

Prevalence and factors associated with poor sleep quality among secondary school teachers in a developing country

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Abstract: This study aimed to determine the prevalence and factors associated with poor sleep quality among secondary school teachers in the state of Selangor, Malaysia. This was a cross sectional study, conducted in two phases. Phase I tested the reliability of the Pittsburgh Sleep Quality Index in the Malay language (M-PSQI), whereas Phase II determined the prevalence and factors associated with poor sleep quality where a total of 1,871 secondary school teachers were studied. Participants were recruited using multistage sampling. Self-administered questionnaire was used to collect data on socio-demographic and teaching characteristics, comorbidities and characteristics of sleep. The M-PSQI was used to measure sleep quality. The Depression Anxiety Stress Scale-21 was used to measure mental health status. Results showed that the M-PSQI had a good internal consistency and moderate reliability. The prevalence of poor sleep quality was 61 (95% CI: 54–67)%. Total teaching hours/day, depression and stress were significantly associated with poor sleep quality in the univariate analysis, while only stress (OR 1.04; 95% CI 1.02–1.05%) remained significant in the multivariate analyses. In conclusion, stress level of the secondary school teachers should be reduced to improve sleep quality.

Key words: Pittsburgh Sleep Quality Index, Reliability, Stress, Teachers, Malaysia

Introduction

Teachers form a significant proportion of the workforce globally as well as in Malaysia. According to the Ministry of Education, Malaysia, teachers are among the largest professional group of the country's workforce. Teaching is viewed as a demanding and stressful profession¹. Teachers are burden with high load of administrative duties

in addition to teaching, as well as increasing academic demands from both students and parents. Teachers also face constant challenges of having to update their teaching methodologies, and some may seek to upgrade their qualifications through specialization courses^{2, 3}. Some teachers may attempt to increase income by teaching extra classes after school. All these may affect their sleep duration or sleep quality.

Sleep duration is easily measured but it may not be comprehensive as duration of sleep does not indicate the quality of sleep. One can have an adequate duration of sleep which is of poor quality. Sleep quality is one of the important factors for maintaining good physical and mental health⁴. Poor sleep quality may affect body function

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and give negative mental, emotional and physical effects, similar as low grade depression⁵). Sleep quality is also related with metabolic syndrome, poor glucose metabolism and poor control of blood pressure; contributing to higher risks of cardiovascular diseases^{6, 7}), poor mental health^{8, 9}) and poor quality of life^{10–12}).

The prevalence of poor sleep quality varies depending on the methodology used in studies ie: objective (polysomnography) or subjective/self-perceived measures (questionnaires). An ideal screening instruments would incorporate all items relevant to the concept of sleep dysfunction and be able to differentiate “good” and “poor” sleepers¹³).

Polysomnography is the gold standard providing valid measures of sleep duration, efficiency, fragmentation, and architecture¹⁴). However, it usually requires an overnight stay in a sleep laboratory or clinic, which is unpractical in epidemiology research. Some self-perceived sleep quality questionnaires includes the Consensus Sleep Diary¹⁵) and Pittsburgh Sleep Quality Index¹⁶). The Pittsburgh Sleep Quality Index (PSQI) is one the most widely used questionnaires¹⁷). It is able to assess subjective sleep quality over the past month and to differentiate between “good” and “poor” sleepers¹⁸). The PSQI questionnaire had been extensively validated in the English version as well as other languages and cultures with good validity and reliability^{17–20}).

The prevalence of poor sleep quality in western countries lies between 20–30% and increase with age²¹). Between 15% to 20% of adults reported having chronic sleep problems¹³). A review of sleep disorders in Asia found that people were not only sleeping less, but also their quality of sleep was getting worse²²).

In Malaysia, there are limited studies conducted on sleep quality. Among Malaysian population aged 30 to 70 yr in four urban areas in Selangor, the prevalence of poor sleep quality with symptoms of insomnia was 33.8%, with 12.2% of them reported to have chronic insomnia²³). Another study among nurses reported the prevalence of poor sleep quality (PSQI>5) as 57.8%²⁴). Study among undergraduate students reported 16 to 67% having poor sleep quality^{25–27}). All the above mentioned studies used PSQI as the measurement tool for sleep quality except the one conducted in urban area in Selangor²³).

Previous studies reported that risk factors of poor sleep quality among teachers included being women²³), having lower levels of emotional support or being single, divorced or widowed^{28, 29}); lack of physical activity and smoking³⁰).

As the PSQI is commonly used in our country in mea-

suring sleep quality, we attempted to translate the PSQI into the Malay (national) language and test the reliability of the Malay version PSQI (M-PSQI) in our local setting, as well as to estimate the prevalence and determine the associated factors of poor sleep quality among secondary school teachers in the state of Selangor, Malaysia.

Subjects and Methods

Study design and sampling method

This study was conducted in two phases. Phase I was a cross sectional study, testing the reliability of M-PSQI conducted in public secondary schools from Kuala Lumpur (n=2) and Selangor (n=4). The schools were sampled using convenient sampling method. All teachers from the selected schools were invited to participate.

Phase II was a cross-sectional study using multistage sampling to recruit the participants. Seventy percent of all public secondary schools (excluding those participated in Phase I) in all the districts (ten) from the state of Selangor were invited to participate. All eligible teachers from the selected schools were invited. Participation was voluntary. The inclusion criteria were permanently employed teachers who worked for more than six months. Pregnant teachers were excluded. Data collection was carried out from June to November 2013. This study was part of the CLUSTER cohort study³¹).

Ethics clearance and approval

Ethical approval was obtained from the Medical Ethics Committee of the University Malaya Medical Centre (UMMC) (Ref No.950.1). Permission was obtained from the Ministry of Education, Malaysia (Reference number: KP (BPPDP)/603/5/JLD.12 (24)); Education Department in the states of Wilayah Persekutuan and Selangor; and the school principals. Informed consent was obtained from participants prior to data collection.

Data collection

In phase I, we translated the PSQI into the Malay (national) language using the forward and backward method. Test-retest reliability of the final translated M-PSQI was assessed over 2–3 wk interval. Socio-demographic information including age, sex, and highest education levels achieved was also inquired using a self-administered questionnaire.

In phase II, a self-administered questionnaire was used to ascertain socio-demographic information including age, sex, and highest education levels achieved. Teach-

ing characteristics such as number of students taught per class, total teaching hours per day (in school and extra classes after school), years of teaching and subjects taught according to teachers' qualification, were also enquired. Self-reported comorbidities such as diabetes mellitus and hypertension diagnosed by medical doctors was enquired. The M-PSQI and Depression, Anxiety and Stress Scale 21 (DASS 21) were used to measure sleep quality and mental health respectively.

Pittsburgh Sleep Quality Index (PSQI)

The PSQI consists of 19 items grouped in seven domains. The domains are sleep duration, sleep disturbance, sleep latency, daytime dysfunction due to sleepiness, overall sleep quality, sleep efficiency and dependency on medicine to sleep. The scores of each statement ranged from 0=no difficulty (better sleep quality), 1=mild difficulty, 2=moderate difficulty and 3=severe difficulty (worse sleep quality). Each domain's scores were summed to produce a global measure of sleep quality and the scores ranged from 0 to 21. Total score of above five is defined as poor sleep quality. Higher score indicates poorer quality of sleep. High degree of internal consistency was observed among the PSQI domains; with Cronbach α of 0.83 was reported¹⁹.

The PSQI was found to be a valid instrument in differentiating healthy participants from patients. The PSQI's validity was supported by polysomnographic findings^{16, 19, 32}. Overall test-retest reliability of the PSQI global score was high, with a reliability of 0.90 two days after administration, and 0.87 on an average of 45 d¹⁷.

Depression, Anxiety and Stress Scale (DASS 21)

Depression, anxiety, and stress were measured using the Depression, Anxiety and Stress Scale (DASS 21)³³ which consists of 21 questions; seven under each domain. DASS 21 inquires the experience in the past week and each item is scored from 0 (did not apply to me at all) to 3 (applied to me very much). The total scores were summed and multiplied by 2. Normal scores for depression were 0 to 9, anxiety 0 to 7 and stress were 0 to 14. Higher scores imply mental health problem. The original DASS-21 has Cronbach's alpha (internal consistency) ranging from 0.76 to 0.84³³, while the Malay version of DASS21 by Ramli *et al.*³⁴ used in this study had comparable results, with Cronbach's alpha ranging from 0.74 to 0.84.

Statistical analysis

The internal consistency of M-PSQI was assessed using

Cronbach's α coefficients. Spearman's correlation coefficients and Intra-class correlation (ICC) coefficients were used to assess the reliability of the M-PSQI questionnaire. Cohen's κ coefficient was used to examine the agreement on quality of sleep classification.

Complex sample analyses were carried out as samples were weighted to account for unequal probabilities of selection and non-response in the multi-stage sampling used³⁵. Other than descriptive analyses, the associations of poor sleep quality with the independent variables (socio-demographic characteristics, teaching characteristics, comorbidities and mental health) was conducted using χ^2 tests. Complex sample analyses with multiple logistic regression were performed. In the modelling strategy, independent variables with $p < 0.05$ were included in the univariate analyses, using the enter method. Adjusted odds ratios with 95% confidence intervals were reported. A p -value of less than 0.05 was considered statistically significant. Statistical analyses were undertaken using the IBM SPSS Statistic version 21.0.

Results

In Phase I, the number of participants that filled the M-PSQI at the first and second administrations were 175 and 162 respectively (response rate for both tests=92.6%). Majority of the participants were females (87.7%), Malays (72.8%) and married (77.8%). More than two third of them were degree holders (82.1%). The mean (SD) age of the participants was 39 (8) yr with the range between 24–55 yr old.

The Cronbach's α coefficients for global score was 0.82 and for each domain ranged from 0.64 to 0.82; indicating good internal consistency. The Intra-class Correlation (ICC) coefficients for global score and the individual domains ranged from 0.45 to 0.70 indicating low to moderate reliability (Table 1).

In phase II, a total of 155 schools (70% of all national secondary schools in Selangor) were randomly sampled. Of a total of 134 schools that were successfully contacted via telephone calls, 94 schools' principals agreed to participate. From the 94 schools, 1,871 (out of 6,735) teachers participated in the study (response rate=27.8%). The main reasons for non-participation were not interested or busy, while some teachers were unavailable during data collection days. Some of them were attending courses or meeting outside schools, or accompanying students for sports events. Therefore complex sample analyses with weighted samples were carried out to account for non-response and

Table 1. Internal consistency and reliability of M-PSQI

M-PSQI	Internal consistency Cronbach's α	Reliability			
		ICC	95%CI	Spearman correlation coefficient (ρ)	κ
M-PSQI Global Scores	0.821	0.7	(0.60–0.76)	0.674 ^a	0.442
Subscores					
PSQI Duration	0.821	0.7	(0.61–0.77)	0.702 ^a	-
PSQI Disturbance	0.723	0.6	(0.45–0.66)	0.625 ^a	-
PSQI Latency	0.77	0.62	(0.52–0.71)	0.575 ^a	-
PSQI Daydys	0.653	0.45	(0.32–0.57)	0.609 ^a	-
PSQI HSE	0.64	0.45	(0.32–0.56)	0.300 ^a	-
PSQI SLPQual	0.76	0.6	(0.50–0.70)	0.607 ^a	-
PSQIMeds	0.8	0.66	(0.56–0.74)	0.664 ^a	-

^a $p < 0.001$.

M-PSQI: Pittsburgh Sleep Quality Index-Malay version; PSQI Duration: Duration of sleep; PSQI Disturbance: Sleep Disturbance; PSQI Latency: Sleep latency; PSQI Daydys: Day dysfunction due to sleepiness; PSQI HSE: Sleep Efficiency; PSQI SLPQual: Overall sleep quality; PSQIMeds: Need Medicine to sleep; ICC: Intra class Correlation; CI: confidence Interval.

unequal probabilities of sampling.

The participants were majority females (87.4%), Malays (86.4%) and married (89%). To be a secondary school teacher, the minimum qualification is diploma level, while most teachers (84.7%) have degree qualification. There were also teachers with post-graduate qualifications such as master and doctorate degrees. About half of them (44.6%) were in the age range of 40–49 yr old. Most of the participants (89%) reported teaching subjects equivalent to their qualifications. Almost half of them had been teaching for 10 to 19 yr (41.3%) and 65% of them taught extra classes. Mean number of students taught per class was 33. The mean teaching hours a day during school time was 4.1 (95% CI 3.0–5.2) h. Meanwhile, the mean total teaching hours with extra class a day was 5.1 (95% CI 4.4–5.9) h. Only 11.7% of the participants had diabetes mellitus and 22.5% had hypertension. The means (95% confidence interval) of mental health scores were 5.8 (95% CI 5.2–6.5) for depression, 8.0 (95% CI 6.9–9.1) for anxiety and 9.5 (95% CI 9.3–9.8) for stress (Table 2).

The scores for each domain of M-PSQI are presented in Table 3. The mean global score of M-PSQI was 5.45 (95% CI: 3.80–7.09). The prevalence of poor sleep quality among the participants was 61% (95% CI 53.9–66.7%). Only 21% of them had sleep duration of seven hours and more. Most of them (74.3%) had mild difficulty in the PSQI disturbance domain. Forty three percent had no difficulty in falling asleep (PSQI latency). Majority of them (70%) had mild difficulty in PSQI day dysfunction due to sleepiness. However, 81% of them had good PSQI sleep

efficiency and 97% did not use sleeping medicine to sleep during the past month. Eighty seven percent self-reported that their overall sleep quality was fairly good to very good.

In the univariate analyses, poor sleep quality was associated with total teaching hours (odds ratio (OR) 1.06; 95% CI: 1.02–1.11), depression score (OR 1.09; 95% CI: 1.04–1.15), anxiety score (OR 1.09; 95% CI: 1.08–1.11) and stress score (OR 1.08; 95% CI: 1.06–1.10) (Table 4). In the multivariate model, stress was the only significant factor (OR 1.04; 95% CI: 1.02–1.05) of poor sleep quality.

Discussion

This study aimed to determine the prevalence and factors associated with poor sleep quality among secondary school teachers in the state of Selangor, Malaysia; using the Pittsburgh Sleep Quality Index in the Malay language (M-PSQI). Our results found that the prevalence of poor sleep quality among these teachers was relatively high (61%). Stress was the only factor associated with poor sleep quality in the adjusted model.

The participants in both phases of our study were predominantly females, Malays, married and degree holders; corresponded with the characteristics of public secondary school teachers in our country^{36, 37}.

There was evidence of high internal consistency and moderate reliability on the M-PSQI. Comparable results were reported by other studies^{17, 19, 38–41}, which ranged from 0.74 to 0.85. The internal consistency of M-PSQI

Table 2. Socio-demographic, comorbidities, teaching characteristics and mental health scores of the participants (n=1,871)

	n (weighted %)	(95% CI)	Mean (95% CI)
Gender	n=1871		
Male	249 (12.6%)	(1.2–62.1)	
Female	1,622 (87.4%)	(37.9–98.8)	
Age (yr)	n=1871		
<30	166 (9.4%)	(0.7–60.8)	
30–39	527 (28.8%)	(10.6–58.0)	
40–49	870 (44.6%)	(6.2–90.7)	
≥50	308 (17.2%)	(7.6–34.7)	
Ethnicity	n=1,871		
Malay	1,614 (86.4%)	(64.7–95.6)	
Chinese	126 (6.6%)	(3.5–12.2)	
Indian	114 (6.2%)	(1.4–24.1)	
Others	17 (0.8%)	(0.2–4.0)	
Religion	n=1,871		
Islam	1,628 (87.0%)	(67.4–95.6)	
Buddhism	95 (4.8%)	(4.1–5.7)	
Hinduism	99 (5.5%)	(1.7–16.1)	
Christianity	41 (2.2%)	(0.1–28.7)	
Others	8 (0.5%)	(0.4–0.5)	
Marital status*	n=1,867		
Single	141 (7.7%)	(1.5–31.1)	
Married	1,668 (89.0%)	(78.1–94.9)	
Divorce	28 (1.6%)	(0.4–6.8)	
widow	30 (1.7%)	(0.6–4.3)	
Education level*	n=1,856		
Secondary school/Diploma	64 (3.3%)	(1.6–6.7)	
Degree	1,569 (84.7%)	(73.5–91.7)	
Masters/PhD	223 (12.0%)	(6.9–20.3)	
Comorbidities: Diabetes mellitus	n=1,871		
No	1,646 (88.3%)	(75.3–94.9)	
Yes	225 (11.7%)	(5.1–24.7)	
Hypertension	n=1,871		
No	1,459 (77.5%)	(59.9–88.8)	
Yes	412 (22.5%)	(11.2–40.1)	
Teaching characteristics:			
Subjects teaching equivalent to teachers qualification*	n=1,858		
No	203 (10.8%)	(2.8–33.4)	
Yes	1,655 (89.2%)	(66.6–97.2)	
Experience in years	n=1,833		16.32 (12.2–20.5)
<10	403 (22.4%)	(2.0–80.5)	
10–19	765 (41.3%)	(16.3–71.8)	
≥20	665 (36.3%)	(22.9–52.2)	
Teach extra class	n=1,871		
No	862 (44.0%)	(23.0–67.4)	
Yes	1,009 (56.0%)	(32.6–77.0)	
Number of students taught per class*	n=1,790		33 (32–35)
Duration of teaching hours a day during school time*	n=1,797		4.1 (3.0–5.2)
Total hours of teaching with extra class a day*	n=1,477		5.1 (4.4–5.9)
Duration of co-curriculum activities per week (h)*	n=1,799		2.5 (2.5–2.6)
Mental health:			
Depression*	n=1,821		5.8 (5.2–6.5)
Anxiety*	n=1,821		8.0 (6.9–9.1)
Stress*	n=1,827		9.5 (9.3–9.8)

*Total not equal to 1,871 due to missing data.

Table 3. PSQI sleep parameters of the participants (n=1,871)

Domains of PSQI	n (weighted %)	95% CI
PSQI Duration		
No difficulty (7 h and more)	386 (20.6%)	(7.9–43.9)
Mild difficulty (6 to <7)	709 (38.0%)	(29.3–47.7)
Moderate difficulty (5 to <6 h)	559 (30.0%)	(18.1–45.3)
Severe difficulty (< 5 h)	217 (11.4%)	(3.3–32.8)
PSQI Disturbance		
No difficulty (0)	106 (6.0%)	(0.9– 31.6)
Mild difficulty (1 to 9)	1,391 (74.3%)	(59.8–84.8)
Moderate difficulty (>9 to 18)	357 (18.8%)	(15.7–22.4)
Severe difficulty (> 18)	17 (0.9%)	(0.0–65.3)
PSQI Latency		
No difficulty (0)	802 (43.1%)	(35.5–51.1)
Mild difficulty (1–2)	752 (40.6%)	(29.6–52.6)
Moderate difficulty (3–4)	274 (14.2%)	(6.1–29.8)
Severe difficulty (5–6)	43 (2.1%)	(0.0–54.1)
PSQI Day dysfunction due to sleepiness		
No difficulty (0)	355 (18.8%)	(17.1–20.6)
Mild difficulty (1–2)	1,299 (69.5%)	(66.7–72.2)
Moderate difficulty (3–4)	195 (10.5%)	(7.8–14.0)
Severe difficulty (5–6)	22 (1.1%)	(0.3–3.9)
PSQI Sleep Efficiency		
No difficulty (85 and above)	1,503 (80.5%)	(39.9–96.3)
Mild difficulty (75 to <85)	229 (11.9%)	(3.9–30.8)
Moderate difficulty (65 to <75)	90 (5.2%)	(0.7–30.7)
Severe difficulty (<65)	49(2.5%)	(0.2–22.6)
PSQI Overall Sleep Quality		
Very good	341 (17.7%)	(10.9–27.4)
Fairly good	1,291 (69.7%)	(52.6–82.7)
Fairly bad	228 (12.1%)	(7.0–20.0)
Very bad	11 (0.5%)	(0.1–.5)
PSQI Medicine (Use of sleeping medicine)		
Not during the past month	1,815 (97.0%)	(82.3–99.5)
Less than once a week	35 (1.9%)	(1.3–2.8)
Once or twice a week	14 (0.8%)	(0.0–22.8)
Three or more times a week	7 (0.3%)	(0.0–99.5)

was slightly better than Shochat *et al.*⁴²⁾ in the Hebrew version, with internal consistency (Cronbach's alpha) for the global scores were 0.70 and 0.52 for clinical sample and non-clinical sample respectively. Our results on Intra-class correlation for the global score and individual domains ranged between 0.45 to 0.70, which implied low to moderate reliability. Thus, the M-PSQI is a stable and reliable tool in measuring sleep quality.

Majority of our teachers spent six to less than seven hours in bed, similar as another study⁴³⁾. It has also been reported that most people sleep about five to six hours a night, although some people may need between seven and eight hours of sleep⁴⁴⁾. Study by Cherasse reported that

41% of Japanese slept less than 7 h a day while 12% of Indonesians slept less than 6 h²²⁾. In comparison, our participants had shorter sleep duration and poorer sleep quality. Therefore, it is suggested that our participants should increase their sleep duration around one to two hours.

One third of our participants reported mild sleep disturbance and mild days dysfunction due to sleepiness. Day-time sleepiness may be due to reduction in wakefulness, decrease in night time sleep or a combination of both⁴³⁾. Although one third of our participants reported mild sleep disturbance and mild day dysfunction, majority of them did not take any medicine to sleep, contradicting with another study that reported almost one-third of those with

Table 4. Factors associated with poor sleep quality

Characteristics	Categories of sleep quality		Univariate logistic regression	**Multivariate logistic regression	
	n	Poor (PSQI global >5) n (weighted %)	Good (PSQI global ≤5) n (weighted %)	Crude OR (95% CI)	Adjusted OR (95% CI)
Gender	1,871				
Male		150 (60.4%)	99 (39.6%)	1.00	-
Female		984 (60.5%)	638 (39.5%)	1.00 (0.24–4.21)	
Age (yr)	1,871				
<30		105 (65.3%)	61 (34.7%)	1.00	-
30–39		324 (60.6%)	203 (39.4%)	0.82 (0.50–1.34)	
40–49		512 (57.7%)	358 (42.3%)	0.72 (0.31–1.71)	
≥50		193 (64.9%)	115 (35.1%)	0.98 (0.71–1.35)	
Ethnicity#	1,871				
Malay		979 (60.1%)	635 (39.9%)	1.00	-
Chinese		73 (59.3%)	53 (40.7%)	0.97 (0.46–2.03)	
Indian		74 (69.5%)	40 (30.5%)	1.52 (0.52–4.39)	
Others		8 (49.0%)	9 (51.0%)	-	
Religion#	1,871				
Islam		988 (60.1%)	640 (39.9%)	1.00	-
Buddhism		56 (60.5%)	39 (39.5%)	1.02 (0.50–2.09)	
Hinduism		64 (70.3%)	35 (29.7%)	1.57 (0.27–9.15)	
Kristianity		21 (53.1%)	20 (46.9%)	0.75 (0.65–1.87)	
Others		5 (53.1%)	3 (46.9%)	-	
Marital status	1,867				
Single		84 (60.3%)	57 (39.7%)	1.00	-
Married		1,012 (60.4%)	656 (39.6%)	1.01 (0.63–1.60)	
Divorce and widow		38 (69.0%)	20 (31.0%)	1.47 (0.12–17.87)	
Education level	1,856				
Diploma		37 (58.0%)	27 (42.0%)	1.00	-
Degree		964 (61.2%)	605 (38.8%)	1.14 (0.90–1.50)	
Masters/PhD		129 (59.3%)	94 (40.7%)	1.06 (0.22–5.19)	
Comorbidities Diabetes mellitus	1,871				
No		984 (59.5%)	662 (40.5%)	1.00	-
Yes		150 (67.8%)	75 (32.2%)	1.43 (0.86–2.40)	
Hypertension	1,871				
No		882 (60.2%)	577 (39.8%)	1.00	-
Yes		252 (61.5%)	160 (38.5%)	1.06 (0.65–1.71)	
Teaching characteristics: Subjects teaching equivalent to teachers qualification	1,858				
No		128 (62.1%)	75 (37.9%)		-
Yes		1,003 (60.7%)	652 (39.3%)		
Experience in years	1,833				
<10 yr		244 (60.6%)	159 (39.4%)		-
10–19 yr		476 (60.8%)	289 (39.2%)	1.00	
≥20 yr		396 (60.9%)	269 (39.1%)	1.01 (0.14–7.32)	
Teach extra class	1,871				
No		497 (58.4%)	365 (41.6%)		-
Yes		637 (62.2%)	372 (37.8%)	1.00	

Continuation of Table 4

Characteristics	Categories of sleep quality		Univariate logistic regression	**Multivariate logistic regression	
	n	Poor (PSQI global >5) n (weighted %)	Good (PSQI global ≤5) n (weighted %)	Crude OR (95% CI)	Adjusted OR (95% CI)
	Sleep duration#	1,871			
7 h and more		32 (8.3%)	354 (91.7%)	1.00	
6 to <7 h		175 (24.7%)	534 (75.3%)	3.62 (2.43–5.41)*	
5 to <6 h		396 (70.8%)	163 (29.2%)	26.88 (17.92–40.30)*	
<5 h		200 (92.2%)	17 (7.8%)	130.15 (70.49–240.31)*	
Number of students taught per class	1,790	-	-	1.01 (0.10–1.02)	-
Duration of teaching hours per day during school time	1,797	-	-	1.08 (1.00–1.17)	-
Total hours of teaching with extra class per day	1,477	-	-	1.06 (1.02–1.11)*	1.05 (0.94–1.17)
Duration of co-curriculum activities per week (h)	1,799	-	-	1.022 (0.90–1.17)	
Mental Health: Depression	1,821	-	-		
Anxiety	1,821	-	-	1.09 (1.08–1.11)*	1.03 (0.96–1.12)
Stress	1,827	-	-	1.08 (1.06–1.10)*	1.04 (1.02–1.05)*

* $p < 0.05$.

**Adjusted for total hours of teaching with extra class per day, depression, anxiety and stress.

did not include in multivariate model as there is collinearity between sleep duration and PSQI total score.

sleep disturbances took medications to sleep⁵). The reasons they did not take medication to sleep could be due to the fear of addiction, difficulty in getting sleeping medicines, taking their poor sleep quality for granted, or they were probably able to cope with poor sleep quality without the need for sleeping medicines.

The prevalence of poor sleep quality among our participants was 60.5%, higher than some local studies. In a study among Malaysian adults in urban areas of Selangor, the prevalence of poor sleep quality with symptoms of insomnia was 33.8%, with 12.2% having chronic insomnia⁴⁵). Another study among nurses in Melaka, using the PSQI, found 57.8% had poor sleep quality (PSQI >5)²⁴). The difference observed in the first study may be due to different tool used in the assessment of sleep quality, while the second study using the same tool had comparable results. However, detailed research is required as nurses are subject to shift work which may be different from the teaching profession.

Although the prevalence of poor sleep quality established from the PSQI was high among our participants, majority of the participants rated their overall sleep quality as fairly good and very good. The discrepancy may be due to our participants not aware of their sleep quality problem. It may imply that poor sleep quality was prevalent

without their knowledge and no precautionary measures were taken. Their ignorance in sleep problem should be addressed promptly as it may affect their physical and mental health as well as quality of life^{9, 10}).

Most of other studies showed that women were more likely to report sleep problems than men due to household chores that lead to bed time delay^{23, 46, 47}). Likewise, our study showed higher proportion of women reported sleep problem than men although the differences is not statistically significant. Sleep quality was frequently reported to decline with age⁴⁸) but we did not find significant association between age and sleep quality.

Being widow and divorce were more likely to have poor sleep quality compared to single⁴⁹). They may also have poor relationships, contributing to poor sleep quality compared to those with good social ties. Nevertheless, we did not find any significant association among our participants in marital status with poor sleep quality.

Teaching hours was significantly associated with poor sleep quality in the univariate analysis. Previous study showed that teachers who taught more than ten hours per week were more likely to wear out emotionally⁵⁰). Therefore this could imply that emotional exhaustion caused poor sleep quality⁵¹). It is thus recommended that teachers reduce their teaching hours, especially the extra classes to

avoid physical and emotional exhaustion.

Teachers also need to be involved in administration and clerical duties. Most of them have to enter students' data and exam marks into the online system after working hours (7:30 am to 1:00 pm) as the system may be over congested during working hours. Sometimes the teachers may have to wait until midnight for the online system to be less congested, which may reduce their duration of sleep.

In the univariate analyses, both depression and anxiety were significantly associated with poor sleep quality. The odds of having poor sleep quality was nine percent higher for every unit increase in depression score, higher than study by Stringhini *et al*⁵²). Similarly reported in other studies, the higher the anxiety score, the higher odds of poor sleep quality^{52, 53}). Teachers may experience anxiety about their students' academic performance, which forms part of their key performance index. Of note, the associations between depression and anxiety with sleep quality became insignificant after adjusted for confounders.

Stress remained a significant factor of poor sleep quality in both univariate and multivariate analyses. In DASS 21, stress was assessed in terms of difficulty relaxing, nervous arousal, and being easily upset/agitated, irritable/over-reactive and impatient³³). All these symptoms may influence sleep quality. In our study, the odds of having poor sleep quality was 8% higher for every unit increase in stress scores univariately, but the magnitude was attenuated to 4% in the multivariate analysis. Stress faced by teachers may arise from the high demand for students' excellent academic performance from parents and school management. Work overload and repetitive tasks were also associated with poor sleep quality⁴⁷).

Teachers' poor mental health and poor sleep quality can impact on the school instructional system⁵⁰) which may influence the students' academic performance. In addition, the teachers' health and quality of life may also be affected due to poor sleep quality. Therefore, it is recommended that teachers to be screened for sleep quality and mental health routinely. These measures may improve quality of life, daily work and job performance; reduced accidents due to poor concentration or unsustainable attention⁴³).

Limitations and strengths

There are several limitations that need to be addressed while interpreting the results. First, recall bias cannot be ruled out as sleep quality and its associated factors were self-reported. PSQI which is a self perceived questionnaire may be inferior compared to objective measures

(ie: polysomnography), however PSQI is well established and widely used where comparison between studies can be carried out. Polysomnograph may not be feasible to be carried out in epidemiological studies with large sample size. In addition, some potential confounders such as domestic burden of caring for children and household duties, family make-up, age of children and care responsibilities were not taken into consideration in this study. Sleep disorder and factors associated with disrupted sleep such as surrounding climate, housing standards, partners' sleeping habits were also not inquired. Further, causal relationship between poor sleep quality and its associated factors can not be established in this cross sectional design. Finally, the generalizability of results may be limited to secondary school teachers only. Future research with prospective design should be carried out among teachers from the primary or vocational schools as well as other occupation cohorts. Objective measurement using polysomnograph should also be used.

Nonetheless, this study is a step forward as there were limited studies investigating the prevalence and the associated factors of poor sleep quality among teachers. The questionnaire used in our study was translated into the local language and found to be reliable. The huge sample size provided adequate power. In addition, the multistage sampling procedure used ensured the sample were representative of all secondary school teachers. Although the response rate was relatively low, however complex sample analyses with weightage addressed the issues of unequal probabilities of selection and non-response. Application of sample weights ensured that the results estimated on the sample were representative of the intended secondary school teacher population⁵⁴). Units that are oversampled have a smaller weight value so that, when weighted, those oversampled units have less influence in the analysis⁵⁵).

Conclusion

The M-PSQI is reliable to be used in our local setting. There was slightly more than half of the secondary school teachers reported with poor sleep quality. Stress was a significant factor of poor sleep after adjusting for other confounders. It is recommended that evaluation of sleep quality and mental health particularly in stress among teachers should be carried out and intervention such as counseling or stress management should be implemented accordingly.

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Conflict of Interests

No conflict of interests declared.

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