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Article

Technostress Level of Medical Education Study Program Students and Its Relationship With Sleep Quality

Muhammad Mikail Zia Ul-haq [1], Zulkhah Noor [2*]

[1] Medical student, Faculty of medicine and health sciences, Universitas Muhammadiyah Yogyakarta; mikailulhaq@gmail.com

[2] Physiology department, Faculty of medicine and health sciences, Universitas Muhammadiyah Yogyakarta; zulkhah.noor@umy.ac.id

* Correspondence: zulkhah.noor@umy.ac.id;

Abstract: The prevalence of poor sleep quality among medical students is high, with some meeting the criteria for insomnia. This study aimed to examine differences in technostress levels based on gender, age, and year of study, as well as the relationship between technostress and sleep quality. Using an observational analytic design with a cross-sectional approach, 138 male and female students aged 17–23 years from three study years participated. Data were collected online using the Pittsburgh Sleep Quality Index (PSQI) to assess sleep quality and the Tech-Q questionnaire to measure technostress. Statistical analysis was conducted using Spearman's correlation test. Results indicated that female students experienced significantly higher technostress levels than males ($p=0.002$). However, technostress was not influenced by age, year of study, or associated with sleep quality ($p>0.05$). In conclusion, while gender differences in technostress exist, there is no correlation between technostress and sleep quality among medical students.

Keywords: Medical student; sleep quality; technostress

1. Introduction

High-quality sleep is crucial for sustaining physical and mental well-being. Sufficient sleep facilitates bodily recovery, enhances cognitive performance, fortifies the immune system, and preserves hormonal equilibrium. A significant proportion of university students suffer from inadequate sleep quality, with 7.7% fulfilling the criteria for insomnia disorder. Prior study indicated that 74% of individuals had symptoms of insomnia disorder, with 51.9% fulfilling all criteria for the disease as outlined in the Diagnostic and Statistical Manual of Mental Disorders (fifth edition). Furthermore, PSQI scores indicated that university students had clinically significant sleep issues. [1].

Medical students frequently deprioritize sleep in academic settings, opting to reduce sleep duration in favor of studying and fulfilling assignment requirements. This behavior contributes to inadequate sleep patterns, particularly prior to examinations [2]. Factors contributing to students' sleep issues include academic workload, inadequate sleep practices, and insufficient awareness of sleep's significance [3]. Technology use, particularly gadgets, contributes to sleep issues among students. A study conducted at the Faculty of Medicine, University of North Sumatra, utilizing the Pittsburgh Sleep Quality Index (PSQI) questionnaire, revealed that 84% of 100 students exhibited poor sleep quality [4]. In the United States, 51% of medical students reported experiencing poor sleep problems [5], whereas in Lithuania, this figure was 59%[6].

Research conducted across multiple countries indicates that the average sleep duration for adults falls below the seven hours advised by sleep Sleep deprivation results in impaired mood, judgment, learning, and information processing [7], [8], and is linked to health risks including cardiovascular disease, obesity, diabetes, metabolic syndrome, and an elevated risk of mortality [9], [10].

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Studies indicate a correlation between high smartphone usage and diminished sleep quality [11]. Moreover, technostress resulting from smartphone usage can lead to sleep disturbances. The hypothesis posits a positive relationship between technostress and poor sleep quality among college students. Technostress is associated with diminished individual well-being and performance [12], [13], [14]. Research on technostress has predominantly concentrated on specific groups, including employees [15], [16], teacher [17], [18], [19], librarians [20], and older adults [13]. Studies examining technostress among medical students remain limited, particularly in Indonesia.

It is essential to analyze the influence of technology utilization on the technostress experienced by medical students, especially concerning sleep quality. Increased frequency f technology use among new generations may elevate the risk of technostress. This study investigates the relationship between technology use, technostress levels, and sleep quality among medical students.

2. Materials and Methods

This study was carried out following the approval of ethical clearance from KEPK FKIK UMY, reference number 181/EC-KEPK FKIK UMY/V/2023. This study employs a quantitative cross-sectional design to investigate the relationship between technostress and sleep quality among students in the medical education program at Universitas Muhammadiyah Yogyakarta. The study involved 138 students as research subjects. Research tools and materials consist of Informed Consent, a participation consent form, a respondent personal data form, the PSQI Questionnaire for assessing sleep quality, and the technostress questionnaire (Tech-Q) adapted from Tarafdar et al. (2014).

The research was conducted via online methods. The research program and related concerns were communicated to students through the WhatsApp class group. Respondent data forms, sleep quality assessments, and technostress questionnaires were created using Google Forms and distributed to research subjects via WhatsApp. The data were tabulated and analyzed employing the Spearman correlation test.

This study employs the Spearman rank correlation test to assess the relationship between technostress and sleep quality among medical education students, given the ordinal nature and non-normal distribution of the data. Likert-scale responses produce ranked values, making non-parametric methods like Spearman's more suitable than Pearson's correlation. Spearman's test effectively detects monotonic trends, identifying whether higher technostress correlates with poorer sleep quality. It is also less affected by outliers, common in psychological research. Since self-reported stress and sleep are ranked rather than numerical, this method enhances the accuracy of interpreting their association in medical education contexts.

3. Results and Discussion

This research involved 138 students as research subjects after going through selection criteria for inclusion and exclusion.

Table 1. Characteristics of Research Subjects by Gender, Age, and Force Level

Variable		**Frequency (N)**	**Percentage (%)**
Gender	Male	41	29.7
	Female	97	70.3
Total		138	100
Age	17-20	80	58
	21-23	58	42
Total		138	100
Class group	2020	75	54.3
	2021	54	39.1

Variable	Frequency (N)	Percentage (%)
2022	9	6.5
Total	138	100

Table 1. Shows that the majority of subjects were women (70.3%). The age range of the subjects is dominated by the 17-20 year age group (58%).

Table 2. Comparison of Technostress Levels in Various Student Groups

Variable	Frequency N = 138	Mean level of technostress ± SD	P-value
Age			0.231
17–20	80	2.70 ± 0.40	
21–23	58	2.78 ± 0.38	
Gender			0.025*
Male	41	2.60 ± 0.48	
Female	97	2.79 ± 0.34	
Class group			0.135
2020	75	2.68 ± 0.40	
2021	54	2.79 ± 0.39	
2022	9	2.89 ± 0.30	

*p < 0.05

Table 2 shows that the level of stress in women is significantly higher than that of men.

Table 3. Comparison of Sleep Quality in Student Groups

Variable	Sleep quality		p-value
	Good	Poor	
	N (%)	N (%)	
Gender			0.083
Male	8 (28.6%)	33 (30.0%)	
Female	20 (71.4%)	77 (70.0%)	
Age			0.002
17–20	9 (32.1%)	71 (64.5%)	
21–23	19 (67.9%)	39 (35.5%)	
Class group			0.142
2020	19 (67.9%)	56 (50.9%)	
2021	9 (32.1%)	45 (40.9%)	
2022	0 (0.0%)	9 (8.2%)	

Table 3. Shows that the group aged 17-20 years experienced more poor sleep quality (70%), while the student group aged 20-23 years experienced more good sleep quality (67.9%).

Table 4. Comparison of Technostress Based on Sleep Quality

Group	Sleep quality	N	Technostress score	p
Male	Good	8	2,73 ± 0,517	0,521
	Poor	33	2,57 ± 0,477	
Female	Good	20	2,78 ± 0,355	0,309
	Poor	77	2,80 ± 0,341	

It was found that the average technostress score was inconsistent for each sleep quality in the male and female groups. The group of men with good sleep quality had a higher technostress score than the group of men with poor sleep quality. No significant

relationship was found between technostress and sleep quality, both in the male and female gender groups, (p>005).

The average level of student technostress is categorized as medium, with a score of 2.74 on a 5-point scale. The results suggest that students experience considerable pressure stemming from the integration of technology in academic pursuits. Technological uncertainty is the primary factor influencing technostress, with a mean score of 3.36. This reflects the uncertainty associated with updates, changes, or the need to adapt to new technology. This condition may induce anxiety as students perceive a necessity to persist in learning or to compensate for gaps in technological proficiency [21].

Students exhibited moderate levels of technostress, with a mean score of 3.01 for technological burden and a mean score of 3.18 for technological invasion. Technology overload denotes the stress experienced due to the constant demands for connectivity and responsiveness, potentially disrupting the equilibrium between academic and personal life. Simultaneously, the proliferation of technology indicates a perception that it has encroached upon students' privacy, resulting in pressure to remain connected beyond academic hours [22].

The dimension of technological complexity reveals a lower level (mean: 2.20), suggesting that the majority of students perceive themselves as competent in comprehending and utilizing the technology at their disposal. This can be linked to the growing digital proficiency observed in contemporary students. Furthermore, the dimension of insecurity regarding technology received the lowest score (mean: 1.95), indicating that students are generally not concerned about technology replacing their roles or jeopardizing their positions within the education system. The findings underscore the necessity for a strategic approach in assisting students with technostress management, specifically through enhanced technology training and the establishment of psychological support systems. Educational institutions must account for temporal and spatial constraints in technology utilization to maintain the equilibrium of students' lives. Gender-based analysis indicates disparities in technostress levels among male and female students. Female students exhibited a higher average technostress score (mean: 2.79 ± 0.34) than their male counterparts (mean: 2.60 ± 0.48). The observed difference is statistically significant, with a p-value of 0.025, indicating that gender influences variations in the level of technostress experienced by students.

The elevated technostress levels among female students can be linked to their greater sensitivity to technological demands, particularly regarding multitasking and academic obligations. Research indicates that women generally perceive technological burden and invasiveness more acutely than men [16]. Differences in coping styles between men and women may contribute to this phenomenon, with women more frequently employing an emotional approach to manage technological pressure [22].

Cores do not exclude the potential for male students to experience other forms of stress that are not captured within the technostress dimension. The findings highlight the significance of a gender-based approach in developing interventions aimed at mitigating technostress, including the implementation of more inclusive technology training programs and psychological support that addresses the differing needs of men and women.

This research assessed the sleep quality of medical students at Muhammadiyah University Yogyakarta through the Pittsburgh Sleep Quality Index (PSQI). Among the 138 respondents, 20.3% indicated good sleep quality, whereas 79.7% reported poor sleep quality. These findings align with studies conducted in Kazakhstan and Brazil that reported comparable percentages. This study found a higher prevalence of poor sleep quality compared to similar studies conducted in Malaysia, Saudi Arabia, Ethiopia, and Nigeria [23], [24], [25], [26].

This study examines the differences in technostress levels between two student age groups: those aged 17-20 and those aged 21-23. The t-test analysis indicated no significant difference in technostress levels between the two age groups ($t = -1.203$, $p > 0.05$). The older age group (21-23 years) exhibited a higher average level of technostress compared to the younger age group; however, this difference lacked sufficient statistical significance.

The findings contrast with several prior studies that indicated a correlation between age and levels of technostress. Studies conducted by Ragu-Nathan et al. [29] demonstrate that younger individuals exhibit greater adaptability to new technology, resulting in lower levels of technostress compared to their older counterparts. [27] indicate that older age groups frequently experience challenges in adapting to technological changes, leading to increased levels of technostress.

The variations in results observed in this study may be attributed to multiple factors. The homogeneity of respondents is restricted to the student population. College students, irrespective of age, typically exhibit significant exposure to technology in both academic and social contexts, suggesting a more uniform adaptability to technology compared to the general population. An academic environment that facilitates technology use may mitigate the impact of age-related factors on technostress.

This research also highlights the importance of considering other factors that may influence technostress, such as level of digital literacy, experience with technology use, and type of technology used. Thus, further research is needed that includes more diverse populations and considers additional variables to deepen understanding of the relationship between age and technostress.

This research compares the level of technostress between three groups of students, namely the classes of 2020, 2021, and 2022. The results of statistical analysis show that there is no significant difference in the level of technostress between the three groups of students ($r = 0.135$, $p > 0.05$). Thus, hypothesis H3 which states that there are differences in the level of technostress based on generation group is not supported by the data.

Literature that specifically discusses technostress in the context of different student cohort groups is still limited. However, these findings can be understood in the context of broader theories about the relationship between education and technostress. Several previous studies have shown a negative relationship between education level and technostress. Tarafdar et al. [16] report that individuals with higher levels of education tend to have better skills and experience in using technology, thus being better able to manage the stress generated by technology use.

However, other studies, such as [27], show that the relationship between education level and technostress is not always significant. This may be due to other factors, such as the level of digital literacy, the type of technology used, and institutional support for technological adaptation. In the context of this study, the homogeneity of the student population-who have similar exposure to technology in the curriculum and academic activities-may be one of the reasons why no significant difference was found in the level of technostress between cohort groups.

In addition, the technologies used in higher education today are generally uniform across cohorts, with the same standards and platforms, reducing the potential for variation in technostress by cohort. This underscores the need for further research to explore other variables, such as individual preferences for technology, perceptions of institutional support, or academic pressure, which may influence the level of technostress among university students.

This study explored the relationship between technostress and overall sleep quality. Based on the results of the analysis, no significant relationship was found between technostress and sleep quality in the respondents of this study ($p = 0.219$, $p > 0.05$). Thus, hypothesis H4 which assumes a relationship between technostress and sleep quality is rejected.

This result contrasts with the findings of [28], who showed a positive relationship between technostress and poor sleep quality in university students. The study found that college students who experienced high levels of technostress tended to report sleep disturbances, such as difficulty falling asleep or poor sleep quality. These findings are in line with previous studies by [29] and [28], which showed that technostress can affect individual well-being, including sleep patterns, through mechanisms such as increased psychological stress, anxiety and mental strain due to technology use.

However, the insignificant results in this study could be due to several factors. First, the respondents in this study may have better stress management skills, making the impact of technostress on sleep quality insignificant. Second, other external factors, such as academic load, lifestyle, or living environment, may be more dominant in influencing sleep quality than technostress. Third, the variables of technostress and sleep quality in this study were measured subjectively, so the possibility of respondents' perception bias cannot be ignored. It is in line with study who stated that technostress has no significant affect to sleep quality in Paraguay college students based on gender [22]. However, it should be take notes that the smartphone use should be a consideration in analysis [23]. Another study proved that the quality of sleep is significantly affected by lifestyle factors, with mental health, social, and physical factors also playing important roles [24].

This study shows that there is no significant relationship between the level of technostress and sleep quality, although physiologically, stress generated by technology can affect sleep quality. Technostress triggers an increase in cortisol levels in the body, which has the potential to disrupt restful sleep. The sympathetic nervous system activated during stress reduces the body's ability to enter a deep sleep phase [29]. Although no significant relationship was found in this study, such physiological mechanisms suggest that technostress could potentially affect sleep quality, depending on an individual's sensitivity to technological stress and other factors that might affect their sleep quality.

This study underscores the importance of a more holistic approach in understanding the relationship between technostress and sleep quality.

Further research that includes objective measures, such as analysis of sleep patterns using sleep monitoring devices, as well as moderator variables such as level of social support or habitual use of technology before bedtime, is needed to deepen understanding of this relationship.

4. Conclusions

Technostress and sleep quality were evaluated among medically educated university students. The results showed that technostress levels were unaffected by age or year of study, demonstrating that all students faced digital learning settings and academic technology obstacles. Technostress did not correlate with sleep quality, suggesting that other variables may influence students' sleep habits more.

Technostress was greater in female students than males. This suggests gender-based variations in coping strategies, technology-related stressor perceptions, digital knowledge, and adaptability. The findings show that female students may need targeted technostress management programs or assistance.

Future study should examine academic burden, psychological resilience, and digital proficiency as moderators of technostress and sleep quality. Qualitative studies may also illuminate gender disparities in technostress and coping. Understanding these factors can help educators and institutions create focused interventions to reduce technostress and improve students' well-being in a digital learning environment.

Supplementary Materials: The following supporting information can be accessed through correspondence author email.

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