

## **Stress, Sleep, and Performance in International and Domestic University Students**

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### **ABSTRACT**

Stress and poor sleep quality are serious and common problems among university students that could have detrimental effects on their academic performance. International students may experience greater difficulty than domestic students because they also need to deal with the challenges associated with moving to a new culture. The present study aims to investigate the relationship between stress (perceived and acculturative), sleep quality, and academic performance by comparing them between international and domestic students. Perceived stress negatively correlates with sleep quality. However, no relationship is found between acculturative stress and sleep quality, between sleep quality and academic performance, and between stress (perceived and acculturative) and academic performance. Differences in perceived stress and sleep quality between international and domestic students are found. Perceived stress is found to be an important factor that requires the university to focus on effective stress management programs that could be useful for achieving better sleep quality.

**Keywords:** academic performance, acculturative stress, domestic students, international students, perceived stress, sleep quality

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University education provides students with the opportunities to grow intellectually and actualize their potential for future. However, university life is not only, and certainly not always, stimulating and empowering. It can also be stressful and anxiety producing. While the common stressors associated with

university education are many, the situation may be more complex for international students. In addition to having to deal with the challenges and difficulties faced by domestic students, international students are also confronted with a wide variety of potential new challenges such as the lack of familiarity with the academic system, language barriers, immersion in a new culture, difficulties in finding accommodation, and the loss of closeness to family and friends (Adlaf et al., 2010; Ansari & Stock, 2010; Furnham, 2004; Khawaja & Dempsey, 2008).

While there are a number of outcomes of stress, we choose to focus our investigation on the effects of stress on sleep quality and the academic performance of university students, for three reasons. First, university students have been shown to be more vulnerable to stress and poor sleep quality than the general population (Altun et al., 2012; Suresh, 2008). Second, sleep quality in university students is rarely considered an important consequence of stress. The majority of studies are more concerned with the association between stress and mood changes such as depressed mood and anxiousness (Haq et al., 2018), and individual moderator variables such as locus of control (Khan et al., 2010) and coping strategies (Azizi, 2012). Third, academic performance is of utmost importance to university students for a number of reasons including gaining entry into postgraduate programs and securing a job.

There are inconclusive findings regarding the association of academic performance and stress and sleep quality, which are reviewed below. Moreover, to date, no systematic investigation of the impact of stress on sleep quality and academic performance has been conducted with domestic and international students. Given the importance of academic performance and the different sources of stress for domestic and international students, an examination of the relationship between stress, sleep quality, and academic performance among domestic and international students is warranted.

## **STRESS, SLEEP QUALITY, AND ACADEMIC PERFORMANCE**

Evidence for stress in university students abounds for many reasons (Safhi et al., 2020; Saleh et al., 2017; Zhai et al., 2021). One of the outcomes of stress is poor sleep quality. Sleep plays a very important role in our physiological and neurocognitive functioning, and these abilities are important for university students to excel academically (Gikunda et al., 2014). The increasing demands of a university education often result in irregular sleep schedules and a higher risk of sleep disorders (Chokroverty, 2009; Taylor & Bramoweth, 2010).

Prior work has suggested that changes in stress level result in changes in sleep quality (Hamilton et al., 2007; Lund et al., 2010). For instance, Lemma et al. (2012) found that students who experienced stress were more likely to complain about having poor sleep quality.

Since sleep quality is assessed by a combination of several sleep parameters, such as sleep duration, feeling rested upon waking, and sleep efficiency, the investigation of the relationship between stress and sleep quality does not reveal much about the different aspects of sleep quality that are affected by stress. Due

to the known effect of stress on sleep quality, the exploration of the components of sleep quality influenced by stress is a promising addition to the field.

Academic achievement is one of the most imminent concerns of university students (Siraj et al., 2014). Unfortunately, many students are unaware that poor sleep quality could lead to reduced academic performance (Engle-Friedman et al., 2003; Pilcher & Walters, 1997). Diekelmann and Born (2010) asserted that sleep plays an important role in the learning process and memory consolidation (Beebe, 2011; Louca & Short, 2014; Stickgold, 2005). The effects of poor sleep on cognitive functioning may explain the association between sleep quality and academic performance (Dixit et al., 2012).

There are inconsistent findings about the components of sleep quality that have been associated with academic performance. For example, using the Pittsburgh Sleep Quality Index (PSQI), Cates et al. (2015) examined the different aspects of sleep quality on academic performance among pharmacy students, and they found that only sleep efficiency (i.e., the proportion of sleep time to the amount of time spent in bed attempting to sleep) and the use of sleeping medication were important predictors of academic performance. However, when Mirghani et al. (2015) studied medical students, they found that all components of the PSQI, except for sleep latency (i.e., the amount of time after lights off before sleep begins), were associated with academic performance. It appears that more research on the relationship between sleep quality and academic performance is needed, especially on the different aspects of sleep quality.

Clearly, stress generates burdens on students in problem-solving ability, health, self-efficacy, and academic success, which subsequently affects their academic performance (Largo-Wight et al., 2005; Zajacova et al., 2005). However, the relationship between stress, sleep, and academic performance is inconclusive. Several studies have found no relationship between sleep and academic performance (Eliasson et al., 2002; Smart, 2019). Likewise, Rafidah et al. (2009) reported no relationship between stress and academic performance at the beginning and the middle of the school semester.

## **INTERNATIONAL STUDENTS**

Over the past decade, the number of international students has been on the rise in most developed countries (Organization for Economic Cooperation & Development [OECD], 2015). International students are an important asset to a country for both academic prestige and financial benefits (Altbach & Knight, 2007). First, they enrich the cultural diversity of universities with their home culture and ethnic experiences, thus, helping domestic students to develop their cultural sensitivity and skills in working with people from different cultures (Zhao et al., 2005). Second, they enhance the academic excellence of the universities because they tend to be academically well-prepared. Many international students are highly ranked students in their home countries, but in order to study abroad, they also have to meet academic and language requirements (Wu et al., 2015). As a result, these students bring new divergent ways of thinking and catalyze academic competition. Third, international students also represent a large

economic and international relations investment through their expenditures in tutoring and living expenses (Kaur, 2017).

However, adjustment of international students to university life has always been a concern. While the adjustment to university is often fraught with many difficulties and challenges for all students, international students have to adjust to more radical changes than their domestic counterparts as they relocate to a host country and face the challenges of adapting to a foreign culture. Studies that look into the experiences and adaptations of international students to university life have found that the common difficulties that international students encounter include language barriers, discrimination, loss of social support, and intense pressure from families and home culture to excel academically (Furnham, 2004; Kosheleva et al., 2015; Sullivan & Kashubeck-West, 2015). Such difficulties resulting from moving to and living in a new culture have been identified as acculturative stress (Sullivan & Kashubeck-West, 2015).

Acculturation is often quite challenging, coupled with the fact that these students also face academic pressures (Banjong, 2015). These difficulties may have negative consequences on their health and academic achievement (Kilinc & Granello, 2003). This was supported in the study by Forbes-Mewett and Sawyer (2016), which revealed a greater incidence of psychological problems and a higher level of stress among international students compared with domestic students. Similarly, acculturative stress has been found to detract from academic performance (Albeg & Castro-Olivo, 2014). Although several studies point to international students experiencing more difficulties than domestic students, few studies have utilized comparison groups, and even fewer have compared them on a range of variables to determine the nature and sources of differences.

### **AIMS OF THE STUDY**

In a fast-paced, excellence-driven society like Singapore where academic excellence is valued, sleep deficiency may be especially problematic where many students believe that it is necessary to sacrifice their sleep to pursue academic goals. Based on the Program for International Assessment, Singapore was near to top in the world in science, reading and mathematics (OECD, 2019). However, students in Singapore also rank high for schoolwork-related anxiety and amount of time spent in learning (Borgonovi & Pál, 2016). Due to the greater emphasis on academic goals, many students may prioritize their work over sleep. To help student achieve better academic performance, it is important to identify associated factors that can be modified to improve student achievements. With this long-term goal in mind, the objective of the current study was to investigate stress, sleep quality, and academic performance in students in Singapore.

Taken together, studies that investigate the relationship between stress, sleep quality, and academic performance among university students provide weak and inconsistent results. Given the high prevalence of stress and poor sleep quality and the importance of academic performance in university students, it is important to explore any relationship among these factors and the predictive power of these relationships. The current study will further investigate the relationships between

stress, sleep quality, and academic performance by comparing these factors between international and domestic students, with the aim of investigating two aspects of stress, namely perceived stress and acculturative stress, and to determine which aspect of stress contributes more to sleep quality and academic performance. The current study also aims to investigate all the sleep parameters assessed by the PSQI and their relationship with stress and academic performance and the possible mediating effects of sleep quality in the relationship between stress and academic performance.

Accordingly, the study hypothesized that: (a) both perceived stress and acculturative stress will be negatively correlated with sleep quality and academic performance, and sleep quality will be positively correlated with academic performance; (b) sleep quality will mediate the relationship between stress (perceived and acculturative) and academic performance; and (c) international students will experience more stress, poorer sleep quality, and poorer academic performance than domestic students.

## **METHOD**

### **Participants and Procedures**

Participants in this study were 194 students (96 international, 98 domestic) enrolled in undergraduate programs across all four academic years in universities located in Singapore. There were 94 males and 100 females, from 18 to 30 years old ( $M = 21.79$ ,  $SD = 2.29$ ). The majority of the participants were studying full time (95.9%). The mean age for international participants was 21.29 ( $SD = 2.32$ ), and the gender distribution was 56 males and 40 females. The majority of international participants held citizenship in Asian countries (76%). The domestic participants had a mean age of 22.28 ( $SD = 2.16$ ), and the gender distribution was 38 males and 60 females. All domestic participants held citizenship in Singapore. Data collection took place during the third semester (September), and participants completed the survey online either at the beginning or at the end of a class. Participants were recruited through a range of advertising techniques, which included a local university research platform, word of mouth, and social media. All university students in Singapore were invited to complete the questionnaires via an online link. If participants identified themselves as international, they were prompted to complete three questionnaires measuring perceived stress, acculturative stress, and sleep quality. However, if participants identified themselves as Singaporean, they did not complete the measurement of acculturative stress. The project was approved by the James Cook University Human Research Ethics Committee.

### **Measures**

Perceived stress was assessed for the previous month using the Perceived Stress Scale (PSS-10; Cohen et al., 1983). It is a self-administered questionnaire, which consists of 10 items. Each item is rated on a 5-point Likert scale, ranging

from 0 and 4 (0 = *never*, 1 = *almost never*, 2 = *sometimes*, 3 = *fairly often*, and 4 = *very often*). Six of the items have a negative context (e.g., “How often have you been upset because of something that happened unexpectedly?”), and four are positively worded (e.g., “How often have you felt that you were on top of things?”). Those items reflecting a negative tone comprised the General Distress subscale, while the Ability to Cope subscale contained items that are more positive in nature. The total score is calculated by finding the sum of the 10 items after reversing the scores on Items 4, 5, 7, and 8. The PSS-10 has a range of scores between 0 and 40, and a higher score reflects a higher level of stress. A total score of below 14 would be considered as low stress, whereas a score between 14 and 26 would be considered as moderate stress, and a score above 27 would be considered as high stress.

Acculturative stress was measured with a 14-item scale adapted from the Cross-Cultural Loss Scale (CCLS; Wang et al., 2015). The 14 items generate three component scores: belonging competency (e.g., “feel less connected to others around you”), national privileges (e.g., “have less access to the cultural environment of home”), and access to home familiarity (e.g., “experience more restriction as a foreigner”). Each item is rated on a 5-point Likert-scale, ranging from 1 to 5 (1 = *not at all*, 2 = *slightly*, 3 = *moderately*, 4 = *strongly*, 5 = *completely*). The total score ranges from 1 to 70 and is computed by adding the three CCLS component scores. A higher score reflects a higher level of acculturative stress.

Sleep quality was assessed for the previous month using the Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989). The 19 self-reported items generate scores on seven components: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, use of sleeping medication, and daytime dysfunction. Each component score can range from 0 to 3. The first four items ask respondents about their usual bedtimes, wake times, minutes it takes to fall asleep, and sleep hours. The remaining items are rated on a 4-point Likert scales ranging from 0 to 3 (0 = *not during the past month*, 1 = *less than once a week*, 2 = *once or twice a week*, 3 = *three or more times a week*). The scores of the seven components are then added to yield a global sleep quality score, ranging from 0 (no difficulties) to 21 (severe sleep difficulties). A global score of 5 or greater is indicative of poor sleep quality (Buysse et al., 1989).

Academic performance was measured as participants’ self-reported academic grades in the previous study period and classified into the following five categories: high distinction (85% and above), distinction (70%–84%), credit (60%–74%), pass (50%–59%), and fail (below 50%).

## RESULTS

### Descriptive Statistics

The mean, standard deviation, minimum, maximum, and skewness scores from the PSS-10, CCLS and its three subscales, and the global PSQI score are displayed in Table 1. As skewness values were low and nonsignificant, no

transformations of scores were considered and parametric statistical methods were employed in analyses.

**Table 1: Descriptive Statistics of PSS-10, CCLS and Its Three Subscales, and Global PSQI Scores**

Assessment	<i>M</i>	<i>SD</i>	Min	Max	Skewness
PSS-10	18.81	6.19	3	31	-0.57
CCLS belonging competency	12.65	4.14	6	27	0.61
CCLS home familiarity	9.06	3.27	4	18	0.27
CCLS national privilege	9.59	3.40	4	17	0.22
CCLS Total	31.27	7.74	14	51	0.09
PSQI global	6.82	3.36	0	18	0.65

*Note:* PSS-10 = Perceived Stress Scale; CCLS = Cross-Cultural Loss Scale; PSQI = Pittsburgh Sleep Quality Index.

### Stress, Sleep Quality, and Academic Performance

Table 2 presents the results of the Pearson’s correlations coefficients used to test our hypotheses on the relationship between perceived stress, sleep quality, and academic performance in the full sample. The correlations between stress, both acculturative and perceived, sleep quality, and academic performance among the subsets of international and domestic students are depicted in Table 3. The upper diagonal of Table 3 illustrates the relationship of these variables among domestic students, whereas the lower diagonal of the table illustrates the relationships of these variables among international students. Of note, unlike domestic students, international students completed the CCLS to examine acculturative stress.

**Table 2: Correlations Between Scores on the PSS-10, PSQI and Its Seven Components, and Academic Performance in the Full Sample (*n* = 194)**

Assessment	PSS-10	PSQI							AP	
		SSQ	SL	SDUR	SE	SDIS	MEDI	DD		Global
PSS-10	1									
PSQI SSQ	.23**	1								
PSQI SL	.20**	.41**	1							
PSQI SDUR	.17*	.41**	.13	1						
PSQI SEFF	.14	.25**	.27**	.48**	1					
PSQI SDIS	.24**	.21**	.34**	-.02	-.05	1				
PSQI MEDI	.14	.24**	.13	.10	.14	.15*	1			
PSQI DD	.36**	.29**	.22**	.19**	.15*	.30**	.15**	1		
Global	.35**	.68**	.64**	.64**	.64**	.39**	.40**	.55**	1	
AP	.12	-.001	.50	-.004	-.05	.09	.12	.08	.05	1

*Note:* PSS-10 = Perceived Stress Scale; PSQI = Pittsburgh Sleep Quality Index; AP = academic performance; SSQ = subjective sleep quality; SL = sleep latency; SDUR = sleep duration; SEFF = sleep efficiency; SDIS = sleep disturbance; MEDI = use of sleep medication; DD = daytime dysfunction.  
\* $p < .05$ ; \*\* $p < .01$

### ***Perceived Stress and Sleep Quality***

In the full sample, PSS-10 scores were positively correlated with the global PSQI scores and five of its components: subjective sleep quality, sleep latency, sleep duration, sleep disturbance, and daytime dysfunction. However, these correlations were all less than .40, and only those with the global scores on the PSQI and the daytime dysfunction component score were above .30. In summary, stress, as assessed by the PSS-10, was not strongly associated with sleep measured using the PSQI.

In international students, PSS-10 scores were positively correlated with global PSQI scores and three of its components: sleep disturbance, daytime dysfunction, and subjective sleep quality, but only the correlations with the sleep disturbance component and with the global scores were in excess of .30. In domestic students, PSS-10 scores were positively correlated with the global PSQI scores and two of its components: sleep latency and daytime dysfunction, but the correlation with sleep latency was less than .30. *Z* tests comparing the correlations in international and domestic students were conducted for all the correlations between the PSS-10 and the PSQI and its seven components. No significant differences were found between these correlations.

### ***Acculturative Stress and Sleep Quality***

No significant association was found between CCLS and its three subscales and PSQI and its seven components in the sample of international students.

### ***Sleep Quality and Academic Performance***

In the full sample, no significant association was found between the global PSQI scores, its seven components, and scores on the academic performance. A similar result was found for both international and domestic students.

### ***Perceived Stress and Academic Performance***

In the full sample, no significant association was found between PSS-10 and academic performance. Similarly, in domestic students, no significant association was found between PSS-10 and academic performance. In contrast, in international students, PSS-10 scores were positively, but weakly, correlated with



academic performance (Table 3). However, the difference between these correlations in international and domestic students was not statistically significant.

**Table 3: Correlations Between Scores on the PSS-10, CCLS and Its Three Subscales, PSQI and Its Seven Components, and Academic Performance in International (Lower Diagonal,  $n = 96$ ) and Domestic Students (Upper Diagonal,  $n = 98$ )**

	CCLS				PSS	PSQI							AP	
	BC	HF	NP	Total	-10	SSQ	SL	SDUR	SE	SDIS	MEDI	DD	Global	
CCLS														
BC	1													
HF	.39**	1												
NP	.25*	.20	1											
Global	.80**	.71**	.65**	1										
PSS-10	.18	-.15	.11	.08	1	.16	.21*	.10	.11	.15	.09	.43**	.33*	.06
PSQI														
SSQ	.10	.05	.05	.10	.26**	1	.30**	.42**	.18	.08	.29**	.14	.64**	-.07
SL	.09	.14	.05	.13	.19	.30**	1	.47	.28**	.25*	.22*	.18	.61**	.03
SDUR	-.004	-.07	-.11	-.08	.11	.42**	.26*	1	.45**	-.15	.08	.06	.62**	.06
SEFF	.12	-.06	-.20	-.06	.13	.18	.27**	.54**	1	-.13	.15	.02	.63**	-.10
SDIS	.11	.13	.08	.15	.37**	.08	.43**	.18	.05	1	.13	.25*	.27**	.08
MEDI	-.03	-.16	.04	-.07	.20	.29**	.04	.16	.12	.17	1	.10	.44**	.09
DD	.18	.04	.10	.16	.24*	.14	.27**	.31**	.28**	.38**	.21*	1	.43**	.08
Total	.14	.02	-.02	.00	.32**	.73**	.68**	.67**	.65**	.54**	.38**	.65**	1	.03
AP	.05	-.05	.08	.03	.23*	.10	.07	-.05	.03	.09	.14	.12	.12	1

Note: CCLS = Cross-Cultural Loss Scale; PSS-10 = Perceived Stress Scale; PSQI = Pittsburgh Sleep Quality Index; AP = academic performance; BC = belonging competency; HF = home familiarity; NP = national privilege; SSQ = subjective sleep quality; SL = sleep latency; SDUR = sleep duration; SEFF = sleep efficiency; SDIS = sleep disturbance; MEDI = use of sleep medication; DD = daytime dysfunction.

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

### Acculturative Stress and Academic Performance

No significant association was found between the total CCLS score and its three subscales and academic performance.

### Mediation Effect

Planned tests of whether sleep quality acted as a mediator between stress (perceived and acculturative) and academic performance were abandoned. This is because the conditions required for mediation were not met (Baron & Kenny, 1986). In the present case, as there were no significant relationships between either perceived stress or acculturative stress and the outcome of academic performance, tests for a potential mediating role of sleep quality were not able to be conducted.

### Comparisons Between International and Domestic Students

The mean and standard deviation of scores, the results of *t* tests, and effect sizes comparing international and domestic students on perceived stress, sleep quality, and academic performance are depicted in Table 4. These statistics suggest that international students have longer sleep duration, less daytime dysfunction, better overall sleep quality, and a lower level of perceived stress than domestic students, with the effect size ranging from small to medium. No significant difference was found on sleep latency, sleep disturbance, subjective sleep quality, use of sleep medication, sleep efficiency, and academic performance between international and domestic students.

**Table 4: Descriptive Statistics, Results of *t*-Tests and Effect Sizes Comparing International (*n* = 96) and Domestic (*n* = 98) Students on PSS-10, the Global Scores on PSQI and its Seven Components, and the Scores on Academic Performance**

Assessment	International		Domestic		t	d
	M	SD	M	SD		
PSS-10	17.27	5.93	20.33	6.09	-3.54**	0.51
PSQI SSQ	1.15	0.70	1.32	0.77	-1.62	0.23
PSQI SL	1.42	1.02	1.46	0.98	-0.30	0.04
PSQI SDUR	0.44	0.78	1.02	1.13	-4.17**	0.60
PSQI SEFF	0.61	0.99	0.78	1.12	-1.06	0.16
PSQI SDIS	1.21	0.54	1.20	0.59	0.05	0.02
PSQI MEDI	0.19	0.60	0.18	0.56	0.05	0.02
PSQI DD	1.20	0.78	1.47	0.82	-2.38**	0.34
Global PSQI	6.21	3.39	7.43	3.24	-2.56**	0.37
AP	2.68	0.72	2.57	0.75	1.01	0.15

*Note:* PSS-10 = Perceived Stress Scale; PSQI = Pittsburgh Sleep Quality Index; SSQ = subjective sleep quality; SL = sleep latency; SDUR = sleep duration; SEFF = sleep efficiency; SDIS = sleep disturbance; MEDI = use of sleep medication; DD = daytime dysfunction; AP = academic performance.

\*\*  $p < .01$ .

## **DISCUSSION**

### **Stress, Sleep Quality, and Academic Performance**

The results suggested that students who have higher perceived stress are more likely to experience poor sleep quality. This finding builds upon and further extends the findings of Lemma et al. (2012) and Zunhammer et al. (2014). However, Zunhammer et al. (2014) found weak relationships in their assessment of sleep quality over the past month and perceived stress over the past week. In the current study, our study both perceived stress and sleep quality were assessed over the past month, and the administration of both variables over the same time frame might be responsible for the increased magnitude of the correlations in this study. It may be that individuals who perceive that they are stressed tend to experience intrusive thoughts after bedtime (Akerstedt et al., 2007; Hall et al., 2000).

The relationship between acculturative stress and sleep quality has not been assessed previously. The current study found no association between acculturative stress and sleep quality. Unlike perceived stress, acculturative stress results from moving and living in new cultures and, as such, one may have limited control over these stressors (Sullivan & Kashubeck-West, 2015). When people have no control over a stressful situation, they learn to “live with it” (Wakeman, 2010, p. 14). The lack of association could also be due to the level of stress. Doane and Thurston (2014) postulated that stress levels need to be relatively high in order to influence sleep quality. It is notable that, in the current study, the level of acculturative stress was not high. Hechanova-Alampay et al. (2002) argued that acculturative stress decreases over the years as international students successfully adjust to the new cultures.

A further prediction of this study was that sleep quality would be negatively correlated with academic performance. However, no significant relationship was found between sleep quality and academic performance. This was not consistent with previous studies (Cates et al., 2015; Desouky et al., 2015). In terms of the measurement of academic performance, the current study differed from previous studies where grade point average scores and actual scores were commonly used to assess academic performance (Cates et al., 2015; Desouky et al., 2015). It may be possible that the different measurement of academic performance was responsible for the failure to find a relationship between sleep quality and academic performance. However, this lack of association is not without precedent. Hoswell et al. (2004) also reported no association between scores on the PSQI and scores on academic performance. Some students may sacrifice sleep in order to study longer and thereby experience poor sleep quality, but still achieve good academic results.

The current study further predicted that stress, both perceived and acculturative, would be negatively correlated with academic performance. These predictions were not supported, and these findings were not consistent with previous studies that investigated the relationship between academic performance and perceived stress and acculturative stress (Albeg & Castro-Olivo, 2014; Rafidah et al., 2009). It is possible that the nonsignificant relationship between

perceived stress and academic performance was due to the inclusion of students across four years of tertiary study. Given that the Year 4 students are normally about to complete their degree, they may be more familiar with the academic system than the Year 1 students who are new to the university and the Year 2 or 3 students who are still in the process of adjusting to the university academic standard. Analysis of academic years as a confounding variable could not be conducted due to a small number of students in each year level.

The nonsignificant relationship between acculturative stress and academic performance could be due to international students having a relatively high level of academic ability. This notion was supported by Banjong (2015) and Wu et al. (2015), who noted that many international students already have succeeded academically prior to arrival in the host country. If the academic performance of international students was generally high at the baseline, then the current study that uses a one-time point survey may not truly reflect the relationship between acculturative stress and academic performance.

Given the nonsignificant relationship between sleep quality and academic performance and stress and academic performance, the presence of a mediation effect was not suggested. Contrary to the prediction, international students actually experienced a lower level of perceived stress and better sleep quality than domestic students. In regards to the sleep parameters assessed by the PSQI, international students had longer sleep duration and less daytime dysfunction than domestic students. This was unexpected, as the literature has documented additional stress and poorer well-being in international students than their domestic counterparts (Forbes-Mewett & Sawyer, 2016). It is possible that academic support provided by the university may have ameliorated the potential stressors (Omeri et al., 2003). Moreover, it is also possible that international students who tend to come from a high socioeconomic background need not worry about the financial pressure during university education compared with their less privileged domestic counterparts.

Another possible explanation could be the length of stay. Hechanova-Alampay et al. (2002) argued that the first six months of residing in a new country may produce growing stress, however, such stressors generally diminish over time as individuals adjust to the environment. The majority of the international students in this study may have adapted and acculturated adequately. However, academic years were not assessed in this study. Future research may consider addressing these potential factors that may have contributed to the differences on stress level between international and domestic students.

### **Comparison Between Domestic and International Students**

No previous studies have compared the sleep quality of international and domestic students. Given that international students tend to report poorer well-being than domestic students (Forbes-Mewett & Sawyer, 2016), it was surprising to find that international students actually had better sleep quality than domestic students. However, such differences could also be possible if the sleep environment was better for international students than domestic students. A

number of studies have shown that a good sleep environment is essential to ensure good sleep quality (Kayaba et al., 2014; National Sleep Foundation [NSF], 2017; Yang & Oldfsson, 2015). It is possible that international students who come from a high socioeconomic background have their own private bedroom compared with the domestic students who often need to share a bedroom with their siblings. It is also possible that, as a result of moving into a new environment, they have fewer home entertainment devices in the bedroom. As such, they may have a less disruptive sleep environment than their domestic counterparts, and may experience better sleep quality.

It is possible that a reduction of entertainment available (or desirable) for international students resulted in a longer sleep duration than domestic students. It is unsurprising that the acculturation process may include a loss or reduction of time devoted to entertainment in the host country and, as such, the exchange of sleep hours for such activities may be absent in international students (Hense et al., 2011).

Both international and domestic students had a similar level of academic performance. This is not consistent with the study conducted by He and Banham (2009). However, this lack of difference is not without precedent. Phang et al. (2013) also found no significant difference between international and domestic students with respect to academic performance. It is possible that, because of the greater difficulty of adjusting to university education, international students put in the extra effort and spent more time in their studies to keep up with domestic students.

### **Limitations and Implications for Future Research**

There are several limitations that suggest exciting directions for future research. First, given the nature of this correlational study, the causal link between perceived stress and sleep quality is unclear. While perceived stress may influence sleep quality, it is also possible that sleep quality influences perceived stress (Akerstedt et al., 2012). A cross-lagged study where stress and sleep quality are measured at two or more occasions is needed to confirm the directionality of the current findings.

Moreover, the reliance on self-report opens the study to potential response bias. It is recommended that future research employing self-reported measurements also include an assessment of socially desirable responses to assess the extent to which response bias may be operating. Similarly, this study could be further extended by considering other background factors such as gender differences, socioeconomic status, and race, which may serve as possible modifiers. Of particular concern is the fact that academic years were not assessed in this study and the possibility of accustomed acculturation effect might occur in the data collection. However, this concern is somewhat minimized by the contrary finding. It seems like the level of stress and sleep quality between international and domestic students could be similar due to an acculturation effect. However, the contrary results advance the body of the literature and could be addressed in future works.

## CONCLUSION

The aim of this study was to examine the relationships between stress, sleep quality, and academic performance in domestic and international students. The findings show that perceived stress leads to a decrease in sleep quality in both samples. No significant association was found between acculturative stress and sleep quality, between sleep quality and academic performance, and between stress (perceived and acculturative) and academic performance. Comparing significant correlations of the same variables between the two samples reported no significant difference.

The current findings also point to a need to investigate factors (e.g., resilience) that may influence the association between stress (perceived and acculturative), sleep quality, and academic performance and factors (e.g., socioeconomic status) that may influence the differences in these variables between international and domestic students. Given the importance to students and their future careers of performing well in the university, and particularly the costs of such an education to international students, further work to better understand how to optimize their performance and provide good support to students is essential.

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