among secondary level school students. The finding of this study is supported by a study in Brazil among secondary school students by Gomesa et al.<sup>28</sup> and among adolescents in Iran by Bajoghli, Alipouri, Holsboer, and Brand.<sup>40</sup> This is due to psychopathology of depression, anxiety and stress in an individual causing difficulty in getting to sleep leads to poor quality of sleep in them. Hence, it is important to monitor this psychological factors at an early age to prevent the development of poor sleep quality among future generation.

This study revealed that there is a significant association between academic performance and poor sleep quality among adolescents in secondary school. This study is supported by Chung & Cheung<sup>4</sup> and Jiang et al.<sup>7</sup> that adverse academic performance significantly associated with poor sleep quality among adolescents at secondary school. Poor or average academic performance will result in some form of stress that will affect sleep quality among adolescents at secondary school. According to Jiang et al.<sup>7</sup>, academic stress due to high pressure from parents to obtain good results and homework time has the potential effect on poor sleep quality among adolescents at secondary school. Stress may be the mediating variables that mediate the relationship between adverse academic performance and poor sleep quality.

This study has several limitations. Firstly, due to the cross-sectional design, thus the factors identified in this study cannot be extrapolated as causation. Incidentally, the selected schools were located in urban areas. Hence, the results could not be generalized to both urban and rural area. The study also recruited only school-going students and cannot be generalized to those out of school.

The following recommendations are suggested; as this was a cross-sectional study with inherent study limitations, prospective studies should be carried out with the focus on modifiable and non-modifiable risk factors for poor sleep quality among secondary school students to strengthen the findings of this study. Based on the finding of the predictors of poor sleep quality in this study, it is recommended that a behavioural intervention program is developed, implemented and evaluated. The program should also include sleep quality and mental health such as overcoming depression, anxiety and academic stress due to high pressure from parents to obtain good results. If the program is effective and has a good effect size than the behavioural intervention program should be recommended to Ministry of Education to be implemented in secondary schools. Parents should also play a major role in monitoring their children sleep timing and behaviours.

## CONCLUSION

The overall prevalence of poor sleep quality was considerably high (24.0%) in this study. The predictors of poor sleep quality in this study were age, marital status of parents, depression, anxiety, stress and academic performance. Those in the age group of 16 to <17 years has higher chances of getting poor sleep quality than those less than <13 years and those with parents marital status of 'divorced' or 'widow' has higher chances of getting poor sleep quality than those with parents with 'married' status. Those with depression, anxiety, stress, and scored 'poor' and 'average' in examination also has higher chances of getting poor sleep quality.

## ACKNOWLEDGMENTS

We thank My-Brain 15 for the financial support. Our gratitude also goes to the University Putra Malaysia (UPM), principals, teachers, and students of secondary schools students in Gombak District, Selangor.

## REFERENCES

1. Smaldone A, Honig JC, Byrne MW. Sleepless in America: inadequate sleep and relationships to health and well-being of our nation's children. *Pediatr* 2007; 119(1): 29-37.
2. Sadeh A, Shamsuddin K, Fadzil F, Ismail WSW, Shah SA, Omar K, et al. Consequence of sleep loss or sleep disruption in children. *Sleep Med* 2007; 2: 513-20.
3. National Sleep Foundation. National sleep foundation recommends new sleep times. [cited Dec 2016]. Available from: <https://sleepfoundation.org/press-release/national-sleep-foundation-recommends-new-sleep-times>.
4. Chung KF, Cheung MM. Sleep-wake patterns and sleep disturbance among Hong Kong Chinese adolescents. *Sleep* 2008; 31: 94-185.
5. Ernst M, Pine DS, Hardin M. Triadic model of the neurobiology of motivated behavior in adolescence. *Psychol Med* 2006; 36(3): 299-312.
6. Blakemore SJ, Burnett S, Dahl RE. The role of puberty in the developing adolescents brains. *Hum Brain Mapp* 2010; 31(6): 926-33.

7. Jiang X, Hardy LL, Baur LA, Ding D, Wang L, Shi H. Sleep Duration, Schedule and Quality among Urban Chinese Children and Adolescents: Associations with Routine After-School Activities. *PLoS ONE* 2015; 10(1): e0115326.
8. Huang YS, Wang CH, Guilleminault, C. An epidemiologic study of sleep problems among adolescents in North Taiwan. *Sleep Med* 2010; 11(10): 1035-42.
9. Xu Z, Su H, Zou Y, Chen J, Wu J, Chang W. Sleep quality of Chinese adolescents; distribution and its associated factors. *J Paediatr Child Health* 2011; 48: 138-45.
10. Olds T, Blunden S, Petkov J, Forchino F. The relationships between sex, age, geography and time in bed in adolescents: a meta-analysis of data from 23 countries. *Sleep Med* 2010; 14: 371-8.
11. Matricciani L, Olds T, Petkov J. In search of lost sleep: secular trends in the sleep time of school-aged children and adolescents. *Sleep Med Rev* 2012; 16: 203-11.
12. Chen MY, Wang EK, Jeng YJ. Adequate sleep among adolescents is positively associated with health status and health-related behaviours. *BMC Public Health* 2006; 6: 59.
13. Firouzi S, Koon BP, Noor MI, Sadeghilar A. Sleep pattern and sleep disorders among a sample of Malaysian children. *Sleep Biol Rhythms* 2013; 11: 185-93.
14. Feldon EP, Leite CR, Rebelatto CF, Andrade RD, Beltrame TS. Sleep in adolescents of different socioeconomic status: a systematic review. *Rev Paul Pediatr* 2015; 33(4): 467-73.
15. Merikangas KR, He JP, Burstein M, Swanson SA, Avenevoli S, Cui L, et al. Lifetime prevalence of mental disorders in U.S. adolescents: results from the National Comorbidity Survey Replication—Adolescent Supplement (NCS-A). *J Am Acad Child Adolesc Psychiatr* 2010; 49: 980-9.
16. Bakotic M, Radosevic BV, Koscec A. Educating Adolescents About Healthy Sleep: Experimental Study of Effectiveness of Educational Leaflet. *Croat Med J* 2009; 50(2): 174-81.
17. Steptoe A, Peacey V, Wardle J. Sleep Duration and Health in Young Adults. *Arch Intern Med* 2006; 166(16): 1689-92.
18. Glozier N, Martiniuk A, Patton G, Ivers R, Li Q, Hickie I, et al. Short Sleep Duration in Prevalent and Persistent Psychological Distress in Young Adults: The DRIVE Study. *Sleep* 2010; 33(09): 1139-45.
19. Aday LA & Cornelius LJ. Designing and Conducting Health Surveys: A Comprehensive Guide. 3rd ed. USA: Jossey-Bass; 2006.
20. Lemeshow S. Adequacy of Sample Size in Health Studies: New York, USA: Wiley; 1990.
21. Carlin JB. Design of cross-sectional surveys using cluster sampling: an overview with Australian case studies. *Aust N Z J Public Health* 1999; 23(5): 546-51.
22. Buysse DJ, Reynolds CF, Monk TH, Berman SH, Kupfer DJ. The Pittsburgh sleep quality index: a new instrument for psychiatric practice and research. *J Psychiatr Res* 1989; 28(2): 193-213.
23. Lovibond SH, Lovibond PF. Manual for depression, anxiety, stress scales. 2nd ed. Psychology Foundation of Australia, Sydney; 1995.
24. Ramli M, Ariff MF, & Zaini Z. Translation, validation and psychometric properties of Bahasa Malaysia version of Depression Anxiety and Stress Scales (DASS-21). *Asian J Psychiatr* 2007; 8(2): 82-9.
25. National Sleep Foundation. Sleepictionary-Definitions of common sleep terms. [cited Nov 2016]. Available from: <https://sleepfoundation.org/sleepictionary>.
26. Hosmer Jr DW, Lemeshow S. Applied logistic regression: 2nd ed. San Francisco: John Wiley, Sons; 2000.
27. Zhou Y, Guo L, Lu CY, Deng JX, He Y, Huang JH, et al. Bullying as a risk for poor sleep quality among high school students in China. *PLoS ONE* 2015; 10(3): e0121602.
28. Gomesa GC, Passosb MHP, Silvab HA, Oliveirab VM, Novaes WA, Pitanguib ACR et al. Sleep quality and its association with psychological symptoms in adolescents' athletes. *Rev Paul Pediatr* 2017; 35(3): 316-21.
29. Liu X, Zhao Z, Jia C, Buysse DJ. Sleep patterns and problems among Chinese adolescents. *Pediatrics* 2008; 121(6): 1165-73.
30. Byrne JJ. Sleep quality and quantity and associated factors among high school students from south Texas. *Texas Medical Center Dissertations* 2009; AA11462419.
31. Gradisar M, Gardner G, Dohnt H. Recent worldwide sleep patterns and problems during adolescence: a review and meta-analysis of age, region, and sleep. *Sleep Med* 2011; 12: 110-18.
32. Razali R, Ariffin J, Aziz AFA, Puteh SEW, Wahab S, Iryani T. Sleep quality and psychosocial correlates among elderly attendees of an urban primary care centre in Malaysia. *Neurology* 2016; 21(3): 265-27.
33. Nazatul SM, Saimy I, Moy FM, Nabila AS. Prevalence of sleep disturbance among nurses in a Malaysian government hospital and its association with work characteristics. *JUMMEC* 2008; 11(2): 66-71.
34. Stamatakis KA, Kaplan GA, Roberts RE. Short Sleep Duration across Income, Education and Race/Ethnic Groups: Population Prevalence and Growing Disparities over 34 Years of Follow-Up. *Ann Epidemiol* 2007; 948-55.
35. Jarrin DC, McGrath JJ, Quon EC. Objective and subjective socioeconomic gradients exist for sleep in children and adolescents. *Health Psychol* 2014; 33: 301-5.
36. Boe T, Hysing M, Stormark KM, Lundervold AJ, Sivertsen B. Sleep problems as a mediator of the association between parental education levels, perceived family economy and poor mental health in children. *J Psychosom Res* 2012; 430-36.
37. Troxel WM, Lee L, Hall M, Matthews KA. Single-parent family structure and sleep problems in black and white adolescents. *Sleep Med* 2014; 15(2): 255-61.
38. Kalak N, Gerber M, Kirov R, Mikoteit T, Pühse U, Holsboer E, et al. The relation of objective sleep patterns, depressive symptoms, and sleep disturbances in adolescent children and their parents. *J Psych Res* 2012; 46: 1374-82.
39. Alfano CA, Ginsburg GA, Kingery JN. Sleep-related problems among children and adolescents with anxiety disorders. *J Am Acad Child Adolesc Psychiatr* 2007; 46: 224-32.
40. Bajoghli H, Alipouri A, Holsboer E, Brand S. Sleep patterns and psychological functioning in families in northeastern Iran; evidence for similarities between adolescent children and their parents. *J Adolesc* 2013; 36(6): 1103-13.