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Association between nomophobia and learning performance among undergraduate students: the mediating role of depression and anxiety

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Background: There is a gap in the existing literature concerning the connection between nomophobia and diminished academic performance, potentially influenced by anxiety and depression. The present study aimed to examine the relationship between undergraduate students' nomophobia and learning outcomes, and whether depression and/or anxiety mediate this potential link.

Methods: A quantitative cross-sectional survey design was employed. Nomophobia, anxiety, and depression were measured in 307 undergraduate students using validated self-report questionnaires. Learning performance was assessed based on participants' grade point averages. Correlation analysis and mediation analysis were conducted to test the hypotheses.

Results: The Pearson correlation analysis and multiple parallel mediation modeling suggest that anxiety plays a significant role as a causal pathway through which nomophobic behavior leads to lower grades among university students compared to their less anxious peers. Depression had no significant mediation effect.

Conclusion: The findings support the notion that nomophobia is linked to poor academic achievement. The detrimental impact of nomophobia on learning performance appears to be more closely tied to anxiety rather than depression. This research contributes to the understanding of the complex interplay between technology use, psychological well-being, and educational outcomes in the higher education context. The study's implications include the validation of the measurement scales in a non-English population and the recognition of the influence of technology on mental health and academic outcomes.

KEYWORDS

academic achievement, nomophobic behavior, smartphone addiction, technology addiction, university students

1 Introduction

In contemporary times, despite the expanded educational opportunities facilitated by digital technologies, challenges concerning student learning discipline have emerged. Nomophobia, a term stemming from "no mobile phone" and "phobia," stands as one manifestation of this issue. Nomophobia refers to a psychological condition characterized by unreasonable fear or discomfort due to possible non-availability of their smartphone or the services it offers, such as connectivity with people and information (Garcia et al., 2020; Sui and Sui, 2021). This term was first introduced in 2008 by the United Kingdom Post Office, who conducted a survey on mobile phone usage and found that 53% of mobile phone users in Britain experienced stress when their mobile phones were inaccessible (Cinar et al., 2023). Since then, as society has become increasingly reliant on technology (Mai et al., 2024; Pan et al., 2024), nomophobia has emerged as a multifaceted psychological and cultural phenomenon with potential ramifications in mental health, including learning possibilities. Therefore, research on the prevalence of nomophobia among students has been proliferating, and a recent systematic review of 28 cross-sectional studies on the prevalence of nomophobia in 11,300 university students (Tuco et al., 2023) revealed that, overall, it was close to 100%. Another systematic review covering 108 publications (Leon-Mejia et al., 2021) concluded that the prevalence of nomophobia among individuals varied greatly, ranging from 6 to 73%, depending on the study and sample size. This condition is not officially recognized as a disorder, but it can cause physical symptoms like cervicogenic headaches, as well as emotional manifestations (Goncalves et al., 2020). Studies have suggested that the risks associated with nomophobia include decreased productivity (Torpil and Pekcetin, 2022; Mamun et al., 2023), poor sleep quality (Copaja-Corzo et al., 2022), and social disconnect (Hussien, 2022; Sui et al., 2022). Studies on the relationship between nomophobia and learning performance have also gained attention in recent years as outlined below.

2 Literature review

2.1 Link between nomophobia and academic performance

There is evidence to suggest that nomophobia is associated with learning performance, but the results of investigations on this topic are controversial in terms of the direction of the association. For instance, Essel et al. (2021) concluded that lower nomophobic behavior in university students was associated with better academic achievement, expressed as the cumulative weighted average of the academic year. Conversely, in a study by Aldhahir et al. (2023), medical students with the highest cumulative grade point average had the highest nomophobia scores. The findings from a descriptive correlational study (Qutishat et al., 2020) indicate a lack of significant differences in tertiary students' perceived nomophobia across various academic performance levels. In regard to mediation analysis, Lin et al. (2021) documented the function of nomophobia as a mediator between the influence of non-educational use of a mobile device (e.g., social media) on learning performance of college students; in that framework, nomophobia was responsible for late sleep and insomnia, which in turn, directly or indirectly, brought about deviations in learning behavior. Instead, our study views the effect of nomophobia on academic performance as mediated by other variables, namely anxiety and depression.

2.2 Nomophobia as a predictor of depression and anxiety

Depression is a condition characterized by a reduction in mood, lack of pleasure, persistent contemplation, and decreased cognitive function (Ma et al., 2023). Anxiety can be described as a state of heightened arousal that involves both emotional and mental changes in response to a stimulus (Rustamov et al., 2023). Overall, there is agreement in the extant research on the significant contribution of depression and anxiety to undergraduate students' problematic smartphone use. In a study on university students (Boumosleh and Jaalouk, 2017), multiple linear regression revealed that anxiety and depression scores reported by the participants were related to smartphone addiction. Additionally, a systematic review of 23 publications (Elhai et al., 2017) inferred the presence of a relationship between excessive smartphone use and anxiety, as well as depression. In another study (Kuru and Celenk, 2021), mediation analyses revealed that problematic smartphone use among undergraduate students was independently predicted by both depression and anxiety, with psychological inflexibility as a mediator.

However, although smartphone addiction and nomophobia are related concepts, they are not identical: nomophobia is a more specific concept, centered on a sense of fear, while smartphone addiction denotes a broader pattern of overuse. Furthermore, our hypothetical model posits a contrary causal pathway, in which nomophobia is a precursor of depression and anxiety. In doing so, we rely mainly on a cognitive-behavioral model that assumes that negative cognitive biases such as rumination can potentially catalyze negative emotions and behaviors (Hofmann, 2014; Catanzano et al., 2022). Additionally, research in the field of addiction psychology emphasizes the contribution of increased smartphone use to the onset of addiction-related symptoms, including withdrawal, tolerance, and loss of control (Larsen et al., 2022). These symptoms may further exacerbate anxiety and depression symptoms, leading to a cycle of negative affect and maladaptive coping behaviors (Wacks and Weinstein, 2021). In the case of nomophobia, the constant need to check one's phone, the fear of being without it, or being unable to use it may be perceived as a stressor, leading to the development of negative cognitive biases and subsequent anxiety and depression, which in turn impair their academic success owing to decreased motivation and engagement in learning activities.

Nevertheless, research evidence on the link between these emotional disorders and learning gain is inconclusive. In a study by Awadalla et al. (2020), a longitudinal survey was administered among university students at baseline and after 6 months, and linear regression detected a weak but significant association between higher levels of depression and anxiety and worse academic performance. Wallin et al. (2019) longitudinally observed 26,766 individuals born between 1967 and 1982 in Sweden, from around the age of 16 up to 48; eventually, those who scored in the lowest quartile of grade point average had a higher likelihood of receiving a diagnosis of depression when compared to those who scored in the highest quartile.

On the other hand, a survey by Jamil et al. (2022) unearthed a negative correlation between the National Medical Unified Examination scores of medical students and their anxiety and depression; withal, this correlation was insignificant after considering other weighty predictors within multiple regression analysis, so the authors reject causation. According to a meta-analytic paper (Brumariu et al., 2023), anxiety is not a significant impediment to academic achievement, although it is a crucial factor associated with dropout rates and academic self-concept. Similarly, a recent network analysis of college students' cross-sectional data (Wang et al., 2023) reports that feeling depressed was the most central symptom for those with a bottom 27% grade point average.

3 Research gap and aim

Our review of the literature revealed a lack of studies that examined the relationship between nomophobia and flawed academic performance mediated by anxiety and depression. Yet, a cross-sectional study (Kubrusly et al., 2021) revealed that anxiety and depression are correlated with nomophobia in the way that the latter could provoke depression and anxiety, which in turn could decrease academic achievement. However, the analytic strategy of that study is restricted to correlation analysis, while it would also be beneficial to perform mediation analysis in order to assess possible causality and establish the directionality of the links between the variables of interest, which could inform the development of interventions aimed at reducing the negative impact of nomophobia on learning performance.

Given the evidence presented above, we speculate that depression and anxiety may play a mediating role in the relationship between nomophobia and academic success. Thus, the objective of the present study was to test the following hypotheses:

> *H1*: There is a significant negative association between nomophobia and learning performance among undergraduate students, suggesting that learning performance decreases as nomophobia increases.
>
> *H2*: Anxiety mediates the relationship between nomophobia and learning performance.
>
> *H3*: Depression mediates the relationship between nomophobia and learning performance.

Hopefully, the findings could inform theoretical models within educational psychology, offering a more comprehensive framework for conceptualizing the impact of digital technology on student learning processes. By addressing the multifaceted challenges posed by nomophobia, anxiety, and depression, this research could advance the fields of educational psychology and educational technology toward more holistic and student-centered approaches to learning and well-being.

4 Materials and methods

4.1 Study design

This research adopted a quantitative approach using a cross-sectional survey design.

4.2 Measurement instruments

4.2.1 Nomophobia

The Nomophobia Questionnaire (NMP-Q) (Yildirim and Correia, 2015) is a commonly used measure of nomophobia, so we chose this instrument for assessing nomophobia. The NMP-Q encompasses 20 items, e.g., "If I were to run out of credits or hit my monthly data limit, I would panic" with a 7-point response format (1 = "strongly disagree," 7 = "strongly agree") with possible overall result of 20 to 140 scores where higher scores are suggestive of more nomophobia severity.

4.2.2 Anxiety

To measure anxiety, the State–Trait Anxiety Inventory (STAI) elaborated by Spielberger (1983) was applied in its trait version, which comprises 20 items, such as "I take disappointments so keenly that I cannot put them out of my mind." Participants rated each item on a 4-point scale (1 = "almost never," 4 = "almost always"). Scores on the inventory range from 20 to 80, with higher scores signifying greater anxiety levels.

4.2.3 Depression

The Center for Epidemiological Studies Depression Scale (CES-D) invented by Radloff (1977) was utilized to gage depression by 20 items, including "I had trouble keeping my mind on what I was doing." Students were asked to report how frequently they had the symptoms in last week using four options (1 = "rarely or none of the time," 4 = "most or all of the time"). The total score was between 20 and 80, with larger values denoting greater symptoms of depression.

4.2.4 Learning performance

Participants' grade point averages were obtained by accessing the computerized record of student information at the university. In Kazakhstan's education system, the grade is between 1 and 5. In this study, students had a mean grade of 3.70 (standard deviation = 0.65).

4.3 Adaptation of the scales

Two separately working English to Kazakh translators created two Kazakh-language versions for each questionnaire, which were then merged by a third translator and mailed to three Kazakh-speaking education psychologists with at least 5 years of experience in the field. They confirmed the adequacy of the Kazakh items. These drafts were then back-translated to English to see whether they accurately reflected the original tools. Each resultant measurement was then preliminarily tested on three to five undergraduate students to evaluate its clarity and practicality. For each scale, the students uniformly agreed that the items were properly phrased and straightforward. Following that, consensus was reached on final Kazakh-language

versions of the CES-D, NMP-Q, and STAI. Split-half reliability coefficient for the translated instruments ranged from 0.73 to 0.91.

4.4 Participants and procedures

Convenience sampling was employed to recruit participants. The present study complies with the Helsinki Declaration. Participation was anonymous and voluntary. The Ethics Committee of the corresponding author's university reviewed and approved the study protocol (ВНД-ZU-27-02).

Faculty members at three universities in Kazakhstan disseminated an electronic letter inviting students to participate in the study, explaining its purpose and providing a brief description of the questionnaires that would need to be completed. Two inclusion criteria for participants were articulated: (a) consent to the collection of data, including those on academic performance and (b) completion of the electronic survey (all items were set mandatory, ensuring the lack of incomplete responses). From end-April to late September 2023, informed consent was obtained from 321 students who agreed to be enrolled in the study and received a confidential e-mail with a link to the self-selection survey in October 2023. Faculty members gathered data on cumulative grades for each person who agreed to participate in the study. Apart from basic demographics (gender and age), the survey form included a field to enter the number assigned to each respondent up front. Upon survey closure, these numbers were provided to the faculty members who in turn excluded those who had not submitted a response, so that we obtained data on grade point averages that did not contain any personal data. In late November 2023, the online survey was closed and we ended up with a final sample of 307 appropriate returned questionnaires from 307 undergraduate students who were majoring in diverse fields including education, computer science, psychology, and foreign language studies. The participants had an average age of 19.09 years (standard deviation = 1.52) and 181 (59%) of them were female. There were no restrictions on the grade levels of the respondents.

4.5 Statistics

The use of multiple self-report questionnaires to obtain data from the same individuals in this study may have begot common method variance (also known as common method bias), which could slant the relationship between constructs (Fajriyati et al., 2020). To address this issue, the Harman single-factor test was performed as an initial step (Podsakoff et al., 2003). The test was run in the conmet R package and was interpreted in such a way that if the average variance extracted is >0.50, it was inferred that the dataset was likely to be affected by common method bias. Statistical normality of the data was confirmed by skewness within −2.0 to 2.0 and kurtosis within −7.0 and 7.0. Further, Pearson's correlation analysis was executed to explore bivariate correlations coefficients between the variables. The magnitude of the relationship was interpreted as low, moderate, or strong when the correlation coefficient (r) was 0 to 0.29, 0.30 to 0.59, and > 0.60, respectively. Finally, the data were subjected to statistical mediation using the PROCESS computational tool (see, for example, Igartua and Hayes, 2021) to explore whether nomophobia predicted academic success and whether depression and anxiety mediated this link. The model number two was employed as it was structurally consistent with the set of our hypotheses. Gender and age were inputted as covariates. The indirect effects as per unstandardized coefficients (b) and bias-corrected 95% confidence intervals (CIs) were computed based on 200 bootstrap replications drawn from the original 307 subjects. The presence of a mediating effect was accepted if the 95% CI did not cross zero (Mao et al., 2023). All tests were two-tailed with a significance level of $\alpha = 0.05$. Descriptive analysis included calculating the mean and standard deviation for the collected data.

5 Results

The Harman single-factor test yielded the average variance extracted of 0.461, below the recommended <0.50 threshold, and it is hence safe to claim that no common method variance was detected in the collected data. Table 1 presents the means, standard deviations, and correlation coefficients among the variables are presented. It appears that learning performance was negatively associated with nomophobia, anxiety, and depression, and the relationship with the latter was negligible and statistically insignificant ($r = -0.09$, $p > 0.05$), in contrast to the connections to anxiety ($r = -0.73$, $p < 0.001$) and nomophobia ($r = -0.83$, $p < 0.001$). Students' scores on depression were positively but marginally and insignificantly correlated with both anxiety level ($r = 0.06$, $p > 0.05$) and degree of nomophobia ($r = 0.09$, $p > 0.05$). The latter was significantly and positively associated with anxiety ($r = 0.73$, $p < 0.001$).

The parallel mediating model for respondents' data is depicted in Figure 1. The direct effect of nomophobia on learning performance was significantly negative, albeit negligible ($b = -0.012$, $p < 0.001$, 95% CI: −0.014, −010), supporting H1. Those who reported higher nomophobia were more likely to have higher anxiety ($b = 0.384$, $p < 0.001$, 95% CI: 0.346, 0.422), and increased anxiety was related to slightly lower academic gain ($b = -0.010$, $p < 0.001$, 95% CI: −0.014, −0.007). The indirect path of nomophobia on learning performance through anxiety was significantly negative ($b = -0.004$, $p < 0.001$, 95% CI: −0.006, −0.002). These results confirm H2.

On the other hand, higher scores on nomophobia enhanced levels of depression but insignificantly ($b = 0.044$, $p = 0.087$, 95% CI: −0.035, 0.080), and depression tended to decrease grade points insignificantly as well ($b = -0.001$, $p = 0.661$, 95% CI: −0.003, 0.002). Overall, the indirect effect value of nomophobia on academic performance via depression was zero ($p = 0.735$, 95% CI: 0.000, 0.000); therefore, it cannot be considered a mediator of the link between the variables. These findings contradict H3.

6 Discussion

6.1 Research implications

The findings of this paper highlight a critical issue at the intersection of technology use, mental health, and academic success. When juxtaposing our findings with the study (Aydin and Kus, 2023) that investigated the parallel mediating role of social media tools usage

TABLE 1 Descriptive statistics and Pearson correlations for survey responses ($n = 307$).

Variable	M	SD	Nomophobia	Learning performance	Depression
Nomophobia	86.24	33.34			
Learning performance	3.7	0.65	−0.83***		
Depression	50.22	16.35	0.09	−0.09	
Anxiety	57.36	17.66	0.73***	−0.73***	0.06

*** Significant at $p < 0.001$. SD, standard deviation.

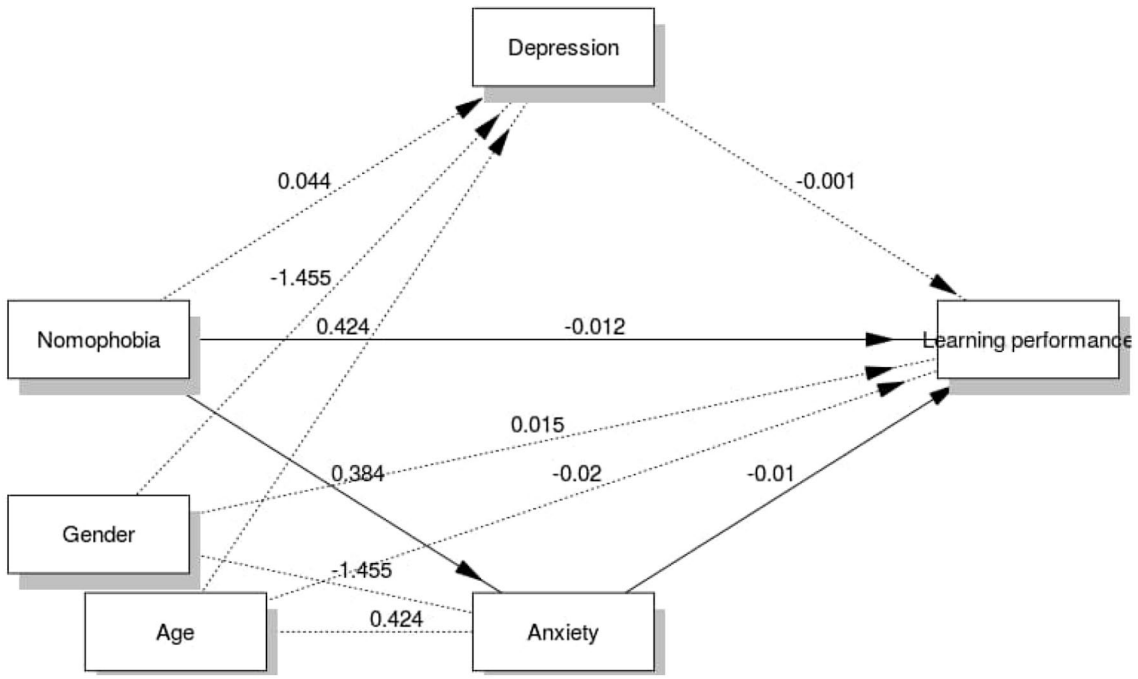

FIGURE 1
Parallel-multiple mediation of depression and anxiety between nomophobia and learning performance (unstandardized coefficients).

and digital gaming behavior in the relationship between nomophobia and smartphone addiction among secondary school students, it becomes apparent that while both studies address nomophobia, they focus on different variables and education contexts. This distinction reaffirms the research gap we spotted earlier and plays up the importance of tailored research approaches that account for contextual factors and individual differences in understanding and addressing the multifaceted challenges posed by excessive technology use.

The results outlined here can contribute to education research and practice. First, we confirmed the validity of the CES-D, STAI, and NMP-Q beyond the Turkish-and English-speaking populations. Second, we evaluated depression and trait anxiety as mediators between nomophobia and learning success, bridging the research gap to some extent. Third, this study adds to the growing body of research on the impact of technology on mental health and academic performance, as our findings may provide valuable and complementary insights into the impact of nomophobia on academic performance among tertiary students. For practitioners, these results highlight the need to design interventions that support students' ability to regulate their mobile phone use, particularly in academic settings. Furthermore, this study may serve as a foundation for future research aimed at identifying the underlying psychological mechanisms that connect nomophobia to academic performance. Our findings suggest that there is a negative association between nomophobia and learning performance; that is, the more symptoms of nomophobic behavior a student has, the lower their average grade.

Our research also found that depression was not a significant mediator in the relationship between nomophobia and learning performance, while anxiety was. Specifically, nomophobia did not just affect academic performance directly, but this effect was exacerbated by amplified anxiety levels among the learners; that is, those who reported higher nomophobia scores were more likely to have more severe anxiety, which was connected to lower academic gain. This suggests that while nomophobia is linked to mental health issues, its impact on learning performance may be more directly related to anxiety than depression. One possible explanation is that anxiety is a common emotional response associated with the fear of being separated from one's mobile phone, and this emotion can have detrimental effects on learning by reducing concentration and attentional resources. This is because anxiety can consume cognitive

resources that would otherwise be available for learning and problem-solving tasks. On the other hand, depression may not mediate the relationship between nomophobia and learning performance, since depression may have a separate effect on learning performance, whereas it may not be related to nomophobia or dysfunctional smartphone use.

Evidence offers several factors allegedly explaining the progression of anxiety against the background of nomophobia. For instance, a case study of an individual with dependency on virtual communication devices and social phobia (King et al., 2013) suggests that the changes in daily habits resulting from nomophobic behavior may bring about coexisting mental disorders. Bragazzi et al. (2019) administered an online survey among young adult participants (mainly undergraduate students) and revealed that individuals with nomophobia tended to use maladaptive coping techniques, such as self-blame, denial, and behavioral disengagement. Correlation and multivariate regression analyses of the survey data determined that these coping strategies were "independently associated with anxiety." Finally, the anxiety that emerges in nomophobic individuals may be due to a variety of factors, such as fear of missing out (Bacaksiz et al., 2022) or low self-esteem (Vagka et al., 2023).

6.2 Recommendations

As technology use becomes increasingly ubiquitous in education, it is crucial for researchers and educators to continue investigating the associations between technology and mental health to develop evidence-based strategies for promoting healthy technology use and improving academic outcomes. One implication of our study is that educational institutions should consider implementing programs or interventions that help students manage anxiety and nomophobia. For example, institutions could provide students with resources to manage stress and anxiety, such as counseling services, mindfulness programs, or stress-reduction techniques. Furthermore, institutions could consider incorporating technology or digital literacy skills training into their curricula to help students develop healthier relationships with technology.

It is suggested that programs for the prevention of nomophobia should not only focus on individuals' smartphone adhesion but also on the underlying psychological mechanisms through which nomophobia elicits self-destructive behaviors in undergraduate students. An experimental study (Tams et al., 2018) focused on the relationship between nomophobia and stress in young business professionals as well as the factors that influence this relationship. Their results imply that nomophobia is a situation-specific condition that emerges in response to situations that prevent access to a smartphone, and feelings of uncertainty and lack of control aggravate the adverse impacts of nomophobia on stress levels. The authors believe that managers can lessen the undesirable effects of nomophobia by promoting trust and social connectivity among personnel and granting them greater control over smartphone usage during meetings. This can be partially extrapolated to the education field in the vein that teachers could foster a supportive classroom environment by encouraging students to connect with each other and by providing opportunities for students to discuss their experiences and feelings about technology use. On the whole, further research is needed to better understand the causes and consequences of nomophobia, as well as the most effective interventions for addressing it.

6.3 Limitations

This research, like most others, has limitations that should be considered when interpreting the findings. Firstly, the sample size was relatively small, consisting of 307 undergraduate students and the survey was carried out in Kazakhstan, which has a unique cultural and educational context. Therefore, the findings may not be generalizable to other countries or educational systems, particularly to those with different levels of technological advancement or cultural attitudes toward mobile phone use. Secondly, this study relied on self-report measures, which may be subject to social desirability bias or recall bias. Participants may have underreported or overreported their levels of nomophobia, anxiety, or depression, which could have impacted the accuracy of the results.

7 Conclusion

This study provides evidence consistent with the idea that nomophobia is an antecedent of poor academic achievement. The relationship between nomophobia and learning performance is likely to be complex, and may involve a range of psychological and cognitive factors. However, anxiety was found to be the causal pathway through which nomophobia could hinder academic progress. This mediation model implies that nomophobia causes anxiety, which in turn gets university students into lower grades as compared with their less anxious counterparts. The negative impact of nomophobia on learning performance may be more related to anxiety rather than depression, as anxiety can consume cognitive resources that would otherwise be available for learning and problem-solving tasks. Supposedly, negative thinking patterns and dysfunctional coping strategies are some of the factors that contribute to anxiety in nomophobic individuals.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Ethics committee at the Zhetysu University named after Ilyas Zhansugurov. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

AA: Conceptualization, Methodology, Investigation, Writing – original draft. BA: Investigation, Project administration, Writing – review & editing. AM: Formal analysis, Writing – original draft. AS: Methodology, Writing – original draft. AD: Data curation, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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