Prevalence of insomnia and relationship with depression, anxiety and stress among Jazan University students: A cross-sectional study

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Abstract: Insomnia, a common sleep disorder, is a public health concern, as it can lead to physical and mental exhaustion. The objective of this study was to determine the prevalence of insomnia and the common associated risk factors among students at Jazan University, in the Jazan region of southwestern Saudi Arabia. An observational cross-sectional study was conducted among a sample of 712 students. A pre-designed, structured questionnaire was used to collect the relevant information pertaining to the study variables. The overall prevalence of insomnia in the study was 19.3%. There was no significant difference in prevalence between males and females (p-value = 0.5). Participants from health colleges had greater prevalence of insomnia than those from art and Islamic colleges and science colleges (p-value = 0.03). Symptoms of depression, anxiety, and stress were significant risk factors for insomnia (p-value = 0.005, 0.000, 0.000, respectively). Insomnia is widely prevalent among Jazan University students. Symptoms of depression, anxiety, and stress, together with a noisy environment around the sleeping area, are important correlates. Screening for mental illnesses among university students is highly recommended.

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PUBLIC INTEREST STATEMENT
Sleep problems have a great impact on the students’ life including the academic achievement. High prevalence of insomnia among university students was reported in different previous studies. Changes in the university academic atmosphere, academic overload, competitions, and concerns about the future are most commonly implicated. In addition, there are few health promotion recommendations on good sleep health to educate the general public and college students about the importance of sleep for overall health. Results showed that the problem of insomnia is widely prevalent among Jazan University students and the symptoms of depression, anxiety, and stress, together with a noisy environment around the sleeping area, are important correlates. The current study examined the relationship between the problem of insomnia and depression, anxiety and stress among college students of Jazan University.
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1. Background
Insomnia, a common sleep disorder, is a public health concern, as it can lead to physical and mental exhaustion. Insomnia is defined as the inability to initiate and/or maintain sleep, and/or poor sleep quality that results in daytime impairment (National Institutes of Health, 2011). Students are more vulnerable to the problem of insomnia due to many factors. Changes in the university academic atmosphere, academic overload, competitions, and concerns about the future are most commonly implicated (Jensen, 2003; Lund et al., 2010; Taylor et al., 2013).

The prevalence of insomnia among university students was explored in a systemic analysis of seven studies that revealed significantly higher prevalence, ranging from 9.4% to 38.2% (Jiang et al., 2015). Furthermore, considerably higher prevalence of insomnia among university students was reported in the United States (Gaultney, 2010), Libya (Tahe al et al., 2012), Egypt (Ibrahim & Abouelezz, 2011), and Nigeria (James et al., 2011). However, limited studies have been conducted among university students in the Kingdom of Saudi Arabia (KSA), and they are mainly among medical students (Alsaggaf et al., 2016; Mahfouz et al., 2013; Siddiqi et al., 2016).

Several risk factors have been reported in association with insomnia. Demographic factors such as age and gender and social factors such as sleeping hygiene, physical illnesses and mental disorders have been identified in different studies (Ohayon, 2002; Roth, 2007). Family history of mental health problems such as depression or anxiety places students at higher risk of insomnia (Goldman-Mellor et al., 2014). Students who have coexisting psychiatric disorders or are clinically anxious and highly stressed have been reported as having a high prevalence of insomnia in a considerable amount of research (Basta et al., 2007; Forbes et al., 2008; Groves, 2017; Storch et al., 2008).

Current evidence indicates that insufficient and poor-quality sleep represents a high-risk factor for health outcomes including quality of life in both Western and developing countries (Altevogt & Colten, 2006; Danchia et al., 2018; Lee et al., 2009). The impact of insomnia on students’ lives has been reported in many studies. Insomnia is commonly presented with poor-quality sleep and daytime somnolence, which have a negative impact on health and overall wellbeing (Taylor et al., 2013). Students’ academic performance has been found to be affected in many studies (Gilbert & Weaver, 2010; Hershner & Chervin, 2014; Taylor et al., 2013). Moreover, students with insomnia have been reported to have increased risk of substance use, suicidal ideation, smoking, and alcohol use (Hershner & Chervin, 2014; McKnight-Eily et al., 2011; Roane & Taylor, 2008; Taylor et al., 2013). Insomnia can even decrease students’ driving performance, which leads finally to an increase in the risk of road traffic accidents (Hershner & Chervin, 2014).

Given the deleterious impacts of insomnia on the academic performance and quality of life of university students and the paucity of data about the prevalence and risk factors in the Jazan region, the purposes of this study were to determine (1) the prevalence of insomnia among Jazan University students and (2) the common risk factors associated with insomnia among them.

2. Materials and methods

2.1. Setting, design, and population
The study utilized a cross-sectional descriptive design. Jazan University students from different colleges were enrolled in the study. Jazan University has 23 faculties with more than 56,000 students. It is one of the leading higher education institutions in the Kingdom of Saudi Arabia. All students who had registered for the academic year were considered as the study population.
2.2. Sampling procedures
The estimated student sample size was 712 based on the formula used for cross-sectional study designs. The following parameters were used for the sample size calculation: prevalence of insomnia = 50%, 95% confidence interval (CI), error below 4%, and a non-response rate of 20%. A multistage cluster random sampling technique was used. Two colleges were selected from each of the three clusters, namely, health science colleges, other science colleges, and art and humanity colleges. A random sample was selected from each selected college proportionally.

2.3. Data collection and instruments
A pre-designed, structured questionnaire was used to collect the relevant information pertaining to the study variables. The questionnaire had four sections: the first section consisted of questions regarding students' age, gender, college living standards, place of residence, and grade point average (GPA). The second section was for the Insomnia Severity Index (ISI) to evaluate the presence of insomnia among university students. The third section consisted of a set of questions to evaluate the behavioral and environmental factors related to insomnia, such as khat chewing, smoking, caffeine consumption, napping, and environmental noise. The fourth section was for the Depression Anxiety Stress Scale—21 (DASS-21) to determine the presence of any psychological risk factors associated with insomnia.

The Insomnia Severity Index (ISI) is a 7-item screening tool designed to evaluate insomnia (Bastien et al., 2001). It is distributed by Mapi Research Trust on behalf of its copyright holder, Prof. Charles Morin. Each item is rated on a 0–4 scale, and the total score ranges from 0 to 28. Scores are typically classified as No Insomnia (0–7), Sub-threshold Insomnia (8–14), Clinical Insomnia—Moderate (15–21), and Clinical Insomnia—Severe (22–28). Participants were further categorized into a No Insomnia Group (i.e., ISI ≤ 14 [No and Sub-threshold Insomnia]) and an Insomnia Group (i.e., ISI ≥ 15 [Clinical Insomnia—Moderate and Severe]) based on a diagnostic utility study (Morin et al., 2011).

The Depression, Anxiety and Stress Scale—21 (DASS-21) is a set of three scales designed to assess depression, anxiety, and stress states. Each scale contains seven items, divided into subscales with similar content. Each item includes a statement and four short response options to indicate severity, ranging from 0 (“Did not apply to me at all”) to 3 (“Applied to me very much, or most of the time”). The total score of each scale is multiplied by 2 to yield equivalent scores to the full DASS-42 (Lovibond & Lovibond, 1995). Cut-off scores derived from a set of severity ratings proposed by Lovibond and Lovibond (1995) were utilized. A validated Arabic version of DASS-21 developed by Moussa et al. (2017) was used.

2.4. Data analysis and management
Collected data were entered and analyzed using SPSS version 20.0. Descriptive statistics, as well as inferential statistics, were used for data analysis. Simple tabulation, frequencies, and percentages were used to present the data. The Chi-squared test was performed to determine the associations between individual categorical variables and the outcome variable (insomnia). A logistic regression model was used to predict insomnia using a set of sociodemographic and clinical predictors. A p-value less than 0.05 was used as the cut-off level for statistical significance.

2.5. Ethical approval and consent to participate
Participants were informed that they had the right to withdraw from the study at any time, their information would be kept anonymous, and the data collected would only be used for scientific purposes. Further, a written informed consent was obtained from each participant after explaining the purpose of the study. Also, permission was obtained from administration of all colleges that participated in the study before data collection. Finally, ethical approval for this study was provided by the Institutional Review Board of Jazan University.

3. Results
A total of 712 students were contacted to participate in this study, of whom 669 (94%) signed the consent. Out of the total, 50% (335) were male and 50% (334) were female. The age of the
participants was between 18 and 26 years (mean: 22.05 ± 1.61 years). The participants were from different colleges; 51.3% were from science colleges, 36.3% were from art and Islamic colleges, and 12.4% were from health colleges. For other demographic characteristics, refer Table 1.

Table 2 shows the prevalence of insomnia according to the Insomnia Severity Index (ISI) score. The overall prevalence of insomnia in the study was 19.3%. There was no significant difference in prevalence between males and females (p-value = 0.5). Participants from health colleges had higher prevalence of insomnia than those from Art and Islamic colleges and science colleges (p-value = 0.03). Having a high GPA reduced the odds of having insomnia but did not reach statistical significance (p-value = 0.83). Prevalence of insomnia did not differ with college level or living standards (p-value = 0.18 and 0.25, respectively).

Table 3 presents the risk factors associated with insomnia using bivariate regression analysis. Symptoms of depression, anxiety, and stress were significant risk factors (p-value = 0.005, 0.000, 0.000, respectively). Moreover, a noisy environment appeared to be a significant risk factor for insomnia (p-value = 0.017). Substance use, including smoking, khat chewing, and caffeinated drink consumption, appeared not to be significantly related to insomnia (p-value = 0.16, 0.67, 0.20).

| Table 1. Sociodemographic characteristics of the participants |
|-------------------------------------------------------------|
| Characteristics                                             | Male N (%) | Female N (%) | Total N (%) |
| Age Group (n = 666)                                         | 118–22     | 149 (44.6)   | 273 (41)    |
| Marital Status (n = 668)                                    | Single     | 321 (96.4)   | 566 (84.7)  |
| College Specialty (n = 669)                                 | Health colleges | 23 (6.9) | 60 (17.9) | 83 (12.4) |
| College Level (n = 665)                                     | level 1-4  | 61 (18.3)    | 138 (42.6)  |
| Grade Point Average (n = 631)                               | 5.0-4.50   | 40 (12.6)    | 101 (32.3)  |
| Place of Residence (n = 667)                                | Rural      | 212 (63.7)   | 422 (63.3)  |
| Living Standard (n = 667)                                   | Low        | 35 (10.5)    | 54 (8.1)    |
|                                                           | Moderate   | 284 (85.3)   | 458 (82.2)  |
|                                                           | High       | 14 (4.2)     | 65 (9.7)    |
|                                                           | Total      | 334 (100)    | 669 (100)   |
Table 4 presents the risk factors of insomnia following multivariate analysis. Symptoms of stress, anxiety, and depression, and a noisy environment were found to be significantly associated with insomnia. Students with stress were 2.5 times more likely to have insomnia compared to those without stress (95% CI: 1.51–4.24; p-value = 0.000). Furthermore, students who experienced a noisy environment were 1.6 times likelier to have insomnia compared to those with quiet environment (95% CI: 1.03–2.50; p-value = 0.035). For other variables, refer Table 4.

4. Discussion
The prevalence of insomnia varies depending on its definition, the screening tool designed to evaluate insomnia, and the population studied (Darchia et al., 2018). In general, 30–50% of the adult population has one or more of the symptoms to diagnose insomnia, and 5–10% of adults present with a clinical syndrome of insomnia (Riemann et al., 2015). This study
### Table 3. Association between insomnia and some selected risk factors

| Characteristic | No Insomnia N (%) | Insomnia N (%) | COR (95%CI) | p-value |
|----------------|------------------|---------------|-------------|---------|
| **Caffeine (n = 643)** |                  |               |             |         |
| No             | 146 (83.5)       | 29 (16.5)     | 1           | 0.201   |
| Yes            | 369 (79)         | 98 (21)       | 1.35 (0.85–2.13) |         |
| **Smoking (n = 641)** |                  |               |             |         |
| No             | 417 (81.4)       | 95 (18.6)     | 1           | 0.162   |
| Yes            | 98 (76)          | 31 (24)       | 1.39 (0.88–2.20) |         |
| **Khat use (n = 669)** |                  |               |             |         |
| No             | 456 (81)         | 107 (19)      | 1           | 0.670   |
| Yes            | 84 (78)          | 22 (20.8)     | 1.12 (0.88–2.20) |         |
| **Nap (n = 641)** |                  |               |             |         |
| No             | 117 (78)         | 33 (22)       | 1           | 0.443   |
| Yes            | 397 (80.9)       | 94 (19.1)     | 0.84 (0.54–1.31) |         |
| **Noise (n = 642)** |                  |               |             |         |
| No             | 284 (83.8)       | 55 (16.2)     | 1           | 0.017*  |
| Yes            | 231 (76.2)       | 72 (23.8)     | 1.61 (1.09–2.38) |         |
| **Depression (n = 649)** |                  |               |             |         |
| No             | 257 (85.1)       | 45 (14.9)     | 1           | 0.005*  |
| Yes            | 265 (76.4)       | 82 (23.6)     | 1.77 (1.18–2.64) |         |
| **Anxiety (n = 650)** |                  |               |             |         |
| No             | 244 (88.1)       | 33 (11.9)     | 1           | 0.000*  |
| Yes            | 279 (74.8)       | 94 (25.2)     | 2.49 (1.62–3.84) |         |
| **Stress (n = 646)** |                  |               |             |         |
| No             | 371 (86.9)       | 56 (13.1)     | 1           | 0.000*  |
| Yes            | 150 (68.5)       | 69 (31.5)     | 3.05 (2.04–4.55) |         |

Note: *Statistically significant.

### Table 4. Multivariate analysis of the association between insomnia and some selected clinical and other variables

| Variables               | Estimate | S.E.  | p-value | AOR | 95% C.I.   | AOR  |
|-------------------------|----------|-------|---------|-----|------------|-----|
|                         |          |       |         |     | Lower      | Upper|
| Gender (Female)         | −0.021   | 0.237 | .928   | 0.98 | 0.62       | 1.56|
| Noise (Yes)             | 0.474    | 0.225 | .035*  | 1.61 | 1.03       | 2.50|
| Depression (Yes)        | -0.297   | 0.277 | .284   | 0.74 | 0.43       | 1.28|
| Anxiety (Yes)           | 0.621    | 0.285 | .029*  | 1.86 | 1.06       | 3.26|
| Stress (Yes)            | 0.928    | 0.263 | .000*  | 2.53 | 1.51       | 4.24|
| Smoking (Yes)           | 0.265    | 0.258 | .306   | 1.30 | 0.79       | 2.16|
| Nap (Yes)               | -0.321   | 0.254 | .205   | 0.73 | 0.44       | 1.19|
| Caffeine (Yes)          | 0.206    | 0.254 | .416   | 1.23 | 0.75       | 2.02|
| Art and Islamic colleges# | −0.723  | 0.327 | .027*  | 0.49 | 0.26       | 0.92|
| Science colleges#       | −0.170   | 0.345 | .623   | 0.84 | 0.43       | 1.66|
| Gender (1)              | −0.021   | 0.237 | .928   | 0.98 | 0.62       | 1.56|

Note: # Health-related colleges are the reference.

*Statistically significant.
revealed an overall prevalence of insomnia of 19.3% among the university students of the Jazan Region. This prevalence was within the range from 9.4% to 38.2% shown in a systematic review of seven studies among university students by Jiang et al. (2015) but lower than the prevalence in Egypt (Ibrahim & Abouelezz, 2011) and Libya (Taher et al., 2012). In comparison with the local studies done in Saudi Arabia, the prevalence in this study was lower than that reported by Alsaggaf et al. (2016), Mohfouz et al. (2013), and Siddiqui et al. (2016). Possible explanations for this discrepancy include the difference in sociodemographic characteristics, such as the college that students were enrolled in, and the scoring system used for case definition.

In contrast to the present study, previous studies reported a significant association between insomnia and gender (Abdulgani et al., 2012; Gaultney, 2010) and marital status (Haile et al., 2017). This dissimilarity may be attributed to the differences in the sample size and the study population.

Living conditions and a noisy environment around the sleeping area were found to be important correlates to insomnia in this study. Similar results were reported by Gaultney (2010), Veldi et al. (2005), and Esfami Akbar (2012). The environment around the sleeping area is very important for the initiation and maintenance of sleep, and failure to get enough sleep causes daytime sleepiness, reduced cognitive ability, and decreased learning capacity.

The field of study was found to be a significant risk factor for insomnia. Students from health colleges were found to be at greater risk of insomnia compared to students from other fields of study. Studying at art and Islamic colleges reduced the odds of insomnia by 40%. Similar results were reported by Haile et al. (2017) in their study of the association between insomnia and academic performance among Ethiopian university students. In the contrary, other researchers did not find any association (Esfami Akbar, 2012; Ibrahim & Abouelezz, 2011). Studying in health colleges is perceived as being stressful, which may have a negative effect on students’ cognitive functioning and learning outcomes.

Students with symptoms of mental health problems are at greater risk of lower social and academic performance and worse long-term outcomes, such as academic failure and dissatisfaction (Kessler et al., 2005). Therefore, it is very important to discover any risk factors for mental health problems in hopes of developing prevention programs to prevent any negative outcomes in the future. It is reported that as many as 19% to 74.4% of people with insomnia symptoms report mental health problems (Ohayon & Roth, 2003; Taylor et al., 2013). However, it is unknown whether insomnia symptoms lead to mental health consequences or the mental health problems lead to insomnia. In this study, there was a significant correlation between mental health symptoms of depression, anxiety, and stress, and the presence of insomnia. These results are consistent with those of other studies conducted in the US and Hong Kong (Ford & Kamerow, 1989; Wong & Fielding, 2011). Also, the results of this study are in keeping with the results of a study done among students accessing campus health-care university clinics in Canada and the American Midwest and Northwest (Mackenzie et al., 2011).

The impact of insomnia on academic performance has been examined in different studies. Hershner and Chervin (2014), Gilbert and Weaver (2010), and Pagel and Kwiatkowski (2010) concluded that insomnia is significantly associated with reduced academic performance. In this study, having a high GPA was associated with reduced odds of having insomnia but did not reach statistical significance. This discrepancy might be due to the difference in students' colleges, educational level, and pattern of sleep disorders, as a higher percentage of students with low academic performance screened positive for different patterns of sleep disorders, including obstructive sleep apnea, restless leg syndrome, insomnia, hypersomnia, and circadian rhythm sleep disorders (Gaultney, 2010).

4.1. Strengths and limitations
The prevalence of insomnia in this study was measured based on the Insomnia Severity Index (ISI) questionnaire, which is a reliable and useful tool to measure the type and severity of insomnia (Bastien
et al., 2001). The results of ISI are comparable to the results of polysomnography (PSG), which is considered as the gold standard for quantitative and qualitative assessment of insomnia (BaHammam et al., 2011). In addition, students from different colleges were recruited in this study, unlike other previous studies that focused only on medical colleges (Alsagaf et al., 2016; Mahfouz et al., 2013; Siddiqui et al., 2016). However, the use of a cross-sectional institutional questionnaire limits external validity and does not allow differentiation between mental health symptoms as causes and insomnia as an effect. More longitudinal and experimental studies are needed to allow attribution of causality.

5. Conclusions
Insomnia is widely prevalent among Jazan University students. Symptoms of depression, anxiety, and stress, together with a noisy environment around the sleeping area, are important correlates. Screening for mental illnesses, including depression and anxiety, among university students is highly recommended.

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Competing interests
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References
Abdulghani, H. M., Alrowais, N. A., Bin-Saad, N. S., Al-Soubaie, N. M., Haji, A. M. A., & Alhaqwi, A. I. (2012). Sleep disorder among medical students: Relationship to their academic performance. Medical Teacher, 34 (sup1), S37–41. https://doi.org/10.1111/j.1365-2923.2012.656749

Alsagaf, M. A., Wali, S. O., Mardad, R. A., & Mardad, L. A. (2016). Sleep quantity, quality, and insomnia symptoms of medical students during clinical years: Relationship with stress and academic performance. Saudi Medical Journal, 37(2), 173. https://doi.org/10.15537/smj.2016.2.14288

Altevogt, B. M., & Colten, H. R. (2006). Sleep disorders and sleep deprivation: An unmet public health problem. National Academy Press.

BaHammam, A., Sharif, M., Gacuan, D. E., & George, S. (2011). Evaluation of the accuracy of manual and automatic scoring of a single airflow channel in patients with a high probability of obstructive sleep apnea. Medical Science Monitor: International Medical Journal of Experimental and Clinical Research, 17(2), MT13. https://doi.org/10.12659/MSM.881379

Basta, M., Chrousos, G. P., Velo-Bueno, A., & Vgontzas, A. N. (2007). Chronic insomnia and the stress system. Sleep Medicine Clinics, 2(2), 279–291. https://doi.org/10.1016/j.smc.2007.04.002

Bastien, C. H., Vallières, A., & Morin, C. M. (2001). Validation of an insomnia severity index as an outcome measure for insomnia research. Sleep Medicine, 2(4), 297–307. https://doi.org/10.1016/S1389-9457(00)00065-4
Darchia, N., Oniani, N., Sakhelashvili, I., Supatashvili, M., Basishvili, T., Elizoshvili, M., Maisuradze, L., & Cerveno, K. (2018). Relationship between sleep disorders and health related quality of life—Results from the Georgia SOMNUS study. International Journal of Environmental Research and Public Health, 15(8), 1588. https://doi.org/10.3390/ijerph15081588

Eslami Akbar, R. (2012). The prevalence of sleep disorder and its causes and effects on students residing in Jzhrom University of Medical Sciences Dormitories, 2008. Journal of Jzhrom University of Medical Sciences, 9(4), 13.

Forbes, E. E., Bertocci, M. A., Gregory, A. M., Ryan, N. D., Axelson, D. A., Birmaher, B., & Dahl, R. E. (2008). Objective sleep in pediatric anxiety disorders and major depressive disorder. Journal of the American Academy of Child and Adolescent Psychiatry, 47(2), 148–155. https://doi.org/10.1097/chi.0b013e31815cd9bc

Ford, D. E., & Kamerow, D. B. (1989). Epidemiologic study of sleep disturbances and psychiatric disorders: An opportunity for prevention? JAMA, 262(11), 1479–1484. https://doi.org/10.1001/jama.1989.0343011069030

Gaultney, J. F. (2010). The prevalence of sleep disorders in college students: Impact on academic performance. Journal of American College Health, 59(2), 91–97. https://doi.org/10.1080/07448481.2010.483708

Gilbert, S. P., & Weaver, C. C. (2010). Sleep quality and academic performance in university students: A wake-up call for college psychologists. Journal of College Student Psychotherapy, 24(4), 295–306. https://doi.org/10.1087/201058225.2010.509245

Goldman-Mellor, S., Gregory, A. M., Caspi, A., Harrington, H., Parsons, M., Poulton, R., & Moffitt, T. E. (2014). Mental health antecedents of early midlife insomnia: Evidence from a four-decade longitudinal study. Sleep, 37(11), 1767–1775. https://doi.org/10.5665/sleep.4168

Groves, M. (2017). Mental health issues in United Kingdom higher education students. Journal of Health and Social Care Improvement.

Haile, Y. G., Alemu, S. M., & Habbewold, T. D. (2017). Insomnia and its temporal association with academic performance among university students: A cross-sectional study. BioMed Research International, 2017, 1–7. https://doi.org/10.1155/2017/7254236.

Hewitt, S. D., & Chervin, R. D. (2014). Causes and consequences of sleepiness among college students. Nature and Science of Sleep, 6, 73. https://doi.org/10.2147/NSS.S62907

Ibrahim, J. M., & Abouelezz, N. F. (2011). Relationship between insomnia and computer use among students at Ain Shams University, Cairo, Egypt. Egyptian Journal of Community Medicine, 29(2).

James, B. O., Omoaregba, J. O., & Igerbose, O. O. (2011). Prevalence and correlates of poor sleep quality among medical students at a Nigerian University. Annals of Nigerian Medicine, 5(1), 1. https://doi.org/10.4103/0331-3131.84238

Jensen, D. R. (2003). Understanding sleep disorders in a college student population. Journal of College Counseling, 6(1), 25–34. https://doi.org/10.1002/j.2161-1882.2003.tb00224.x

Jiang, X.-L., Zheng, X.-Y., Yang, J., C.-P, Y., Chen, Y.-Y., Zhang, Z.-G., & Xiao, Z.-J. (2013). A systematic review of studies on the prevalence of insomnia in university students. Public Health, 129(12), 1579–1584. https://doi.org/10.1016/j.puhe.2015.07.030

Kessler, R. C., Chiu, W. T.,Demler, O., & Walters, E. E. (2005). Prevalence, severity, and comorbidity of 12-month DSM-IV Disorders in the national comorbidity survey replication. Archives of General Psychiatry, 62(6), 617–627. https://doi.org/10.1001/archpsyc.62.6.617

Lee, M., Choh, A. C., Demerath, E. W., Knutson, K. L., Duran, D. L., Sherwood, R. J., Sun, S. S., Chumlea, W. M., Towne, B., & Siervoel, R. M. (2009). Sleep disturbance in relation to health-related quality of life in adults: The Fels Longitudinal Study. JNHA-The Journal of Nutrition, Health and Aging, 13(6), 576–583. https://doi.org/10.1007/s12603-009-0110-1

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the beck depression and anxiety inventories. Behaviour Research and Therapy, 33(3), 335–343. https://doi.org/10.1016/0005-7967(94)00075-4

Lund, H. G., Reider, B. D., Whiting, A. B., & Roxanne Prichard, J. (2010). Sleep patterns and predictors of disturbed sleep in a large population of college students. Journal of Adolescent Health, 46(2), 124–132. https://doi.org/10.1016/j.jadohealth.2009.06.016

Mockenzi, S., Wiegel, J. R., Mundt, M., Brown, D., Soewyc, E., Heiligenstein, E., Harohan, B., & Fleming, M. (2011). Depression and suicide ideation among students accessing campus health care. American Journal of Orthopsychiatry, 81(1), 101–107. https://doi.org/10.1111/j.1939-0025.2010.01077.x

Mafhouz, M. S., Ageely, H., Al-Sarari, M., Aref, L. A., Hejje, N. H., Al-attas, S. A., & Bani, I. A. (2013). Sleep quality among students of the faculty of medicine in Jazan University, Saudi Arabia. Middle-East Journal of Scientific Research, 16(4), 508–513.

McKnight-Eily, L. R., Eaton, D. K., Lowry, R., Croft, J. B., Presley-Cantrell, L., & Perry, G. S. (2011). Relationships between hours of sleep and health-risk behaviors in US adolescent students. Preventive Medicine, 53(4–5), 271–273. https://doi.org/10.1016/j.prevetmed.2011.06.020

Morin, C. M., Belleville, G., Bélanger, L., & Ivers, H. (2011). Insomnia severity index: Psychometric indicators to detect insomnia cases and evaluate treatment response. Sleep, 34(5), 601–608. https://doi.org/10.1093/sleep/34.5.601

Moussa, M. T., Lovibond, P. F., Laube, R., & Megahed, H. A. (2017). Psychometric properties of an arabic version of the Depression Anxiety Stress Scales (DASS). Research on Social Work Practice, 27(3), 375–386. https://doi.org/10.1177/10497315156662916

National Institutes of Health. (2011). National institutes of health sleep disorders research plan. US Department of Health and Human Services, National Heart Lung and Blood Institute, National Center on Sleep Disorders Research, Trans-NIH Sleep Research Coordinating Committee, Editors. https://doi.org/Report No.DOT HS 808 707

Ohayon, M. M. (2002). Epidemiology of insomnia: What we know and what we still need to learn. Sleep Medicine Reviews, 6(2), 97–111. https://doi.org/10.1016/s1098-2795(02)00052-3

Ohayon, M. M., & Roth, T. (2003). Place of chronic insomnia in the course of depressive and anxiety disorders. Journal of Psychiatric Research, 37(1), 9–15. https://doi.org/10.1016/s0022-3956(02)00052-3

Pogel, J. F., & Kwiatkowski, C. F. (2010). Sleep complaints affecting school performance at different educational levels. Frontiers in Neurology, 1, 125. https://doi.org/10.3389/fneur.2010.00125
Riemann, D., Nissen, C., Palagini, L., Otte, A., Perlis, M. L., & Spiegelhalder, K. (2015). The neurobiology, investigation, and treatment of chronic insomnia. The Lancet Neurology, 14(5), 547–558. https://doi.org/10.1016/S1474-4422(15)00021-6
Roane, B. M., & Taylor, D. J. (2008). Adolescent insomnia as a risk factor for early adult depression and substance abuse. Sleep, 31(10), 1351–1356.
Roth, T. (2007). Insomnia: Definition, prevalence, etiology, and consequences. Journal of Clinical Sleep Medicine: JCSM: Official Publication of the American Academy of Sleep Medicine, 3(Suppl). S7.
Siddiqui, A. F., Al-Musa, H., Al-Amri, H., Al-Qahtani, A., Al-Shahrani, M., & Al-Qahtani, M. (2016). Sleep patterns and predictors of poor sleep quality among medical students in King Khalid University, Saudi Arabia. The Malaysian Journal of Medical Sciences: MJMMS, 23(6), 94. https://doi.org/10.21315/mjmms2016.23.6.10
Storch, E. A., Murphy, T. K., Lock, C. W., Geffken, G. R., Jacob, M. L., & Goodman, W. K. (2008). Sleep-related problems in pediatric obsessive-compulsive disorder. Journal of Anxiety Disorders, 22(5), 877–885. https://doi.org/10.1016/j.janxdis.2007.09.003
Toher, Y. A., Samud, A. M., Rotimy, A. H., & Seabe, A. M. (2012). Sleep complaints and daytime sleepiness among pharmaceutical students in Tripoli. Libyan Journal of Medicine, 7(1), 18930. https://doi.org/10.3402/ljm.v7i1.18930
Taylor, D. J., Bramoweth, A. D., Grieser, E. A., Tatum, J. I., & Roane, B. M. (2013). Epidemiology of insomnia in college students: Relationship with mental health, quality of life, and substance use difficulties. Behavior Therapy, 44(3), 339–348. https://doi.org/10.1016/j.beth.2012.12.001
Veldi, M., Aluojia, A., & Vasar, V. (2005). Sleep quality and more common sleep-related problems in medical students. Sleep Medicine, 6(3), 269–275. https://doi.org/10.1016/j.sleep.2004.12.003
Wong, W. S., & Fielding, R. (2011). Prevalence of insomnia among Chinese adults in Hong Kong: A population-based study. Journal of Sleep Research, 20(1 Pt 1), 117–126. https://doi.org/10.1111/j.1365-2869.2010.00822.x