PSSQ-I for gender differences in sleep deprivation and insomnia: A student community survey to determine the frequency of insomnia before and during the covid pandemic and an overview of its impact on their daily routine and academic performance

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Abstract. The covid-19 pandemic with its unprecedented challenges has also affected students' daily routine and academic performance. The goal of this research was to investigate sleep deprivation among male and female students and its relationship with daily routine and academic performance before and during COVID-19. A cross-sectional quantitative Pittsburgh Sleep Symptom Questionnaire-Insomnia (PSSQ_I) inventory with 13 self-rated questions was conducted before and during the Covid pandemic. To this, 7 questions were added to determine students' academic performance among those with sleep deprivation. Among those 32 (21.47%) diagnosed with insomnia during the covid pandemic, 12 (37.5%) were male and 20 (62.5%) were female. Those with insomnia prior to Covid pandemic were 23 (15.44%), and out of this number, 4 (17.39%) were male and 19 (80.60%) were female students. Independent t-test showed that a difference of mean score measured with its impact on daily routines between the female (M = 3.34, SD = .928, n = 39) and the male (M = 2.37, SD = .885, n = 16) was statistically significant at .05 level of significance (t = 3.58, df = 53, p < .001). Similarly, the result with its impact on students' academic performance between the female (M = 3.34, SD = .721, n = 39) and the male (M = 2.85, SD = .566, n = 16) was statistically significant at .05 (t = 2.391, df = 53, p < .05). The frequency of insomnia among the medical students showed a predominance of female students over male students. The impact on daily routines and academic performance was found significantly different between male and female students.

Keywords: Sleep deprivation, covid-19, insomnia, learner, gender difference, impact, daily routine, academic performance.

INTRODUCTION

The covid-19 pandemic has led to many unprecedented challenges, and sleep deprivation is one of those. Semyachkina *et al.* (2021) identified a new term called 'Coronasomnia' given to sleep problems during the Covid-19 pandemic. However, sleep deprivation is not a new thing as several studies have been documented before the

pandemic in relation to a variety of other factors. Wang and Bíró (2021) reported that those who are vulnerable to sleep deprivation also include college students. Azad *et al.*, (2015) found in their study that medical students due to long-study hours, and higher stress during their education are more susceptible to the deprivation of their sleep.

The covid-19 pandemic has not only adversely affected the physical and mental health of individuals, but also has caused significant changes to human lifestyle. Krishnan *et al.* (2020) mentioned in their study that in many individuals, their sleep schedule and quality of night-time sleep have been affected because of the pandemic. Altena *et al.* (2020) reported that during the lockdown period, students who lived alone and away from their family, have experienced loneliness-induced sleep disorder compared to those living with families. A recently published study reported by Xiao *et al.* (2020) reported that citizens' well-being during the COVID-19 outbreak showed that those who scored higher on a measure of social participation and a sense of belonging reported better sleep quality. A significant increase in the prevalence of insomnia during the Covid pandemic has been reported among students by Marelli *et al.* (2020). A change in daily routine besides sleep deprivation may also be caused by online classes, increased workload, prolonged screen time, or anxiety. Another study by Duong *et al.* (2021) revealed that sleep deprivation happened due to fear and anxiety about Covid-19 and eventually caused psychological distress among university students.

Sleep and academic performance are directly connected through their effect on mental function. Some of the known effects include decreased concentration/attention, impaired memory, slowed processing, worsened cognition, sequential thinking, and reduced creativity. It is further established by Okano *et al.* (2021) and Suni and Vyas (2021) that persistently poor sleepers experience significantly high daytime sleepiness often resulting in fatigue, and poor cognition abilities compared with persistently good sleepers. The Pittsburgh Sleep Quality Index (PSQI) was utilized to assess sleep quality, and students' academic performances using their mean grade point average (GPA). Another study by Maheshwari and Shaukat (2019) showed strong evidence for the link between sleep problems and a downward trend in academic performance. Sleep can also affect someone's performance by its impact on mood, energy level and behaviour and examples include excessive daytime sleepiness, poor decision-making, aggressive behaviour, irritability, hyperactivity, depression, and anxiety. Okano *et al.* (2021) and Suni and Vyas (2021) nursing students' sleep pattern was further researched by Gallego *et al.* (2021) using the 11-item sleep habits questionnaire, which revealed that 30.4% of nursing students had poor sleeping patterns.

Sleep deprivation also affects memory retention. Sleep is needed for the consolidation phase of the memory.

Inadequate sleep makes it harder for the brain to absorb and recall new information Marks (2021). Yet another research by Jalali *et al.* (2020) has also shown that poor quality of sleep can lead to an increased frequency of short sleep, which affects the learning capacity of students and hence, lead to poor academic performances at school. Sleep deprivation pattern and their effect on daily routine and academic performance among students during the Covid pandemic need further research and a solution to avoid the declining state of students' psychological well-being. The current study is an attempt to provide a comparative study to the above findings in literature with a focus being on the gender distribution of sleep deprivation diagnosed as insomnia and its impact on students' daily routine and academic performance using Pittsburgh Sleep Symptoms Insomnia (PSSQ_I) during and prior to Covid pandemic. The null hypothesis generated for this study was that the frequency of insomnia during and before the Covid pandemic has no gender preponderance among the students in one of the private medical institutions in Malaysia. The study also grossly reviews the impact of sleep deprivation diagnosed as insomnia, on students' daily routine and academic performance.

METHODOLOGY

A cross-sectional quantitative questionnaire-based survey using Pittsburgh Sleep Symptom Questionnaire-Insomnia (PSSQ_I) with 13 self-rated questions was conducted. 5 of these were about sleep deprivation and 8 were about the impact on a daily routine before and or during the Covid pandemic. To this, another 7 questions were added as self-reported feedback on their academic performance among those identified with sleep deprivation. Three strict criteria based on sleep symptoms, duration and daytime sleepiness were used to diagnose insomnia before or during the Covid-19 pandemic using a 5 points Likert scale.

The research was conducted in 2 parts in one setting. In the first part, Pittsburgh Sleep Symptom Questionnaire-Insomnia was used to assess sleep deprivation during the Covid-19 pandemic. To undertake part 2, the study added a note towards the end of the PSSQ-I questionnaire before the submission of a duly filled response. Part 1 of PSSQ-I has helped to determine the frequency of sleep deprivation as insomnia using the three criteria in scoring the result. Part 2 of PSSQ-I collected the students' self-reporting feedback to determine the impact of insomnia on their academic performance. After having completed all the items above identifying sleep deprivation, respondents were advised to proceed to provide feedback on their (responding students) academic performance using a set of seven questions.

Recruitment of students and the data collection were done on a Google Form Questionnaire, developed to have
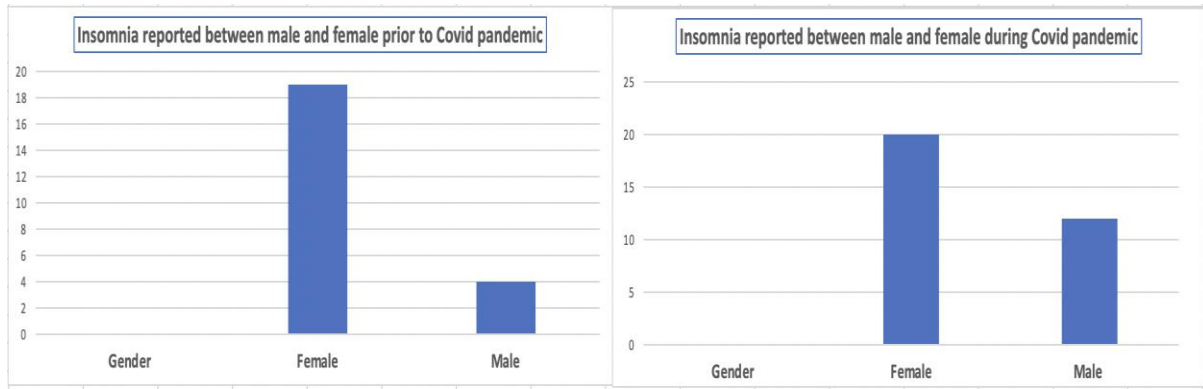
Figure 1. Distribution of Insomnia between female and male daily routines during and prior to the Covid pandemic. *AP (Academic performance) and DR (Daily routine).

Table 1. Demographic distribution of respondents diagnosed with insomnia using PSSQ_I scoring criteria based on symptoms, duration and daytime sleepiness.

	Total No.	Male	Female
No. of PSSQ_I Inventory Administered	250	-	-
Total No. of Respondent	149 (59.6%)	43 (28.85%)	106 (71.14%)
No Sleep Deprivation or insomnia	93 (62.42%)	30 (32.25%)	63 (67.74%)
Diagnosed with Insomnia Prior to Covid Pandemic	23 (15.44%)	4 (17.39%)	19 (82.60%)
Diagnosed with Insomnia During Covid Pandemic	32[1] (21.47%)	12 (37.5%)	20 (62.5%)

[1]33 responded but one was excluded during the data cleaning process due to unengaged commitment.

Part 1 as PSSQ_I and Part 2 as respondents' feedback on their academic performance using a structured format embedded in PSSQ-I Inventory. The survey forms were sent to all students using their WhatsApp group account via a class representative and an email blast with the help of the student service department. Data analysis using SPSS version 28, the mean and standard deviation was performed and applied to scale interval calculated in Microsoft Excel for ultimate level interpreted in a Likert scale for each question using a strict criterion of diagnosing Insomnia based on PSSQ_I survey inventory. Independent sample t-test was used to compare the means of Likert score (DV) diagnosed with insomnia after a questionnaire (PSSQ_I) based survey of 149 respondents categorised into two independent groups (IV) prior to Covid and during the Covid pandemic.

Statistical analysis

Statistical analysis was performed using SPSS (Version 28, SPSS Inc., Chicago, IL, USA). Data were cleaned of missing data points, unengaged students (those selecting one of the Likert scale for all items without a thought), negatively connotated items (for reverse coding) and incomplete questionnaires. Descriptive statistics were run

on the demographic independent variable (ID) of gender defined as male = 1 and female = 2 and continuous dependent variable (DV) of daily routine and academic score including mean and standard deviation. Inferential statistics independent sample t-test was employed to compare the two groups prior to Covid and during Covid measured with insomnia at the same time for its impact on students' daily routine (IDR) and academic performance (IAP).

RESULTS

Respondents return rate of 149 (59.6%) questionnaires were distributed with 43 (28.85%) male and 106 (71.14%) female students. Among these, 23 (15.44%) with insomnia prior to Covid pandemic were 4 (17.39%) male and 19 (80.60%) female students (Figure 1, Table 1). Diagnosed with insomnia during the Covid pandemic were 32 (21.47%) students and out of these 12 (37.5%) were male and 20 (62.5%) were female (Figure 1, Table 1). Looking for the impact of insomnia on daily routine, it showed a mean of 2.37 (.885) among males and 3.34 (.958) among females (Figure 1). Whereas a mean of 2.85 (.566) among males and 3.34 (.721) among females were reported with the impact of insomnia on their academic performance
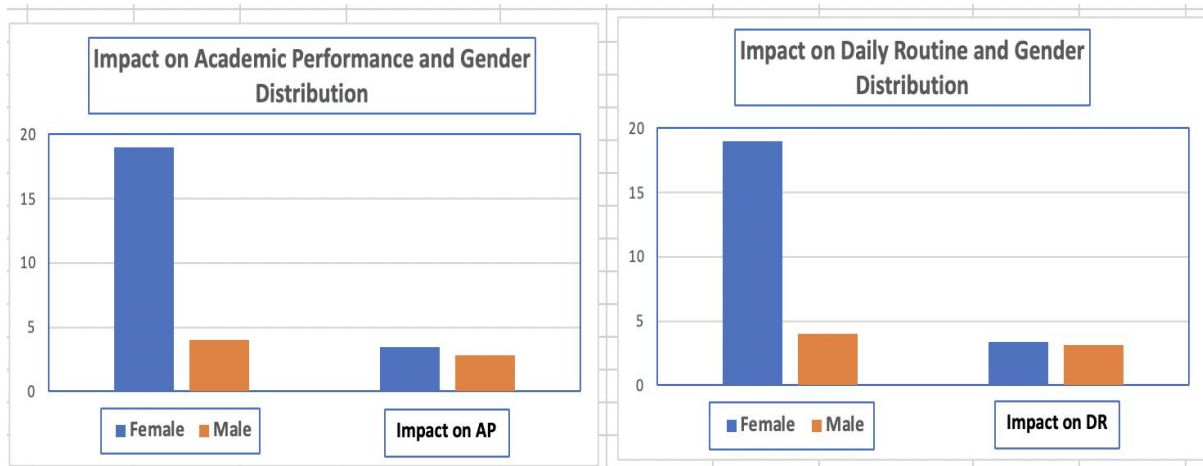
Figure 2. impact of insomnia on academic performance and daily routine distributed between male and female. *AP (Academic performance) and DR (Daily routine).

Table 2. Mean score of males and females in two groups of impacts on academic performance and daily routine.

		Levene's Test	
		F	Sig.
Impact on Academic Performance	Equal variances assumed	1.205	.277
Impact on Daily Routine	Equal variances assumed	.313	.578

Table 3. Levene's test of equality of variance as an assumption met for proceeding with independent sample t-test.

	Gender	N	Mean	Standard deviation	Standard error mean
Impact on Academic Performance	Male	16	2.85714	.566647	.141662
	Female	39	3.34066	.721479	.115529
Impact on Daily Routine	Male	16	2.37500	.885061	.221265
	Female	39	3.34936	.928877	.148739

Table 4. Independent sample t-test to determine the statistical difference of mean score (DV) between the two groups (IV) of males and females.

Variable	Female (n = 39) Mean (SD)	Male (n = 16) Mean (SD)	Mean difference (95% CI)	t statistics (df)	P value
Impact on Daily Routine	3.340 (.928)	2.375 (.885)	.974 (.428, 1.52)	3.851 (53)	.001
Impact on Academic Performance	3.349 (.721)	2.857 (.566)	.483 (.077, .889)	2.391 (53)	.020

(Figure 2).

Leven's test is insignificant at .277 and .578 for academic performance and daily routine data meets the assumption of the equality of variance for using the sample t-test statistical method (Tables 2 and 3). Result of the independent t-test showed that the mean score of respondents measured as the impact on daily routines between female (M = 3.349, SD = .928, n = 39) and male (M = 2.370, SD = .885, n = 16) (Figure 2) is statistically significant at .05 level of significance (t = 3.851, df = 53, p < .001) (Table 4). Similarly, the finding of mean score measured as the impact on students' academic performance between female (M = 3.340, SD = .721, n = 39) and male (M = 2.857 SD = .566, n = 16) (Figure 2) is significant at t = 2.391, df = 53 and p < 0.05 (Figure 2, Table 4). The effect size was also calculated using Glass's

Table 5. Effect size of independent sample t-test to look at the practical or clinical impact of the test.

		Point Estimate
Impact on Daily Routine	Cohen's d	1.063
	Glass's delta	1.049
Impact on Academic Performance	Cohen's d	.710
	Glass's delta	.670

Table 6. PSSQ_I Score system to assign a diagnosis of insomnia based on the criterion used.

PSSQ_I Score process to proceed	Yes	No
Sleep symptom criterion		
Is the answer to at least one of the questions 1, 2 or 5 "Frequently" or "always"?	☐	☐
Duration Criterion		
Is the answer to at least one of the questions 1, 2 or 5 "≥ 4 weeks"?	☐	☐
Day time impairment criterion		
Is the answer to at least one of the questions 6-13 "Quite a bit" or "Extremely"?	☐	☐
If the answer to each question above is "Yes" assign a diagnosis of insomnia disorder	Insomnia disorder	☐
If the answer to one or more questions above is "No" do not assign a diagnosis of insomnia disorder	No insomnia disorder	☐

delta method besides Cohen's d since the sample size and the standard deviation was different in male and female groups (Table 5).

DISCUSSION

The analysis of 149 respondents' data suggests that the majority 93 (62.42%) were not reported to have any sleep deprivation. However, the rest of the 23 (15.44%) were diagnosed to have insomnia prior to Covid pandemic (Table 1) and another 33 (22.15%) students were diagnosed to have insomnia during the Covid pandemic (Table 1). A strict criterion using PSSQ_I inventory based on symptoms, duration and daytime sleep impairment helped to determine the diagnosis of insomnia among students (Table 6). There has been a lack of consistency in the studies of gender differences in sleep quality. Buysse *et al.* (2008) found an association between the female gender with high Pittsburgh Sleep Quality Index (PSQI) scores. A recent school-based study with 7,507 children and adolescents by Zhang *et al.* (2016) showed a higher prevalence of insomnia symptoms in girls than boys. Zhang and Wing (2006) reported that among non-

modifiable factors, gender is seen to play a significant role, as many studies report a higher rate of sleep problems in females. Fatima *et al.* (2016) reported that 3,778 young adults (20.6 ± 0.86 years) were found to have a higher prevalence of poor sleep quality in females than males (65.1% vs. 49.8%) and that the gender difference in poor sleep is independent of depression, socio-demographics, and lifestyle factors.

Considering a line of evidence on morphologic differences between males and females in circadian clock genes, respiratory control, the action of sex hormones, stress responses on sleep mechanisms, and social patterning of behaviours that affect sleep, the difference in sleep quality between genders is likely real as reported by Mong and Cusmano (2016). The gender difference in sleep problems was mainly attributed to the primacy of affective disorders and socioeconomic disparities, suggesting that these may be the pathway variables through which gender disparity in poor sleep is exhibited as reported by Bruck and Astbury (2012). Benca *et al.* (1992) reported the association between sleep and affective disorders is well-established, and disturbed sleep is considered one of the main symptoms of clinical anxiety and depressive disorders. Several factors may have been

the reason for mental stress during a pandemic where daily routine and academic achievement becomes uncertain.

Barad *et al.* (2022) reported that sleep is one of the important aspects to be deranged with physical or mental stress. During the current COVID-19 pandemic, university students suffer from a high level of stress and disturbed sleep, and this has shown its impact on daily routine and academic performance. Hassan and Baloch (2020) in their innovative research on Bedside teaching online during the Covid-19 pandemic promoted the idea that faculty besides, their teaching and assessing responsibilities have an added responsibility to research and publish for sharing with the global community. Data analysis of the current study using an independent t-test showed that the mean score of respondents measured as the impact on daily routines between females and males is statistically significant at .05 level of significance (Table 4). Similarly, the finding of mean score measured as the impact on students' academic performance between females and males (Table 4) has been found significant. Current study finding of insomnia has been found at par with literature findings on the impact of insomnia on daily routine. However, there are only a few published research to measure the impact of insomnia on students' academic performance due to sleep deprivation Maheshwar and Shaukat (2021) and Jalili *et al.* (2020). To capture how much it practically affects daily routine and students' academic performance besides the statistical significance, an effect size was also calculated.

Cohen's d is commonly used to measure the effect size. However, Cohen's d is the appropriate effect size measure if two groups have similar standard deviations and are of the same size. And for different standard deviations of the two groups, the appropriate method to calculate effect size is Glass's delta method. Effect size measures the magnitude of difference as to how strong an observed effect is. A commonly used interpretation for both Cohen's d and Glass's delta is to refer to effect sizes as small (d = 0.2), medium (d = 0.5), and large (d = 0.8) based on benchmarks for both of these methods (Table 5). The current study showed Glass's delta point estimate = 1.049 and .670 as an impact of sleep deprivation on daily routine activities and academic performance as a large and moderate effect size respectively.

CONCLUSION

In conclusion, poor sleep quality is a major challenge among students, and more than half of the students were found to have poor sleep quality predominantly in female subjects. However, the gender difference in sleep deprivation and its impact on daily routine and academic performance could not be attributed to the underlying cause of affective disorders in females and rather stress

outbreaks like the covid pandemic can be an attributing factor. The impact measured as changes both, in daily routines and academic performance, was found significantly different between the male and female students. Female students with higher means were found to have more impact than male students. Longitudinal studies are highly recommended to further explore sleep deprivation because of a Covid-19-like pandemic to help implement effective measures in the future.

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REFERENCES

Altena E, Baglioni C, Espie C, Ellis JG, Gavriloff D, Holzinger B, Frase L, Riemann D (2020). Dealing with sleep problems during home confinement due to the COVID-19 outbreak: Practical recommendations from a task force of the European CBT-I Academy [Internet]. J. Sleep Res. Wiley; Vol. 29.

Azad MC, Fraser K, Rumana N, Abdullah AF, Shahana N, Hanly PJ, Turin TC (2015). Sleep Disturbances among Medical Students: A Global Perspective. J. Clin. Sleep Med. 11(1): 69-74.

Barad S, Sethi M, Lata M, Jha PK (2022). Relationship of perceived sleep quality and stress among university students: An online survey during the COVID-19 pandemic. Natl. J. Physiol. Pharm. Pharmacol. 12(09):1485-1488.

Benca RM, Obermeyer WH, Thisted RA, Gillin JC (1992). Sleep and psychiatric disorders. A meta-analysis. Arch. Gen. Psychiatry. 49:651-668; discussion 669-670.

Bruck D, Astbury J (2012). Population study on the predictors of sleeping difficulties in young Australian women. Behav Sleep Med. 10:84-95.

Buysse DJ, Hall MR, Strollo PJ, Kamarck TW, Owens J, Lee L, Reis SE, Matthews KA (2008). Relationships between the Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS), and clinical/polysomnographic measures in a community sample. J. Clin. Sleep Med. 4:563-571.

Duong CD (2021). The impact of fear and anxiety of Covid-19 on life satisfaction: Psychological distress and sleep disturbance as mediators. Personality and Individual Differences [Internet]. Aug; 178:110869.

Fatima Y, Suhail AR, Najman JM, Mamun AA (2016). Exploring gender difference in sleep quality of young adults: Findings from a large population study, Clin. Med. Res. 14(3-4):138-144.

Gallego-Gómez JI, González-Moro MTR, González-Moro JMR (2021). Relationship between sleep habits and academic performance in university Nursing students. BMC Nurs 20, 100.

Hassan S, Baloch H (2020). Online Small Group Clinical Be (side) Teaching (BeST) Using Authentic Scenario with Hypothetico-deductive Approach and Gagne Instructional Model. Educ. Med. J. 12(3):55-64. doi:10.21315/eimj2020.12.3.7.

Jalali R, Khazaei H, Paveh BK, Hayrani Z, Menati L (2020). The Effect of Sleep Quality on Students' Academic Achievement [Internet]. Advances in medical education and practice. Dove; [Cited Jul15, 2021].

Krishnan V, Gupta R, Grover S, Basu A, Tripathi A, Subramanyam A (2020). Changes in sleep pattern and sleep quality during COVID-19 lockdown. Indian J. Psychiatr. [Internet]. 62(4):370.

Maheshwari G, Shaukat F (2019). Impact of Poor Sleep Quality on the Academic Performance of Medical Students [Internet]. Cureus. Cureus; [Cited 2021Jul15].

Marelli S, Castelnuovo A, Somma A, Castronovo V, Mombelli S, Bottoni D (2020). Impact of COVID-19 lockdown on sleep quality in university students and administration staff. J. Neurol. [Internet]. Jul 11; 268(1):8-15.

Marks H (2016). Sleep deprivation and memory loss [Internet]. WebMD. WebMD; 2021 [Cited 2021Oct24].

Mong JA, Cusmano DM (2016). Sex differences in sleep: impact of biological sex and sex steroids. Phil. Trans. R. Soc. B 371, 20150110

Okano K, Kaczmarzyk JR, Dave N, Gabrieli JDE, Grossman JC (2021). Sleep quality, duration, and consistency are associated with better academic performance in college students [Internet]. Nature News. Nature Publishing Group; [Cited 2021 Jul 15].

Semyachkina-Glushkovskaya O, Mamedova A, Vinnik V, Klimova M, Yu T, Zhu D (2021). Brain mechanisms of COVID-19-sleep disorders [Internet]. Preprints. Preprints; [Cited 2021 Jul 15].

Suni Eric, Vyas Nilong (2021). Can School Performance Be Improved With Good Sleep? [Internet]. Sleep Foundation. [cited 2021 Jul 15].

Wang F, Bíró É (2021). Determinants of sleep quality in college students: A literature review [Internet]. EXPLORE. Elsevier BV; 17:170-7.

Xiao H, Zhang Y, Kong D, Li X. S, Yang N (2020). Social Capital and Sleep Quality in Individuals Who Self-Isolated for 14 Days During the Coronavirus Disease 2019 (COVID-19) Outbreak in January 2020 in China [Internet]. Vol. 26, Medical Science Monitor. International Scientific Information, Inc.

Zhang J, Chan NY, Lam SP, Li SX, Liu Y, Chan JWY, Kong APS, Ma RCW, Chan KCC, Li AM, Wing Y (2016). Emergence of Sex Differences in Insomnia Symptoms in Adolescents: A Large-Scale School-Based Study. Sleep 39(8):1563-1570.

Zhang B, Wing YK (2006). Sex differences in insomnia: a metanalysis. Sleep. 29:85-93.