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### A Study on the Sleep Patterns and Problems of University Business Students in Hong Kong

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# A Study on the Sleep Patterns and Problems of University Business Students in Hong Kong

Y. Y. Tsui, MSc; Y. K. Wing, FRCPsych, MRCP, FHKAM (Psych)

**Abstract. Objective:** To investigate sleep patterns and problems of university business students. **Participants:** Undergraduate Chinese business students in Hong Kong. **Methods:** Self-reported questionnaires were completed during class lectures and through online system. **Results:** Of the 620 participating students (mean age 19.9 years), sleep duration was significantly shorter during weekdays (6.9 hours) than weekends (8.6 hours). Two thirds of students reported sleep deprivation. The following factors were associated with being a “poor sleeper” (Pittsburgh Sleep Quality Index > 5): attending early morning lectures (odds ratio [OR] = 1.90), living on-campus (OR = 1.89), Sleep Sufficiency Index less than 0.8 (OR = 2.55), sleep debt (differences of total time-in-bed between weekday and weekend  $\geq$  75 minutes) (OR = 1.58), and minor psychiatric disturbances (OR = 2.82). **Conclusions:** Poor sleep quality and sleep deprivation were prevalent in university business students in Hong Kong, especially for those attending early morning lectures and living on-campus. Systemic education on the importance of sleep and stress and time management is needed for university students.

**Keywords:** sleep deprivation, sleep quality, university business students

Adolescents and young adults have been identified as a population at high risk of sleep problems and daytime sleepiness by the National Institute of Health (NIH).<sup>1</sup> University students are of no exception. An increase in sleep dissatisfaction and a reduction in sleep duration have been reported by university students over the past 3 decades.<sup>2-8</sup> Indeed, sleep problems of university students are a global issue. A high prevalence of delayed sleep phase syndrome was found in US students.<sup>8</sup> Sixty percent of Spanish students were classified as bad sleepers.<sup>9</sup> Similarly, insuffi-

cient sleep and sleep disturbances were reported by more than 60% of the Korean and Taiwanese students.<sup>2,10</sup>

The consequences of sleep problems such as insufficient sleep and poor sleep quality among university students could be serious. Insufficient sleep was suggested as a risk factor for minor psychiatric disorders,<sup>11</sup> lower life satisfaction,<sup>12</sup> academic deterioration,<sup>10</sup> and detrimental changes in carbohydrate metabolism and obesity.<sup>13</sup> Sleep quality was as important as sleep quantity in affecting students' daytime sleepiness and general health.<sup>14</sup> Decreased sleep quality has been linked to a variety of mental and physical problems, including the feelings of depression, anxiety, and fatigue.<sup>14,15</sup> As a result, there is a growing concern about university students' sleep habits and problems especially in relation to their health and well-being.

The underlying causes for the poor sleep quality and quantity in university students may be complex and multifactorial. Individual factors such as poor sleep hygiene practice associated with inadequate sleep knowledge could lead to reduced sleep quality in university students.<sup>16</sup> Moreover, inappropriate naps in the evening or irregular naps might be the contributing factors for the delay in bedtime, sleep loss, and impairment of daytime functioning in students.<sup>17-19</sup> External factors including the early starting time of morning classes were associated with shorter sleep length on weekdays and compensatory sleep during weekends.<sup>20-22</sup>

Some previous studies investigated the sleep difficulties in the specific groups of university students, mostly medical students,<sup>12,23-25</sup> whereas less is known about the business students, who may face the similar problems. One of the characteristics of the business studies environment is the diversity of course aspects. Students have to complete a large volume of project work to meet the tight coursework requirements, in addition to regular examinations and assignments. Chinese business students do not only function in a business environment that encourages materialistic values, but also within a cultural context that emphasizes public face.<sup>26</sup> Pursuing business degree is not only for a personal interest, but also entails

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better career opportunities in future.<sup>27</sup> To meet the demand of today's competitive career market, business students may prepare themselves by seeking more opportunities of part-time jobs to enhance their skills and practical experiences.

The primary aim of current study was to investigate the sleep quality, patterns, and problems in business students. We postulated that there might be a high prevalence of sleep deprivation and poor sleep quality in this group of university students. In addition, we hypothesized that the study schedule, academic workload, and part-time jobs might adversely influence their sleep patterns. The effects of sleeping environment including on-campus residence, noise, temperature, and the presence of roommates were also examined.

## METHODS

### Procedure and Participants

Approval of the study was obtained from the University's Ethics Committee. The target participants were the full-time undergraduate Chinese business students who attended lectures in the first semester between November and December 2005. The current study was conducted in 2 parts in order to achieve a better recruitment rate. Firstly, purposive sampling was used. We purposely recruited 17 classes that were evenly distributed from the first morning lecture (started at 8:30 AM) to the last evening class (finished at 6:15 PM). The surveys were administered either during the break of the lecture or at the end of the lecture with the purpose of the study properly explained. Secondly, in view of the potential response bias relating to in-class sampling, as some students might not attend class as a consequence of sleep-related problems, an online survey system was set up to facilitate students' involvement. E-mails were sent out through the university internal network to invite all business students for participation. Informed consent was obtained from all participants.

### Materials

Students spent approximately 15 to 30 minutes on completing the survey packet, which comprised of a copy of sleep habit inventory, a Chinese version of Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS), 12-item General Health Questionnaire (GHQ-12), and a shortened version of Morningness-Eveningness Questionnaire (rMEQ). Modified from our previous epidemiological study and specifically being developed for the purpose of the current study, the sleep habit inventory contained 3 sections.<sup>28,29</sup> The first section consisted of the questions on satisfaction of sleep quality, sleep schedule, and sleep habit on weekdays and weekends. The second section included the questions on academic schedule of early morning (8:30 AM) lectures, attendance rate, course load, and time allocation of participants' daily activities. The third section covered the following aspects: living condition, sleep environment, and perceived health status.

To better identify those students who were sleep deprived, a question on subjective appraisal of sufficiency of sleep was

included (Likert scale with the choices of highly insufficient, insufficient, sufficient, and highly sufficient sleep). Students who reported "insufficient or highly insufficient sleep" were categorized into a group under "Sleep Deprived" (DS). Students who reported "sufficient or highly sufficient sleep" were classified as the students with "Sufficient Sleep" (SS). Moreover, we used 2 'objective' sleep measures in corroborating the level of sleep deprivation. Firstly, Sleep Sufficiency Index (SSI) was determined by the ratio of self-reported actual sleep duration over the expected sleep duration.<sup>30</sup> Presence of sleep deprivation among students was defined by SSI less than 80%, which was suggested to be associated with the impairment of daytime functioning.<sup>30</sup> Secondly, an estimation of sleep debt was indicated by the difference of total time in bed between weekday and weekend (TIBdiff) greater than 75 minutes.<sup>31</sup>

PSQI was used to assess sleep quality and disturbances in previous 1 month,<sup>32</sup> which contained 19 self-rated questions that corresponded to 7 components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. The Chinese version of PSQI had a high degree of internal consistency and reliability.<sup>33</sup> Total PSQI score ranged from 0 to 21 as an index of one's overall sleep quality, i.e., the higher the score, the poorer the sleep quality. Participants with PSQI score higher than 5 were classified as "poor sleepers." Difficulty initiating sleep (DIS) was defined as requiring more than 30 minutes to fall asleep for at least 3 times a week in previous 1 month. Difficulty maintaining sleep (DMS) and early morning awakening (EMA) were defined as having troubles in maintaining nocturnal sleep and waking up too early for at least 3 times a week in previous 1 month, respectively. Insomnia was defined as fulfilling the criteria of DIS and/or DMS and/or EMA.<sup>34</sup>

Excessive daytime sleepiness (EDS) was measured by ESS,<sup>35</sup> which required participants to evaluate their tendencies of falling asleep in eight different situations (e.g., watching TV, sitting, and talking to someone) on a 4-point scale (0 = would never doze to 3 = high chance of dozing). The overall prevalence of EDS was determined by an ESS score greater than 14.<sup>36</sup>

GHQ-12 was widely used as a screening instrument for common mental disorders in the general population.<sup>37</sup> The Chinese version has shown good psychometric properties in both validity and reliability.<sup>37,38</sup> A score equal to or higher than four suggested the presence of minor psychiatric disturbances.<sup>37,39</sup>

The Morningness-Eveningness Questionnaire was used to assess an individual's circadian preference by classifying the respondent as a morning-type, evening-type, or neither.<sup>40</sup> In brief, subjects who consider themselves as functioning better in morning are categorized as "morning-type," whereas subjects who prefer working/activities during afternoon or evening are grouped as "evening-type." The reduced version of Morningness-Eveningness Questionnaire (rMEQ) was composed of five questions.<sup>41</sup>

**TABLE 1. Sleep Patterns and Sleep Deprivation in Business Students**

	Overall ( <i>n</i> = 620)	Male ( <i>n</i> = 185)	Female ( <i>n</i> = 435)
<b>Sleep patterns</b>			
<i>Weekday</i>			
Bedtime	1:37 AM ± 1:10	1:43 AM ± 1:08	1:34 AM ± 1:10
Wake-up time	8:28 AM ± 1:02	8:34 AM ± 1:03	8:26 AM ± 1:02
Sleep time	6.87 ± 1.19 h	6.86 ± 1.02 h	6.87 ± 1.25 h
<i>Weekend</i>			
Bedtime	1:43 AM ± 1:21	1:53 AM ± 1:21	1:38 AM ± 1:21*
Wake-up time	10:18 AM ± 1:38	10:14 AM ± 1:40	10:19 AM ± 1:38
Sleep time	8.58 ± 1.48 h	8.35 ± 1.35 h	8.68 ± 1.53 h**
<b>Sleep deprivation</b>			
Expected sleep time	8.23 ± 1.07 h	8.03 ± 1.00 h	8.31 ± 1.10 h**
SSI ≤0.8	38.5%	33.5%	40.7%
Sleep debt	55.8%	53.0%	57.0%

Note. Data for sleep deprivation were expressed as percentage of participants who were classified into the particular groups.

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

### Statistical Analysis

Statistical analysis was performed using SPSS 13.0 (Chicago, IL). Further analysis was stratified by age, sex, educational level, program, and student type to control the potential confounding effects. Continuous variables were analyzed using Student's independent  $t$  test or  $F$  statistic. Differences in the proportion of the studied variables were examined by the chi-square test. Pearson correlations were used to determine the relationships between continuous variables. To conduct multivariate analysis, multiple regression with stepwise procedure was used. Univariate logistic regression was used to explore associations between predictor and dependent variable. Multiple logistic regression with backward stepwise method was performed, which included all significant variables ( $p < .05$ ) in univariate analyses. The cut-off point of entry of the regression was fixed at .05 and the cut-off of exclusion at .10. Odds ratios were reported to indicate the increased odds incurred by predictors. Reported differences were significant at .05 or less. Ninety-five percent confidence intervals were delivered where appropriate.

## RESULTS

### Characteristics of Participants

The final samples consisted of 620 undergraduate students with 435 females (70.2%) and 185 males (29.8%) with a mean age of 19.9 ( $SD$ , ± 1.2; range, 17 to 24 years). As of 31 December 2005, 2,051 students were enrolled in the Faculty of Business Administration. During the study period, valid questionnaires were collected from 363 out of 584 students from 17 classes (62.2% response rate) and 257 questionnaires were received through the online system. A questionnaire with more than 30% of the items unanswered was considered as ineligible. In this regard, 60 incomplete questionnaires had

been excluded from further analysis. Thirty-one duplicate copies (completed by the same students during class and through online system) were entered only once during data entry.

The heterogeneity between the groups of in-class and online participants was tested. Most of the testing items did not differ between the 2 groups, except for age, program, year of study, sleep perception, and weekday wake-up time. More female students belonged to the sleep-deprived group and prevailed among the in-class group (61%;  $\chi^2 = 7.14$ ,  $p < .01$ ). Senior students attended less lectures and less likely to attend the class ( $\chi^2 = 17.52$ ,  $p < .001$ ). There were no significant differences between in-class and online participants in terms of most sleep and psychometric variables, including PSQI, rMEQ, GHQ-12, and ESS. In addition, multiple regression indicated that the SSI did not vary across the sampling groups after controlling for participants' age, sex, program, number of weekly lectures, or year of study. Accordingly, the data were combined across the sampling groups.

### Sleep Patterns and Habits

As indicated in Table 1, the sleep duration of weekdays was significantly shorter than that of weekends in business students ( $t = -26.31$ ,  $p < .001$ ). Female students had longer sleep duration than male students during weekends ( $t = -2.69$ ,  $p < .01$ ). In addition, senior students and junior students had a comparable amount of sleep on weekends while senior students slept more than junior students during weekdays ( $F = 3.99$ ,  $p < .01$ ).

Forty-two percent of students had at least one nap weekly. Students with napping habit usually took the nap at about 3 PM ( $SD$ , ± 2 hours 15 minutes) for 1.27 hours ( $SD$ , ± 0.74) every week. Students living on-campus napped more frequently than students living off-campus (48.4% versus 34.2%;  $\chi^2 = 12.80$ ,  $p < .001$ ).

**TABLE 2. Sleep Patterns and Circadian Preference in Association With Sleep Deprivation and Living Environment**

	SS ( <i>n</i> = 168)	DS ( <i>n</i> = 448)	On-campus ( <i>n</i> = 316)	Off-campus ( <i>n</i> = 302)
<b>Sleep patterns</b>				
<i>Weekday</i>				
Bedtime	0:55 AM ± 1:10	1:52 AM ± 1:03***	2:05 AM ± 1:02	1:07 AM ± 1:06***
Wake-up time	8:31 AM ± 1:04	8:27 AM ± 1:02	8:52 AM ± 0:57	8:03 AM ± 0:58***
Sleep time	7.61 ± 1.02 h	6.59 ± 1.12 h***	6.79 ± 1.12 h	6.95 ± 1.25 h
<i>Weekend</i>				
Bedtime	1:15 AM ± 1:21	1:53 AM ± 1:19***	1:55 AM ± 1:22	1:29 AM ± 1:18***
Wake-up time	9:54 AM ± 1:34	10:27 AM ± 1:39***	10:41 AM ± 1:38	9:54 AM ± 1:33***
Sleep time	8.64 ± 1.35 h	8.56 ± 1.54 h	8.75 ± 1.54 h	8.41 ± 1.41 h**
<b>Sleep deprivation</b>				
Expected sleep time	7.97 ± 1.05 h	8.33 ± 1.07 h***	8.13 ± 1.11 h	8.33 ± 1.04 h*
SSI ≤ 0.8	8.3%	50.2%***	37.0%	40.1%
Sleep debt	36.3%	62.9%**	61.7%	49.7%**
<b>Circadian preference</b>				
Eveningness type	14.3%	46%***	43%	37.9%*

Note. Data for sleep deprivation and circadian preference were expressed as percentage of participants who were classified into particular groups.

SS = students with sufficient sleep; DS = students with sleep deprivation.

\**p* < .05;

\*\**p* < .01;

\*\*\**p* < .001.

### Sleep Deprivation

For the expected sleep duration, students indicated they needed about 8.2 hours (*SD*, ±1.1 hours), which was 1.3 hours more than their actual weekday sleep duration. More than two thirds (72.7%) of students reported being sleep deprived (DS group). Nearly 30% of students perceived having highly insufficient sleep. When comparing the sleep pattern during weekdays, DS group had significantly later bedtime ( $t = -9.67, p < .001$ ) and shorter nocturnal sleep time ( $t = 10.31, p < .001$ ) than SS group. During weekends, DS group went to bed later ( $t = -5.25, p < .001$ ) and woke up later ( $t = -3.74, p < .001$ ) than SS group. Thirty-nine percent of students had SSI lower than 0.8. The SSI of DS group was significantly lower than that of SS group (0.8 versus 0.96;  $t = 13.1, p < .001$ ). In addition, DS group had more sleep debt (i.e., TIBdiff > 75 minutes) comparing to SS group (62.9% versus 36.3%;  $\chi^2 = 36.13, p < .001$ ).

### Circadian Preference

About two fifths (40.4%) of the students belonged to the eveningness type, 6.3% of the students were the morningness type, and the rest belonged to neither type. Differences of eveningness preference between DS and SS group, between students living on-campus and off-campus are shown in Table 2.

### Measures of Sleep Quality, EDS, and Psychiatric Disturbances

Results on PSQI, ESS, and GHQ-12 were shown in Table 4. Comparing to students with sufficient sleep (SS), more students with sleep deprivation (DS) were classified as

“poor sleepers” as determined by PSQI > 5. On the basis of the criteria defined by ESS ≥ 14 and GHQ-12 ≥ 4, excessive daytime sleepiness (EDS) and psychiatric disturbances were both more prevalent in DS group than in SS group.

About 58% of the business students were classified as “poor sleepers.” More “poor sleepers” were found in the students taking early morning (8:30 AM) lectures ( $\chi^2 = 12.72, p < .001$ ). In terms of living environment, more “poor sleepers” were found in students living on-campus than those living off-campus (62.8% versus 52.7%;  $\chi^2 = 6.38, p < .005$ ). There was no significant association between gender and “poor sleepers.” The prevalence rates of difficulty initiating sleep (DIS), difficulty maintaining sleep/early morning

**TABLE 3. Average Time Allocation on Daily Activities in Business Students**

Type of activity	Allocation of time (hours/day)		
	Overall ( <i>n</i> = 620)	SS ( <i>n</i> = 168)	DS ( <i>n</i> = 435)
Study	2.6	2.4	2.6
Using computer	2.5	2.3	2.6
Watching TV	0.77	0.98	0.68*
Doing exercise	0.40	0.44	0.39
Talking on phone	0.77	0.68	0.80
Others	1.3	1.2	1.4

Note. SS = students with sufficient sleep; DS = students with sleep deprivation.

\**p* < .01.

**TABLE 4. Measures of Sleep Quality, EDS, and Psychiatric Disturbances in Business Students**

	Overall	SS	DS
Poor sleeper (PSQI > 5)	58.0%	28.3%	68.6%*
EDS (ESS ≥ 14)	35.0%	13.9%	42.0%*
Psychiatric disturbances (GHQ-12 ≥ 4)	46.0%	26.1%	52.5%*

Note. Data were expressed as percentage of participants who were classified into particular groups. SS = students with sufficient sleep; DS = students with sleep deprivation; PSQI = Pittsburgh Sleep Quality Index; EDS = excessive daytime sleepiness; GHQ-12 = General Health Questionnaire-12; ESS = Epworth Sleepiness Scale.

\* $p < .001$ .

awakening (DMS/EMA), and insomnia (INS) were 5.8%, 5.8%, and 9.8%, respectively.

About 35% of the students reported significant EDS, as indicated by ESS score of  $\geq 14$ . More students with a part-time job reported EDS than those without a part-time job (37.9% versus 29.3%;  $\chi^2 = 4.8, p < .05$ ). Comparing to students with sufficient sleep (SS), there were more students with sleep deprivation (DS) presenting with EDS (42.0% versus 13.9%;  $\chi^2 = 42.71, p < .001$ ). EDS was not significantly associated with gender, type of program, and year of study.

With respect to the GHQ-12 scores, 46% of the business students were considered to harbor minor psychiatric disturbances. More female students had psychiatric disturbances than males (49.4% versus 37.0%;  $\chi^2 = 8.0, p < .01$ ). More students in DS group had psychiatric disturbances than those in SS group ( $\chi^2 = 33.83, p < .001$ ). More students in their 3rd (56.7%) or 4th (47.6%) year had psychiatric disturbances than junior students ( $\chi^2 = 10.37, p < .05$ ).

### Academic Study and Extracurricular Activities

Overall, our business students had an average of 20 lectures ( $SD, \pm 4$ ) per week. The number of lectures ( $\pm SD$ ) for the 1st, 2nd, 3rd, and 4th year students were 23 ( $\pm 3$ ), 20 ( $\pm 2$ ), 17 ( $\pm 3$ ), and 15 ( $\pm 4$ ), respectively, with a progressively lesser amount of lectures across the academic years ( $F = 202.08, p < .001$ ).

More than two thirds (73.7%) of the students were required to attend, on average, 1.7 days ( $SD, \pm 0.8$ ) of morning lecture per week. Of those who attended morning lecture, 47.9% were late and 30.9% were absent. Students who needed to attend early morning lectures had a shorter sleep duration (6.76 versus 7.15 hours,  $t = 3.56, p < .001$ ) and lower SSI (0.83 versus 0.88,  $t = 3.85, p < .001$ ) than those who had no early morning lectures. In addition, students who woke-up early for morning classes attempted to dissipate weekday sleep debt during the weekend ( $\chi^2 = 5.67, p < .05$ ).

Average time allocation on daily activities in business students was summarized in Table 3. Business students in the current study spent most of their time on studying and using computers. Male students spent more time on exercise (33

versus 20 minutes,  $t = 4.08, p < .001$ ) but less time on talking on the phone than female students (38 versus 50 minutes,  $t = -3.15, p < .01$ ). DS group did not differ from SS group in the amount of time spending on various extracurricular activities and weekly part-time job (4.26 versus 3.77 hours/week), except for watching TV. Interestingly, DS group spent less time on watching TV comparing to SS group ( $t = 3.27, p < .01$ ).

More than half of the (57%) business students had a part-time job with average working hours of 7.28 ( $SD, \pm 5.4$ ) per week. Attending fewer lectures was associated with spending more time on part-time jobs ( $r = -.176, p < .01$ ). Students with a part-time job had significantly reduced average sleep duration ( $t = 2.47, p < .05$ ) than their counterparts without a part-time job.

### Perceived Health Status

About 19% of the students perceived themselves as being not healthy. More female students perceived poor health than male students (22.6% versus 15.2%;  $\chi^2 = 11.47, p < .01$ ). More students in DS group perceived poor health comparing to the students in SS group (25.5% versus 6.6%;  $\chi^2 = 57.6, p < .001$ ).

### Living Environment

Majority of the students rated their sleeping environment as being average or good. About 51% of the students lived on-campus during the semester. Majority of the on-campus students shared either a twin room (81.6%) or a triple room (16.2%). In comparison, the off-campus students mainly lived in a single room (55.7%) or a twin room (37.3%). More students living on-campus reported poor sleeping environment (6.6% versus 1.0%;  $\chi^2 = 40.89, p < .001$ ). Furthermore, sleep debt was more prevalent in students living on-campus than those living off-campus (61.7% versus 49.1%;  $\chi^2 = 9.57, p < .01$ ).

### Multiple Logistic Models

As illustrated in Table 5, students who reported having insufficient sleep were 5 times more likely to have SSI less than 80%, 3 times as likely to have EDS, 3 times as likely to be poor sleepers, twice as likely to have minor psychiatric disturbance, and more likely to be eveningness type when compared to those reported having sufficient sleep. However, morningness type (odds ratio [OR] = 0.37; 95% confidence interval [CI] = 0.16–0.87) protected students from sleep deprivation.

Early morning (8:30 AM) lectures (OR = 1.90; 95% CI = 1.24–2.91), living on-campus (OR = 1.89; 95% CI = 1.27–2.82), EDS (OR = 1.52; 95% CI = 1.01–2.29), minor psychiatric disturbance (OR = 2.82; 95% CI = 1.93–4.13), SSI less than 80% (OR = 2.55; 95% CI = 1.68–3.89) and sleep debt (OR = 1.58; 95% CI = 1.07–2.33) were associated with “poor sleepers.”

Attending early morning (8:30 AM) lecture, living on-campus, poor sleepers, and eveningness type were significantly associated with the risk of sleep debt. Napping,

**TABLE 5. Summary of Different Logistic Regression Analysis**

	EDS (ESS $\geq$ 14)		Insufficient sleep		Poor sleepers (PSQI $>$ 5)		SSI $\leq$ 0.8		Sleep debt (TIBdiff $>$ 75 min)	
	Adj. OR	95% CI	Adj. OR	95% CI	Adj. OR	95% CI	Adj. OR	95% CI	Adj. OR	95% CI
Nap	1.50	(1.04, 2.18)	—	—	—	—	—	—	—	—
Part-time jobs	1.59	(1.08, 2.33)	—	—	—	—	—	—	—	—
8:30 AM Lecture	—	—	—	—	1.90	(1.24, 2.91)	1.85	(1.19, 2.89)	1.51	(1.02, 2.25)
Hall/family	—	—	—	—	1.89	(1.27, 2.83)	—	—	1.70	(1.18, 2.45)
EDS (ESS $\geq$ 14)	—	—	3.21	(1.85, 5.55)	1.52	(1.01, 2.29)	1.66	(1.13, 2.44)	—	—
Minor psychiatric disturbance	—	—	2.03	(1.26, 3.27)	2.82	(1.93, 4.13)	1.63	(1.12, 2.37)	—	—
Sleep debt	—	—	—	—	1.58	(1.07, 2.33)	—	—	—	—
SSI $\leq$ 0.8	1.63	(1.11, 2.39)	5.63	(2.96, 10.68)	2.55	(1.68, 3.89)	—	—	—	—
Poor/good sleepers	1.68	(1.13, 2.48)	3.02	(1.90, 4.80)	—	—	2.77	(1.86, 4.14)	2.15	(1.51, 3.06)
Eveningness type	1.73	(1.20, 2.51)	1.64	(1.01, 2.66)	—	—	1.62	(1.12, 2.36)	1.53	(1.07, 2.17)
Morningness type	—	—	0.38	(0.16, 0.87)	—	—	0.21	(0.06, 0.72)	—	—

Note. EDS = excessive daytime sleepiness; ESS = Epworth Sleepiness Scale; PSQI = Pittsburgh Sleep Quality Index; SSI = Sleep Sufficiency Index; TIBdiff = difference of total time in bed between weekday and weekend.

part-time jobs, SSI less than 80%, poor sleepers, and eveningness type were highly associated with excessive daytime sleepiness.

## COMMENT

### High Prevalence of Sleep Deprivation and Poor Sleep Quality

Our results were consistent with the growing evidence suggesting that irregular sleep patterns and sleep deprivation were universal phenomenon in university students.<sup>2,10,22,25</sup> As evident in the current study, business students tended to compensate their weekday sleep loss during weekends at a high prevalence rate of 55.8%. Female students slept more than male students during weekends. The gender difference of sleep pattern in business students bears a similarity to that of the adult general population.<sup>28</sup> In addition to irregular sleep pattern, a large portion of business students (70%) reported having sleep deprivation, which was further supported by 2 other corroborative sleep indexes.

Sleep deprivation could have significant repercussions for students' life. As a consequence, about 35% of the students complained of significant daytime sleepiness, which could potentially jeopardize their attention and concentration.<sup>42</sup> Importantly, there was a higher prevalence of psychiatric disturbances and perceived poor health in the business students with sleep deprivation. If the sleep-deprived students carried on their sleeping patterns, they might develop a vicious cycle of unhealthy lifestyle: inappropriate sleep practice might result in more frequent daytime sleepiness, which could negatively influence students' daytime and academic performance. Consequently, poor daytime performance might lead to more stress, increased sleep deprivation, and poorer sleep quality. As university study is a main period for consolidation and growth of the youngsters, such kind of unhealthy lifestyle and sleeping habits might perpetuate and persist into adulthood. Further prospective study will be needed to examine the longitudinal outcome of these students.

### Etiology of Sleep Deprivation and Sleep Problems

The underlying causes of sleep deprivation in business students were explored in the academic and social context of university experiences. As shown in the current study, the daily life of business students were fully packed with most of the time spending on the academic related activities, including lectures, revision, and homework. Interestingly, sleep-deprived students spent less time on watching TV comparing to those students with sufficient sleep. Instead of spending time on TV, they seemed to spend slightly more time on studying and on the computer. Computer usage seemed to be a regular routine of university life. In particular, business students often needed to work with the computer for activities such as surfing the Internet for academic, recreational, and social purposes. Although physical activities could improve the sleep quality of students,<sup>43</sup> our study found that most business students spent less than half an hour a day on physical exercises, albeit male students did slightly more

than female students. Thus, our study revealed that business students had to cope with a wide range of demands in various academic and social aspects of their university life. Developing strategies of better and efficient time management may be one solution for students to adapt to their busy university life. Moreover, regular exercises may be important for not only better quality of sleep, but also general well-being in business students.

In addition to the academic and leisure activities, taking a part-time job seemed to be common in business students. Notably, students with a part-time job were found to have a significant reduction in average sleep duration and a considerable increase in daytime sleepiness. Our findings were concordant with the result of a previous study on high-school students that working students had a shorter sleep duration than nonworking students.<sup>44</sup> Hence, the research findings on this part-time job phenomenon brought out an essential issue for students in regards to achieving a fine balance of striving for academic success, obtaining working experiences, and maintaining good sleep hygiene and general well-being. Moreover, that some students having a part-time job may be partially related to the financial reasons. Accordingly, universities should also look into the financial need and strain of the students, which might potentially be the causes of students' poor academic performance, sleep disturbances, and poor health status.

Our results indicated that attending the early morning (8:30 AM) lectures were associated with sleep deprivation, sleep debt, and poor sleep quality. From the administrative point of view, a later starting time for early morning lectures or more flexibilities and choices of lectures for students to design their academic schedule may reduce the rate of absenteeism or late attendances. However, further studies are warranted to evaluate the efficacy of a later starting of class schedule on students' motivation and class attendance.

Living environment could play a prominent role that contributed to students' sleep practice. The sleep patterns of the business students living on-campus were markedly different from those living off-campus. Students living on-campus delayed their sleep phases on both weekdays and weekends, with resultant poorer sleep quality. In addition, more students living on-campus complained of their sleeping environment, especially if they shared the room with others. Previous studies demonstrated that on-campus residence students perceived stress with a constellation of sleeping difficulties, chronic illness, depression, and roommate relationship.<sup>42</sup> Similarly found in the current study, a pertinent issue in relation to students' health and sleep problems arose from on-campus residence experience. In spite of the short distance to the lecture rooms, the students living on-campus were found to have a higher rate of absenteeism to the morning lectures comparing to the students living off-campus (39.1% versus 22.3%;  $\chi^2 = 14.99$ ,  $p < .001$ ). Thus, university health education program should deliberately target the on-campus students who may have a higher risk of faulty sleeping habits. However, from the global education viewpoint, the seemingly 'unhealthy' sleep patterns of on-campus



**TABLE 6. Recommended Measures for Tackling Pervasive Sleep Problems in University Students**

Targeting group	Recommended measures
For university administration	<ul style="list-style-type: none"> <li>a. Underscoring the importance of healthy sleep in university students—healthy sleep, healthy students</li> <li>b. Promoting a healthy lifestyle with a balance on sleep, exercise, stress and time management</li> <li>c. Drawing attention to flexible schedules of lectures, especially on early morning lectures</li> <li>d. Addressing the issues of concurrent part-time jobs taking in university students with the aim of achieving a balance on working experience, financial concerns, and healthy life</li> </ul>
For health care professional and residence hall staffs	<ul style="list-style-type: none"> <li>a. Promoting a healthy lifestyle with a balance on sleep, exercise, stress and time management</li> <li>b. Devising systemic and effective education programs to promote the importance of sleep and sleep-related quality of life, particularly targeting the students living on campus</li> <li>c. Balancing activities that promote health, social interactions and academic study</li> <li>d. Taking consideration of lifestyle habits (e.g., circadian preference) during roommate assignment</li> </ul>
For university students	<ul style="list-style-type: none"> <li>a. Enhancing personal awareness of the importance of sleep for overall well-being</li> <li>b. Developing and maintaining healthy living style, good sleep habit, appropriate stress and time management</li> </ul>

living have to be balanced against the enhanced social and academic interactions that on-campus living can provide.

In summary, our study suggested that poor sleep quality and sleep deprivation were highly prevalent in university business students in Hong Kong. There was a constellation of associated factors, including unhealthy lifestyle, early morning lectures attendances, on-campus residence, part-time work, as well as individual vulnerability and minor psychiatric disturbances.

### Interactive and Integrated Effort for Better Well-being

In tackling the sleep problems of the students, there should be a concerted and integrated effort among university, health care professionals, residence hall staffs, and students (Table 6). As university students are generally perceived to be young and healthy, their sleep and health problems are often underrecognized and undermanaged. Universities should start to tackle students' sleep problems by underscoring the importance of healthy sleep towards students' health and global well-being.<sup>45,46</sup> In addition to the organization of sleep management course or sleep education program to improve students' sleep quality and sleep hygiene behaviors,<sup>47</sup> more efforts should be made to address the specific facets that underlie the sleep problems in students. For example, to accommodate students with more flexibility, alternative schedules for morning lectures should be taken into consideration. In terms of on-campus living environment, residence hall staffs should arrange proactive interventions to promote the awareness of good sleep hygiene practice. In addition, roommate relationship may be of crucial concern in terms of a harmonious and comfortable living environment for students. Previous research has suggested that roommate conflict might induce stress among residence hall students.<sup>42</sup> In a similar vein, roommate may have a profound effect on shaping their mutual sleeping environment, as revealed in the current study. Residence hall staffs, therefore, may need to consider

the importance of achieving a better consonance among the students with different lifestyle habits. Students' circadian preference, for example, may be taken into consideration during roommate assignment. Apart from university's effort to promote proper sleep practice and healthy living style, students' self-awareness may be of paramount importance. Appropriate strategies of time and stress management may help students to arrange their limited time and resources for a better balance between academic study and a healthy life.

In conclusion, our study served to highlight the pervasiveness of irregular sleep pattern and sleep deprivation across cultures and different groups of students. Various measures were recommended to the university administrative personnel, residence halls staffs, and university students to address the specific issues in relation to students' sleep problems. Although our study mainly targeted the business students, the prevailing phenomenon of sleep deprivation and sleep-related repercussions also occurred similarly in other groups of university students across the world.<sup>7,8,24,25</sup> In this regard, we think that the results and the related recommended remedial measures in the current study can be generalized to other colleges and university students. Yet future research with rigorous study design is needed to evaluate the effectiveness of interventions as recommended in the current study across different groups of students with various backgrounds.

### Limitations

There are a number of limitations in the current study. The instruments in our survey packet could not possibly cover all the factors potentially associated with students' sleep deprivation. Some variables such as the consumption of coffee or tea, alcohol intake, drugs prescription, nicotine intake, and academic performance were not included. Additionally, use of nonrandom sampling method may limit the generalizability of our results to some extent. Nonetheless, purposive sampling was appropriate to use in considering the current study as an exploratory approach towards the sleep

issues in business students. Another potential bias was the use of self-reported questionnaires to evaluate the sleep quality and patterns instead of objective measurements, such as polysomnography and actigraph. Nevertheless, there were some evidences suggesting a high correlation of subjective reports and objective sleep variables.<sup>48</sup>

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#### NOTE

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