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Circadian Rhythm Characteristics, Poor Sleep Quality, Daytime Sleepiness and Common Psychiatric Disorders among Thai College Students

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Abstract

Objective—To investigate the relationship between common psychiatric disorders (CPDs) and sleep characteristics (evening chronotype, poor sleep quality and daytime sleepiness) among Thai college students.

Methods—A cross-sectional study was conducted among 2,970 undergraduate students in Thailand. Students were asked to complete a self-administered questionnaire that collected information about lifestyle and demographic characteristics. The Horne and Ostberg Morningness-Eveningness Questionnaire (MEQ), Pittsburgh Sleep Quality Index (PSQI), and Epworth Sleepiness Scale (ESS), were used to evaluate circadian preference, sleep quality and daytime sleepiness respectively. The General Health Questionnaire-12 (GHQ-12) was used to evaluate presence of CPDs. Logistic regression models were used to estimate adjusted odds ratios (ORs) and 95% confidence intervals (95% CIs) of CPDs in relation to the covariates of interest.

Results—A total of 337 students were classified as having CPDs (11.2%; 95% CI 10.1–12.3%). Evening chronotype (OR=3.35; 95% CI 2.09–5.37), poor sleep quality (OR=4.89; 95% CI 3.66–6.54) and daytime sleepiness (OR=1.95; 95% CI 1.54–2.47) were statistically significantly associated with CPDs.

Conclusions—Our study demonstrated that CPDs are common among Thai college students. Further, evening chronotype, poor sleep quality and excessive daytime sleepiness were strongly associated with increased risk of CPDs. These findings highlight the importance of educating students and school administrators about the importance of sleep and its impact on mental health.

Introduction

According to estimates from the National Comorbidity Survey Replication, 75% of individuals with a mental disorder experienced onset of their illness prior to turning 24 years old (Kessler et al., 2005). Investigators have also noted that 20–25% of individuals aged 12–24 experience one or more common psychiatric disorders (CPDs) per year (Patel et al., 2007). These disorders include: major depressive disorder, anxiety, bipolar depression, psychosis and addiction (Lemoine et al., 2013). Furthermore, CPDs constituted 60–70 % of the Disability Adjusted Life Years (DALYs) in individuals aged 15–24 years old (Public Health Group, 2005). The risk factors that predispose young people for CPDs include, but are not limited to, genetics, poor economic and social standing, childhood abuse, adverse life events and socio-cultural factors (Patel et al., 2007).

In parallel to CPDs a growing body of epidemiologic literature suggests that the prevalence of sleep disorders among young adults is increasing globally. The increase in sleep disorders is especially pronounced in Asia. One-fifth of the 1.6 billion individuals living in South Asia alone are in the 15–24 year old age group (World Bank, 2012). Yang *et al.*, in their study among Korean 11th and 12th graders, noted that students reported 5.6 and 4.9 hours of sleep per school night, respectively; highlighting the extent of sleep deprivation and their evening-type tendency (Yang et al., 2005). Other investigators have reported similar results. A recent study conducted among Thai college students revealed high prevalence estimates of poor sleep quality: 48.7% among females and 46.8% among males (Lohsoonthorn et al., 2012).

Thailand, one of the most populated Southeast Asian countries, is home to approximately 10.2 million young adults (CIA, 2013). In addition, Thailand ranked among the top five countries with a high burden of depressive symptoms (Steptoe et al., 2007). Despite the existing literature highlighting the growing burden of CPDs among youth, limited studies have been conducted to investigate their impact on the overall health of young people in low- and middle- income countries (Fernandes et al., 2012; Hsu et al., 2012; Huen et al., 2007; Tsui & Wing, 2009), including Thailand. Given this gap in the literature, we conducted the present study to investigate the relationship of CPDs with common sleep problems (eveningness chronotype, poor sleep quality, and daytime sleepiness) among college students in Thailand.

Methods and Materials

Study setting and sample

A cross sectional study was conducted between the months of December 2010 and February 2011 in seven government and private universities in Thailand. Details regarding data collection methods and study procedures have been previously described (Lohsoonthorn et al., 2012).

In summary, flyers were posted in each campus to invite participants to the study. Students who expressed an interest in participating were asked to meet in a large classroom or an auditorium where they were informed about the purpose of the study. Students consenting to participate were asked to complete a self-administered individual survey. Vision impaired

students and those students enrolled in correspondence, extension, or night school programs were not included in the study. A total of 3,000 students were originally included. Participants with incomplete information on sleep characteristics were omitted from further analysis (n=30), giving a final sample size of 2,970 students.

Data collection and variables

A self-administered questionnaire was used to collect information for this study. The questionnaire ascertained demographic information including age, sex, and education level. Questions also included regarding behavioral risk factors such as smoking, consumption of energy drinks, caffeinated beverages, physical activity, and alcohol consumption. Measurements of the student's height, weight, waist, and hip circumference were taken by research nurses using standard protocols.

Morningness-Eveningness Questionnaire (MEQ)

Morningness/eveningness dimensions were assessed using the MEQ (Horne and Ostberg, 1976). The MEQ is a 19-item questionnaire that identifies morningness-eveningness preference. The scores range from 16 to 86 and participants can be classified in five categories: definite and moderate evening type, neutral type, moderate and definite morning type. Higher values on MEQ indicate higher morningness preference. In this study we used the following cut offs: (1) 16 to 30 for evening; (2) 31 to 41 for moderate evening; (3) 42 to 58 for intermediate; (4) 59 to 69 for moderate morning, and (5) 70 to 86 for morning (Schneider et al., 2011).

Pittsburgh Sleep Quality Index (PSQI)

Sleep quality was assessed using the previously validated Pittsburgh Sleep Quality Index (PSQI)(Buysse et al., 1989). The PSQI instrument has been widely used among college students globally, including Southeast Asia (Cheng et al., 2012). The PSQI is composed of 19 questions that evaluate sleep quality within the past month. The PSQI consists of seven sleep components related to sleep habits including duration of sleep, sleep disturbance, sleep latency, habitual sleep efficiency, use of sleep medicine, daytime dysfunction, and overall sleep quality. The sleep components yield a score ranging from 0 to 3, with 3 indicating the greatest dysfunction (Buysse et al, 1989). The sleep component scores are summed to yield a total score ranging from 0 to 21, with higher total scores (referred to as global scores) indicating poor sleep quality. Based on prior literature (Buysse et al, 1989), participants with a global score of greater than 5 were classified as poor sleepers. Those with a score of 5 or less were classified as good sleepers.

Epworth Sleep Scale (ESS)

The ESS is a measure of a person's general level of daytime sleepiness (Johns, 1991). It is composed of 8 questions capturing an individual's likelihood of falling asleep during regularly encountered situations. The questions fall on a scale ranging from 0 to 3. Individual scores are then summed to yield a single total score ranging from 0 to 24. In adults, an ESS score 10 is taken to indicate increased daytime sleepiness (Johns, 1991). The ESS has been previously validated in Thailand (Banhiran et al., 2011) and is widely

used globally among different study populations including college students in Southeast Asia (Giri P, 2013).

General Health Questionnaire (GHQ-12)

The 12-item version of the General Health Questionnaire (GHQ-12) was used for screening for non-pathological common psychiatric disorders (Goldberg et al., 1997). The GHQ has been commonly used worldwide, including in Thailand (Piyavhatkul et al., 1998; Chalernvanichakorn et al., 2008) for studies of various clinical and non-clinical populations. The GHQ-12 asks respondents to report how they felt recently on a range of variables including problems with sleep and appetite, subjective experiences of stress, tension, or sadness, mastering of daily problems, decision making and self-esteem. Response choices included: less than usual, no more than usual, more than usual and much more than usual. Scoring was 0 for the first two choices and 1 for the next two. The maximum possible score was 12 with higher scores suggesting higher mental distress. The presence of CPDs was defined using previously established cut points in other study populations. Those who scored 5 or higher on GHQ-12 scale were considered as having CPDs (Fernandes et al., 2012). The test for reliability and internal consistency of the GHQ-12 questionnaire in our study was measured using Cronbach's alpha coefficient and was 0.82 for all students (0.81 for females and 0.83 for males).

Other Covariates

We defined alcohol consumption as low (<1 alcoholic beverages week), moderate (1–19 alcoholic beverages a week), and high to excessive consumption (>19 alcoholic beverages a week). Other covariates considered were: age (years), sex, cigarette smoking history (never, former, current), stimulant use (no vs. yes) and participation in moderate or vigorous physical activity (no vs. yes); BMI was calculated as weight (in kilograms)/height squared (in meters squared). BMI thresholds were set according to the WHO protocol (underweight, <18.5 kg/m²; normal, 18.5–24.9 kg/m²; overweight, 25.0–29.9 kg/m²; and obese, ≥30 kg/m²).

Statistical Analysis

We first examined the frequency distributions of the socio-demographic and behavioral characteristics of the study participants using counts and percentages. We then used Chi-square and Student's t-tests to determine bivariate differences among categorical and continuous variables, respectively. We calculated the prevalence and associated 95% confidence interval (95% CI) for CPDs. In addition, Spearman correlation coefficients between PSQI and ESS total score with the each of the items in the GHQ-12 instrument were estimated. Lastly, we used logistic regression models to examine the association between CPDs and the above sleep characteristics of interest. Odds ratios (ORs) along with 95% CIs were calculated to examine the association. All analyses were performed using SPSS Statistical Software for Windows (IBM SPSS, version 20, Armonk, NY, USA). All reported p-values are two-sided and deemed statistically significant at a 0.05 level.

Results

The study was conducted on a sample of 2,970 university students, 66.9% of which were females and 33.1% were males. The students' age ranged from 18–28 years old with a mean age of 20.4 (SD=1.34) years.

Distributions of the behavioral and demographic characteristics according to students' CPDs status are presented in Table 1. A total of 337 students were classified as having CPDs (11.2%; 95% CI 10.1–12.3%). No significant difference in CPDs prevalence was noted between males and females. Among the demographic and behavioral indicators, the only significant association was between age and CPDs (p -value = 0.013). Cigarette smoking was found to be marginally significant (p -value = 0.056) with a higher prevalence of CPDs among current and former smokers (around 16% vs. 10.8% for non-smokers).

Table 2 shows the strength of association (as measured by Spearman's correlation coefficient) between the each GHQ-12 items and the total PSQI and ESS scores, respectively. Each of the 12 items of the GHQ-12 instrument had a significant positive correlation with both the PSQI and ESS scores (p -values <0.001). Similarly, the GHQ total score was statistically significantly correlated with the PSQI and ESS scores (p -value < 0.001). With respect to the GHQ-12 items and PSQI scores, we observed the highest correlation with "enjoy normal activity" ($r=0.34$). With ESS scores, we observed the highest correlation ($r=0.15$) with "thinking of self as worthless."

As shown in Table 3, evening chronotype was associated with a 3.5-fold increased odds (OR=3.51; 95% CI 2.25–5.47) of CPDs when compared with morning chronotype. Similar magnitudes of association were noted after adjusting for age and sex (OR=3.46; 95% CI 2.22–5.41), as well as using further adjustment for smoking status, stimulant use, body mass index and physical activity (OR=3.35; 95% CI 2.09–5.37). After adjusting for confounding variables, students with poor sleep quality had a 5-fold increased odds of CPDs as compared with their counterparts who had good sleep quality (OR=4.89; 95% CI 3.66–6.54). In the multivariate adjusted model, the odds of CPDs was increased by 2-fold among students with daytime sleepiness as compared to those without the risk factor (OR=1.95; 95% CI 1.54–2.47).

Discussion

To the best of our knowledge, this is the first large-scale epidemiological study of sleep traits and CPDs among Thai young adults. The findings of our study demonstrated that the odds of CPDs among students with evening chronotype were more than three times higher compared to morning types. Students with poor sleep quality and those having excessive daytime sleepiness had respectively five and two times higher odds of CPDs than their counterparts.

We found the prevalence of CPDs to be 11.2%. This prevalence is comparable to CPDs rates reported among university students both in Asia and elsewhere (Chen L, 2013, Eisenberg et al., 2007). For instance Chen et al (2013) using the Beck Depression Inventory reported an 11.7% prevalence of depressive symptoms in their study among Chinese college students,

while Eisenberg et al. (2007) using the Patient Health Questionnaire-9 reported a 15.6% depressive symptoms prevalence among undergraduate students in the United States. It is possible that there may be cultural values and factors specific to Thai students, such as stigma, that impact endorsement of certain symptoms of CPDs. This question warrants future research.

Similarly, our observation of an increased CPDs prevalence with increased age is consistent with findings from prior reports investigating the relationship (Chen L, 2013). Researchers posit that older students may experience a greater prevalence of CPDs due to increased pressure of employment, social activities, and economic issues, among other factors (Chen L, 2013). It is also possible that the older students may be different in social background compared to students entering colleges. Despite these recorded associations between CPDs and age, other studies have recorded the opposite relationship (Stephoe et al., 2007). Given these prior studies used a cross-sectional design, we have limited knowledge of the temporal relationship between CPD and age. Future longitudinal studies should be conducted to better determine the trend of the relationship.

Our observation of increased odds of CPDs among evening chronotypes corroborates with earlier studies. For instance Abe *et al* (2011), in their study among patients with delayed sleep phase syndrome, found that evening chronotypes had approximately three times higher odds of experiencing depression compared to intermediate types (OR=3.27; 95% CI 1.04–10.28). Similarly, in their population based study of Finish adults, Merikanto *et al* (2013) noted that the odds of depressive symptoms for evening types were 2.7- to 4.1-fold higher compared to morning types. Other investigators have noted similar findings although the mechanism behind it remains elusive. Clearly studies that evaluate the effect of ambient light exposure and variants in clock genes on CPDs are needed to move this area of literature forward.

Our findings of a significant positive association between poor sleep quality and CPD (OR=5.04; 95% CI 3.78–6.71) parallel the findings of similar studies investigating this relationship (Ramsawh et al, 2009). Ramsawh *et al* (2009) in their German Health Survey data found a nearly six fold increased odds of poor sleep quality among individuals with anxiety disorders compared to healthy participants (OR=5.80; 95% CI 4.18–8.04). In concordance, Kang et al (2013), in their study of Korean adults, noted a nearly eight fold increased odds of depression among poor sleepers relative to participants with good sleep quality (OR=7.78; 95% CI 2.55–23.66). On balance, the findings of our study and those of others underscore the comorbidity of these orders.

Similarly, we found that students with daytime sleepiness had twice the odds of CPDs compared to those without daytime sleepiness (OR=1.95; 95% CI 1.54–2.48). Our findings are largely consistent with prior studies that reported a significant association between CPD and daytime sleepiness. For instance, Stroe *et al* (2010), in their study among individuals with various medical disorders, noted a nearly 50% increased risk of daytime sleepiness among individuals with a CPD (OR=1.46; 95% CI 1.16–1.83). In concordance with these findings, Theorell-Haglöw *et al* (2006) in Sweden found that participants with anxiety and depression had approximately 4.5 times higher odds of experiencing daytime sleepiness

relative to healthy controls (OR=4.51; 95% CI 3.51–5.79). Although the positive association between daytime sleepiness and CPD is generally consistent, some investigators have found contradicting results. For instance, depression was associated with increased daytime alertness given greater sleep disturbances during the night (Kayumov et al., 2000). The authors speculated that this alertness experienced by depressed individuals is different from the adaptive alertness experienced by non-depressed individuals. This hypothesis of a sub-category of alertness and its impact on CPDs requires further investigation.

Several plausible and compelling biological mechanisms have been proposed underlying the observed sleep disorder–CPDs association. Melatonin, which is a hormone produced in the pineal gland of the brain (Reiter, 1991), has the ability to manipulate circadian systems (Quera Salva et al., 2011) and affect internal neurohormonal regulation (Chelminski et al., 1999). Studies have shown that individuals with low levels of endogenous melatonin (those who do not have the normal nocturnal peak in secretion) are more likely to have symptoms of CPDs (Malhi & Kuiper, 2013). Similarly CPDs are associated with an attenuation of the normal melatonin-mediated fall in core body temperature and higher average core temperatures, suggesting a blunting of melatonin secretion that may affect biological rhythms (Malhi & Kuiper, 2013; Steiner et al., 1987; Chelminski et al., 1999). Changes in melatonin secretion could be one possible shared pathophysiologic mechanism linking the two disorders. In addition, sleep deprivation and excessive daytime sleepiness are known to inhibit activity of the hypothalamic-pituitary-adrenal (HPA) axis (Aydin et al., 2013). The dysregulation of the HPA axis observed among individuals with depression and anxiety disorders could be one mechanism linking sleep disorders and CPDs (Merikanto et al., 2013). It is also important to note that investigators have shown a link between morningness and higher-orders of personality factors, stability, social agreeableness and motivational conscientiousness (DeYoung et al., 2007; Hsu et al., 2012; Selvi et al., 2010). Moreover, morning chronotype individuals may have healthy lifestyle characteristics which are generally associated with lower levels of stress and CPD risk factors (Gau et al., 2007; Selvi et al., 2010).

Some important limitations must be considered when interpreting the results of our study. First, this was a cross-sectional study and as such, we cannot delineate the temporal relationship between sleep disorders and CPDs. A future longitudinal study with serial measurements of sleep disorders in relation to CPDs would give better insight in this regard. Second, our sample may have been subject to volunteer bias as our sampling method was not random but rather based on students' willingness to participate. Third, our study population was exclusively comprised of participants who were attending college, thus conclusions cannot be other broader populations. Lastly, our use of a self-administered survey that relied on subjective measures of sleep disorders and other covariates may have introduced some degree of bias.

College is often characterized by extremes including voluntary sleep deprivation, increased social commitments, peer pressure, or financial pressure. Letting this intense lifestyle influence sleep behavior, however, can lead to adverse health effects. Given the high prevalence of sleep disorders and depression onset among individuals in the young adult age group (Group, 2005), college students would be remiss not to guard against CPDs by

practicing basic preventative measures such as adequate sleep. In addition to preventing CPDs, adequate sleep is necessary to maintain a high level of academic performance as shown in a comprehensive analysis by Curcio *et al* (Curcio et al., 2006). The effects of poor sleep habits on mental health, academic performance, and behavior suggests that more can and should be done to prevent these habits from developing among young adults, especially college students. In addition, increased knowledge about the comorbid nature of sleep disorders and CPDs will aid school nurses, university academic and administrative staff, residence halls staffs, and other health care providers in recognizing, treating and possibly preventing CPDs among students.

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Table 1

Common Psychiatric Disorders by demographic and lifestyle characteristics

	Common Psychiatric Disorders		
	Yes (n=337)	No (n=2633)	p-value
Age (years)	%	%	
18 (n=162)	7.4	92.6	0.013
19 (n=705)	8.8	91.2	
20 (n=860)	12.2	87.8	
21 (n=728)	11.0	89.0	
22 (n=545)	14.3	85.7	
Sex			0.194
Female (n=2,008)	10.7	89.3	
Male (n=992)	12.3	87.7	
Cigarette smoking status			0.056
Never (n=2,739)	10.8	89.2	
Former (n=206)	16.4	83.6	
Current (n=55)	15.5	84.5	
Alcohol consumption			0.179
<1 drink/month (n= 1,986)	11.2	88.8	
1–19 drinks/month (n= 962)	10.9	89.1	
20 drinks/month (n= 52)	19.2	80.8	
Overweight ($\geq 25.0\text{kg/m}^2$)			0.404
No (n= 2,563)	11.4	88.6	
Yes (n= 437)	10.1	89.9	
Any physical activity			0.266
No (n= 669)	12.4	87.6	
Yes (n= 2,319)	10.9	89.1	

** Presence of common psychiatric disorder was defined as having GHQ total score of 5 and higher

Table 2

Correlations of Pittsburgh Sleep Quality Index (PSQI) total score and Epworth Sleepiness Scale (ESS) score with GHQ-12 items

GHQ-12 Items	Spearman Correlation	
	PSQI score *	ESS score *
<i>Able to concentrate</i>	0.19	0.13
<i>Lost much sleep</i>	0.14	0.09
<i>Playing useful part</i>	0.17	0.11
<i>Capable of making decisions</i>	0.17	0.08
<i>Under stress</i>	0.17	0.10
<i>Could not overcome difficulties</i>	0.16	0.10
<i>Enjoy normal activities</i>	0.34	0.07
<i>Face up to problems</i>	0.29	0.14
<i>Feeling unhappy and depressed</i>	0.25	0.12
<i>Losing confidence</i>	0.25	0.11
<i>Thinking of self as worthless</i>	0.21	0.15
<i>Feeling reasonably happy</i>	0.15	0.12
<i>GHQ Total Score</i>	0.39	0.19

* All p-values <0.001

Table 3

Evening Chronotype, Daytime Sleepiness and Poor Sleep Quality in Relation to Common Psychiatric Disorders **

Characteristic	Unadjusted OR (95% CI)	Age and gender adjusted OR (95% CI)	Multivariate adjusted* OR (95% CI)
Chronotype			
Morning type	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Evening type	3.51 (2.25–5.47)	3.46 (2.21–5.41)	3.35 (2.09–5.37)
Daytime sleepiness			
No	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Yes	2.02 (1.59–2.55)	1.99 (1.58–2.52)	1.95 (1.54–2.47)
Sleep quality			
Good	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Poor	5.03 (3.78–6.71)	5.05 (3.79–6.75)	4.89 (3.66–6.54)

* Adjusted for age, sex, smoking, stimulant use, body mass index, and physical activity;

** Presence of common psychiatric disorder was defined as having GHQ total score of 5 and higher