Child and Adolescent Mental Health

Child and Adolescent Mental Health Volume **, No. *, 2022, pp. **–** doi:10.1111/camh.12626

The role of social support on the relationships between internet use and sleep problems in adolescents during COVID-19 pandemic: a multicentre study

Filiz Orhon[1], Ahmet Ergin[2,3], Seda Topçu[1], Burçin Çolak[4], Habip Almiş[5], Nihal Durmaz[6], Burcu Aygün[7], Perran Boran[8], Özlem Bağ[9], Tuğba Ayçiçek[10], Demet Altun[11] & Sevgi Başkan[1]

[1]*Division of Social Pediatrics, Department of Pediatrics, Faculty of Medicine, Ankara University, Ankara, Turkey*
[2]*Department of Public Health, Faculty of Medicine, Pamukkale University, Denizli, Turkey*
[3]*Division of Social Pediatrics, Department of Pediatrics, Faculty of Medicine, Pamukkale University, Denizli, Turkey*
[4]*Department of Psychiatry, Faculty of Medicine, Ankara University, Ankara, Turkey*
[5]*Department of Pediatrics, Faculty of Medicine, Adiyaman University, Adiyaman, Turkey*
[6]*Department of Pediatrics, Gülhane Training and Research Hospital, University of Health Sciences, Ankara, Turkey*
[7]*Social Pediatrics PhD Program, Institute of Health Sciences, Marmara University, İstanbul, Turkey*
[8]*Division of Social Pediatrics, Department of Pediatrics, Faculty of Medicine, Marmara University, Istanbul, Turkey*
[9]*Dr. Behçet Uz Children's Hospital, University of Health Sciences, İzmir, Turkey*
[10]*Department of Pediatrics, Faculty of Medicine, Ondokuz Mayıs University, Samsun, Turkey*
[11]*Department of Pediatrics, Faculty of Medicine, Ufuk University, Ankara, Turkey*

Background: This study examines the frequency of problematic internet use and sleep problems in adolescents aged 14–18 years during the COVID-19 pandemic and identifies the impact of factors such as sociodemographic characteristics, internet habits, changes in daily life, and perceived social support on these problems. **Methods:** This multicentre study was a questionnaire-based online survey study. The questionnaire included the Young Internet Addiction Scale, the Pittsburgh Sleep Quality Index, and the Multidimensional Scale of Perceived Social Support, as well as questions about demographic information, internet habits, and changes in daily life during pandemic. Several multivariate Backward logistic regression models were run to determine the variables that predicted problematic internet use and poor sleep quality. **Results:** It was determined that the frequency of problematic internet use was 15.5%, and the frequency of poor sleep quality was 47.8%. Poor sleep quality was found 2.5 times higher in problematic internet users. The perceived social support was found insufficient in adolescents with problematic internet use and poor sleep quality. Various factors such as the excessive use of internet and social media, low school success, lack of physical activity, lack of rules for internet use at home, and worsening of relationships with parents were found to be predictive factors for these problems. **Conclusions:** Problematic internet use during the pandemic is associated with worsening sleep quality in adolescents. It is important to create special interventions for problematic internet use and sleep problems that develop in adolescents as a result of restrictions during the pandemic.

Key Practitioner Message

- The restrictions experienced during the COVID-19 pandemic can cause various problems such as problematic internet use and sleep problems in adolescents. However, little is known about the relationship of these problems with perceived social support and changes in daily life.
- In this study, poor sleep quality was found higher in problematic internet users. Problematic internet use and related sleep problems were found significant problems in adolescents during the pandemic period, and these problems were observed together with a poor academic performance and lower perceived social support.
- Various factors such as the excessive use of internet and social media, low school success, lack of physical activity, lack of rules for internet use at home, and worsening of relationships with parents were found to be predictive factors for these problems.
- It is important to establish intervention programs that will improve the daily lives of adolescents who are prone to problematic internet use and sleep problems and increase the social support they receive from family and friends.

Keywords: COVID-19; adolescent; problematic internet use; sleep problems

Introduction

Problematic internet use or internet addiction is defined as an excessive and poorly controlled preoccupation, comprising urges and behaviours related to internet use that leads to clinical impairment and distress (Shaw & Black, 2008). Adolescence is considered a risk period for problematic internet use. In a study conducted in 2014 on 11,356 adolescents in Europe, 4.2% and 13.4% among them were found to exhibit pathological internet use and inappropriate internet use, respectively (Kaess et al., 2014). One of the important negative effects of excessive internet use is deterioration in sleep quality and sleep problems. Adolescence is one of the periods when sleep changes the most in human life, and adequate sleep plays an important role in cortical maturation and cognitive functions in adolescents (Owens et al., 2014). Previous studies conducted on the adolescent age group have shown that problematic internet use may result in sleep problems, including lowered sleep quality, insomnia, excessive daytime sleepiness, and reduced sleep duration (An et al., 2014; Tokiya, Itani, Otsuka, & Kaneita, 2020).

The novel coronavirus disease-2019 (COVID-19) infection is the most important global health disaster of the century, which emerged at the end of 2019 and became a pandemic by spreading all over the world. In order to prevent the spread of the epidemic, practices that would reduce social distance, including lockdown, restriction of travel, meetings and outdoor activities, closure of workplaces, and school suspensions needed to be implemented (Guessoum et al., 2020). Due to these restrictions, children, adolescents, and the elderly have had to stay at home for a long period and to change their daily habits. Children and adolescents are particularly vulnerable to the adverse mental effects of isolation, such as problematic internet use and sleep problems, due to the lockdowns that disrupted their physical activity and social interaction (Meng et al., 2020; Panchal et al., 2021). On the other hand, even considering only the negative effects of stress and anxiety on sleep quality, it is inevitable to experience sleep-related problems in this lockdown period. Recent studies provide evidence of greater sleep latency, increased sleep duration, greater sleep medication use, and poorer sleep efficiency in young adults during the pandemic (Benham, 2020; Robillard et al., 2021).

Different findings on the sleep status of the adolescent age group have been obtained in studies during the COVID-19 pandemic. Adolescents' general concerns during the pandemic, as well as the closure of schools and reduced outdoor activities may increase the likelihood of sleep disorders. Indeed, in a limited number of studies conducted in the adolescent age group during the pandemic period, sleep problems such as poor sleep quality, increased sleep duration, late bedtime, and insomnia have emerged (El Refay, Hashem, Mostafa, Kamel, & Sherif, 2021; Gruber et al., 2021; Zhou et al., 2020). On the other hand, some recent studies have shown that waking up late in the morning during the COVID-19 pandemic likely enabled adolescents to sleep longer, wake later, and to wake at a later circadian phase (Genta et al., 2021; Stone et al., 2021; Weingart et al., 2021). These studies supported the observations that an early morning start time for schools might have an influence on the sleep behaviours of adolescents.

Like other psychological effects, it is estimated that restrictions make it easier for adolescents to interact with technology more, create behavioural addiction problems such as problematic internet use, and cause sleep problems due to the excessive use of internet (Király et al., 2020; Panchal et al., 2021). However, there are potential preventive factors such as social support and positive family relations that may help cope with problematic internet use and sleep problems (Wu et al., 2016). Therefore, identifying individual and familial factors associated with these problems in adolescents is important to guide the design of interventions to reduce these problems. Therefore, in a nationwide approach, the aim of this study has been to determine the frequency of problematic internet use and sleep problems in Turkish adolescents during the COVID-19 pandemic, to examine the effect of problematic internet use on sleep quality, and to identify possible risk factors for both problematic internet use and sleep problems.

Materials and methods

This multicentre study was a questionnaire-based online survey study. The centre responsible for the research was Ankara University Faculty of Medicine, Division of Social Paediatrics. Totally seven Social Paediatric clinics participated in the study. The study was approved by the Ankara University Faculty of Medicine Ethics Committee (Ethics approval number: I3-195-21).

Participants and procedure

The population of the study consisted of adolescents, aged between 14 and 18, who visited health institutions. Additionally, among the participants reaching the researchers at the study centres, those who met the inclusion criteria and gave consent to participate were also included (snowball sampling method). The inclusion criteria of the participants were to be aged between 14 and 18, not to have any chronic medical diagnosis including a chronic illness, a psychiatric illness, sleep disorder, mental retardation, hearing, and vision problems, and not to use any medical medication.

All participants and their parents signed informed consent to participate in the study online. Participants completed the online questionnaire directly using a smartphone, tablet, or computer. The questionnaire included the Young Internet Addiction Scale (YIAS), the Pittsburgh Sleep Quality Index (PSQI), and the Multidimensional Scale of Perceived Social Support (MSPSS), as well as questions about demographic information, internet habits, and changes in daily life.

Data were collected remotely between April and June of 2021 during which time all schools were under government-mandated closures and provided only distance-learning options. All completed questionnaires were in downloadable formats, and the data were stored accordingly.

Measurements

The survey of demographics, internet habits, and changes in daily life. This survey was prepared by the researchers and included questions about the sociodemographic characteristics, internet usage habits, perceived academic success, and changes in daily physical activities, sleep, internet usage habits, hobbies, and relationships with parents, friends, and with a special person during the pandemic period.

Young Internet Addiction Scale. YIAS is a six-point Likert-type self-report scale developed using DSM-IV pathological gambling diagnostic criteria to determine internet addiction

(Young, 1998). The scale was adapted to the Turkish language and standardised by Bayraktar (2001). In this context, participants choose one of the options "never", "rarely", "occasionally", "often", "very often", and "always" and get a score from 0, 1, 2, 3, 4, 5, respectively. Total scores below 50 were considered as "no symptom" (normal internet use), scores between 50 and 79 were considered as limited symptoms (risky use), and scores above 80 were considered as problematic internet use. In our study, individuals who scored 50 and above were considered as problematic internet users.

Pittsburgh Sleep Quality Index. PSQI, developed by Buysse, Reynolds, Monk, Berman, and Kupfer (1989), is a self-reported screening and evaluation test that provides detailed information on sleep quality and the type and severity of sleep disorders in the last month. The PSQI produces seven "component" scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping pills, and daytime dysfunction. The questions are scored between 0 and 3. The sum of the seven component scores constitutes the total PSQI score. If the total PSQI score is in the range of 0–4 points, it is considered as "good sleep quality", and if it is in the range of 5–21 points, it is considered as "bad sleep quality". The validity and reliability study of the PSQI in Turkey was carried out by Ağargün, Kara, and Anlar (1996).

Multidimensional Scale of Perceived Social Support. The scale developed by Zimet, Dahlem, Zimet, and Farley (1988) evaluates the adequacy of perceived social support. The first validity and reliability study of the scale were carried out in Turkey by Eker and Arkar in 1995, and then the validity and reliability studies of the revised form were also conducted (Eker, Arkar, & Yaldız, 2001). The scale consisted of 12 items and used seven-point Likert-type rating options. This scale in question has 3 sub-dimensions: family, friends, and support from a special person. The subscale score is obtained by adding the scores of four items in each subscale, and the total score of the scale is obtained by adding all the subscale scores. The lowest scores that can be obtained from the subscales and the whole scale are 4 and 12, and the corresponding highest score thereof are 28 and 84, respectively. A higher score indicates a higher level of perceived social support. The Cronbach α coefficients for the original form of the scale were calculated as .75 for friend support, .85 for family support, .72 for personal support, and .85 for total, respectively (Zimet et al., 1988). In the Turkish form of the scale, Cronbach's α coefficients were determined as .88 for friend support, .85 for family support, .92 for personal support, and .89 for total, respectively (Eker et al., 2001).

Statistical analysis

Our data were analysed using SPSS version 17 (SPSS, Inc., Chicago, IL, USA). In order to see whether the data were normally distributed, the skewness and kurtosis values of all variables were checked. Basic descriptive statistics (frequencies, ratios, means, and standard deviations) were calculated from the acquired data. Continuous variables were presented as mean (standard deviations) and categorical variables were presented as numbers (percentage). The Student's *t*-test was used to compare continuous variables, and Pearson's chi-square test was used for categorical variables. Finally, variables that are significant in bivariate comparisons, several multivariate Backward logistic regression models were run to determine the variables that predicted problematic internet use and poor sleep quality. The statistical significance level was determined as $p < .05$.

Results

Sociodemographic characteristics, internet habits, and changes in daily life

The descriptive statistics regarding the sociodemographic characteristics and internet usage habits of the participants are shown in Table S1. A total of 3913 adolescents (2588 girls and 1325 boys) fully completed the online questionnaire. The mean age of the participants was 15.6 ± 1.3 (14–18). The mean ages of mothers and fathers were 42.3 ± 5.7 (30–67) and 46.6 ± 6.1 (32–80), respectively.

Results indicate that the participants used the internet for various purposes such as online schooling, using social networking sites, communicating through e-mails, doing homework, playing games, chatting, reading news, and streaming TV or videos. 78.9% of the participants could access the internet every day, and 15.2% spent more than 6 hr a day on the internet. 42% reported a rule or restriction on internet use at home.

Table S2 shows the changes in various daily routines of the participants during the pandemic. 26.3% of the participants did not perform any daily physical activity, and 29% of them discontinued their hobbies. 81.4% reported an increase in the amount of internet use, and 54.5% in the use of social media. 70.3% reported a deteriorated sleep quality. 31.2% stated that their relations with their parents, 45.6% with their friends, and 25.1% with a special person deteriorated.

Results in problematic internet use, sleep quality, and perceived social support

Table S3 shows the data on problematic internet use, sleep quality, and perceived social support. The YIAS total score was 29.40 ± 19.44 (0–100). 84.4% of the participants were defined as normal internet users, 13.6% as risky internet users, and 1.9% as problematic internet users.

The PSQI total score was 5.69 ± 2.91 (0–18). According to the PSQI, 47.8% of the participants had poor sleep quality. The further interpretation of the PSQI findings showed that the night-time sleep duration was 7.9 ± 1.6 hr (median: 8, minimum: 7, maximum: 12), that 27.6% of the participants were able to fall asleep in 30 min or longer after going to bed nighttime, that 38.1% had a bad or very bad sleep quality, and 48.7% had difficulty in staying awake during daily activities.

The total score of MPSSS was 52.49 ± 17.56 (12–84).

Sociodemographic factors and internet usage patterns that affect problematic internet use

Tables S4 and S5 show the factors that affected problematic internet use and sleep quality. The frequency of being a problematic internet user was higher in those participants who lived in a broken family, who had parents with a higher education level, who had a working mother, who had a high monthly income in the family and/or who defined his/her school success as bad or very bad.

As seen in Table S4, the problematic internet use frequency was higher among the participants who had internet at home, who used the internet every day, who used the internet more than 6 hr a day for online courses and extracurricular reasons, who had at least one social media account, and/or who did not have a regular rule against internet use at home. It was found that the age of the participants with problematic internet use was younger (Table S5).

Sociodemographic factors and internet usage patterns that affect sleep quality

As shown in Table S4, the frequency of those with a poor sleep quality was 52% in girls and 39.5% in boys ($p < .001$). The frequency of poor sleep quality in the 12th grade students was 56.3%. The frequency of poor sleep quality was higher in those participants, who had 3 or more siblings, who had divorced parents, who lived in a broken family, who had a mother with a high education, who had a jobless father, who had a lower monthly family income and/or who described his/her school success as bad or very bad.

The frequency of poor sleep quality was higher in participants, who used the internet more than 6 hr a day, who had at least one social media account and/or who did not have regular rules regarding the use of the internet at home.

The frequency of poor sleep quality was higher in both older participants and older parents (Table S5).

While 57.5% ($n = 1900$) of the normal internet users had a good sleep quality, 42.5% ($n = 1403$) had a poor sleep quality. On the other hand, while 23.4% ($n = 143$) of those with problematic internet use had a good sleep quality, 76.6% ($n = 467$) had a poor sleep quality ($p < .001$).

Changes in daily routines and social relations that affect problematic internet use and sleep quality

As shown in Table S6, compared to the pre-pandemic period, both problematic internet use and poor sleep quality rates were higher in participants, who had impaired relationships, who did not have daily physical activity, who increased internet and social media use, and who did not have a hobby or could not continue his/her hobby on a regular basis.

Perceived social support, problematic internet use, and sleep quality

As seen in Table S5, perceived social support scores were found to be statistically significantly lower in problematic internet users and in those with a poor sleep quality.

Multivariate logistic regression analysis results for predicting problematic internet use and poor sleep quality

Table S7 shows the multivariate logistic regression analysis of the factors related to problematic internet use and poor sleep quality. The factors that increased the risk of problematic internet use included being at a younger age, having a mother with a high school or university degree, spending more than 6 hr per day on the internet due to online classes, having at least one social media account, having a poor or very poor school performance, not doing physical activity, having an increased use of social media, having worsened relations with parents, and having a poor sleep quality according to PSQI. The odds of problematic internet use were three times higher in the participants with poor sleep quality.

The factors that increased the risk of poor sleep quality included being a female, having three or more siblings, having married parents, having a mother with a secondary school or high school education, spending more than 1 hr per day on the internet for extracurricular reasons, not having regular internet rules or restrictions at home, having a poor or very poor school performance, having a worsened sleep quality, having worsened relations with parents and/or with a special person, and being an problematic internet user according to the YIAS. The odds of poor sleep quality were 2.5 times higher in problematic internet users.

Discussion

This multicentre study was the first study with a national scope in Turkey regarding adolescents' changes in daily routines, perceived social support, problematic internet use, and poor sleep quality during the COVID-19 pandemic. It was determined that poor sleep quality was found 2.5 times higher in problematic internet users. The changes in daily life and the social support perceived by adolescents were found as predictive factors for problematic internet use and poor sleep quality.

Studies have shown that problematic internet use has become an important issue during the pandemic period (Meng et al., 2020; Panchal et al., 2021). We found that 15.6% of the questioned adolescents were defined as problematic internet users according to YIAS. Various factors including living in a family with a high-socioeconomic level and problematic internet usage habits such as excessive time spent on the internet and the absence of rules regarding internet use were found to be risk factors affecting problematic internet use. In two of the limited studies evaluating internet addiction in adolescents during the pandemic period, the frequency of problematic internet use was found to be around 24.4% and 33.4% (Dong, Yang, Lu, & Hao, 2020; Lin, 2020). Both studies were conducted in the spring of 2020, when the restrictions were most intense. Compared to these studies, we suggest that the reason why problematic internet use frequency was lower in our study is that the study coincided with a period when schools were closed, but restraint measures for children and adolescents were relatively reduced in our country. Our findings were similar to the studies conducted in Turkey before the pandemic, in which the frequency in adolescents was between 18.5% and 21.1% (Cam & Top, 2020; Sayılı, Vehid, & Erginöz, 2021). Contrary to previous studies showing that problematic internet use is more common in male adolescents (Kaess et al., 2014; Tam, 2014), our study showed no gender difference. We suggest that the amount of internet use may have increased in both genders due to the change in daily routines during the pandemic.

Considering the negative effects of stress and anxiety on sleep quality, it is expected to experience sleep-related problems during the pandemic period. However, the results of studies on the sleep state of adolescents during the COVID-19 pandemic appear to be conflicting. Further recent research showed that sleep problems such as poor sleep quality, increased sleep times, later bedtimes, sleep–wake disorders, and insomnia are on the rise in adolescents during the pandemic (El Refay et al., 2021; Gruber et al., 2021; Troxel et al., 2022; Zhou et al., 2020). Similarly, we found that almost half of the adolescents had a poor sleep quality according to PQSI. More than one-third of participants rated their sleep quality as poor or as very poor. About one-third reported the ability to fall asleep in 30 min or longer after going to

bed night-time and about half reported troubles staying awake during daily activities. These findings show that sleep-related problems become important in adolescents during the COVID-19 pandemic, and problems such as poor sleep quality, difficulty falling asleep, and low sleep efficiency often occur. Contrary to our findings, some recent studies have shown that waking up late in the morning, not attending schools as a result of school closures, and distance learning arrangements during the COVID-19 pandemic may prolong sleep in adolescents and improve some subjective symptoms (Santos & Louzada, 2022; Stone et al., 2021; Weingart et al., 2021). Therefore, both our findings and those of previous studies highlight the conflicting experiences adolescents face as a result of restrictions due to the COVID-19 pandemic.

Similar to the studies showing that being a female and having adverse family conditions are risk factors for the sleep quality in adolescents (Bartel, Gradisar, & Williamson, 2015; Zhou et al., 2020), we found that the sleep quality was worse in adolescent girls from relatively lower socioeconomic classes. In addition, problematic internet use was found 2.59 times higher and poor sleep quality was found 2.64 times higher in participants with very poor school performance. In support to these findings, other studies have shown that the presence of a sleep disorder or internet addiction is found related to poor academic performance (Leung & Lee, 2012; Sivertsen, Glozier, Harvey, & Hysing, 2015).

Internet addiction during the COVID-19 pandemic has been found to be a risk factor for sleep problems (Benham, 2020; Robillard et al., 2021). However, there are a limited number of studies evaluating the relation between internet addiction and sleep disturbances in adolescents during the pandemic. Siste et al. (2021) report that increased internet use duration and sleep disturbances in adolescents were found as risk factors of internet addiction during the pandemic. Hu, Wang, Lin, and Tang (2021) show that the relatively high rate of problematic smartphone uses in home isolated adolescents possibly increased the risk of daytime sleepiness. Similar to these studies, we found that more than two-thirds of the participants with problematic internet use had significantly poor sleep quality. We also show that the odds of poor sleep quality were 2.5 times higher in problematic internet users. Further, the frequency of poor sleep quality was higher in those, who had problematic internet use habits and did not have regular internet rules at home. All these findings strongly suggest that prolonged internet use and the absence of internet rules at home during the pandemic are associated with worsening sleep quality in adolescents.

In addition to an increased internet and social media use, we also found that approximately one-third of the adolescents could not perform daily physical activities and could not continue their hobbies during the pandemic. Similar to recent observations (Király et al., 2020), we think that children and adolescents face the negative consequences of quarantine, such as sedentary lifestyles and increased internet use. Recent studies show that the nationwide lockdowns and closure of schools during the pandemic may cause increased the frequency of internet addiction (Chen, Chen, Pakpour, Griffiths, & Lin, 2020; Fegert, Vitiello, Plener, & Clemens, 2020). Further, a recent study indicates that physical activity and social media use may affect later adolescent sleep timing during the COVID-19 pandemic (Hamilton, Hutchinson, Evankovich, & Ladouceur, 2022). Similar to these studies, we found that the rate of both problematic internet use and poor sleep quality was higher in adolescents, who were unable to continue their hobbies and physical activities because of restrictions. These findings suggest that the restriction measures taken due to the pandemic may cause changes in the daily lives of adolescents and bring various problems such as problematic internet use and sleep problems.

Previous studies point to the central role of parent–child relationship in supporting the psychological well-being of children and adolescents during the pandemic (Choi et al., 2021; Panchal et al., 2021). We found a lower perceived social support scores in both problematic internet users and in those with a poor sleep quality. In addition, problematic internet use was 3.78 times higher, and poor sleep quality was 2.5 times higher in the participants whose relationship worsened with their parents. Findings of previous studies support our results in that adolescents with internet addiction have significantly lower social support and family functions during the pandemic period, and that perceived social support was a protective factor for sleep quality (Grey et al., 2020; Lin, 2020; Zhou et al., 2020). On the other hand, previous data show that rules regarding internet use at home and providing parental control are important in preventing problematic internet use (Elsaesser, Russell, Ohannessian, & Patton, 2017). Further, a recent study has shown that the presence of a parent-set technology rule is associated with earlier bedtimes in adolescents (Pillion et al., 2022). Therefore, in addition to the importance of parents' social support, the role of technology rules determined by parents in preventing problematic internet use and related sleep problems in adolescents should not be ignored.

Finally, some limitations and strengths need to be considered. First, due to the pandemic conditions, the study was conducted as an online survey study that included selective and response bias. Second, the sampling design did not use randomisation, resulting in an unbalanced gender distribution because of respondent-oriented sampling. Third, since the online questionnaire is a self-administered assessment, sleep quality, and problematic internet use levels identified may not always be consistent with the assessments of mental health professionals. Despite these limitations, one of the strengths of our study is that it is the first national study on problematic internet use and poor sleep quality in adolescents during the COVID-19 pandemic in our country. Focusing on adolescence, which is a developmental period that may be vulnerable to pandemic-related restrictions and identifying individual and familial factors associated with problematic internet use and sleep problems are important in guiding the design of interventions to reduce these problems.

In conclusion, problematic internet use is an important risk factor for poor sleep quality. Problematic internet use and related sleep problems are significant problems in adolescents during the COVID-19 pandemic period, and these problems are observed together with a poor academic performance. The restriction measures taken due to the pandemic lead to

significant changes in the daily routines of adolescents such as physical activity, sleep, hobbies, and internet usage habits. Changes in daily routines and lower social support are determinants for sleep problems and problematic internet use in adolescents during the pandemic. Mental health problems such as problematic internet use and sleep disturbances in adolescents can have harmful consequences for their physical, cognitive, social, and academic development. For this reason, it is very important to establish intervention programs that will improve the daily lives of adolescents who are prone to problematic internet use and sleep problems and increase the social support they receive from family and friends.

Acknowledgements

The authors did not receive support from any organisation for the submitted work. All the authors share responsibility for the final version of this work. The authors would like to thank Haluk Orhon for editing the English language of this manuscript. The authors have declared that they have no competing or potential conflicts of interest.

Ethical information

This study was approved by the Ankara University Faculty of Medicine Ethics Committee, Turkey (ethics approval number: I3-195-21). All the procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study and from their parents or legal guardians.

Author contributions

All the authors contributed to the study conception and design. Material preparation was performed by F.O., S.T., B.C., and A.E. Data collections were performed by all authors. Data analysis was performed by A.E. and F.O. The first draft of the manuscript was written by F.O. All the authors commented on previous versions of the manuscript. All the authors read and approved the final manuscript.

Correspondence

Filiz Orhon, Division of Social Pediatrics, Department of Pediatrics, Ankara University Faculty of Medicine, 06100 Dikimevi, Ankara, Turkey;
Email: simsekfiliz@hotmail.com

Supporting information

Additional Supporting Information may be found in the online version of this article:

Table S1. Sociodemographic characteristics and internet usage habits of the participants ($n = 3913$).

Table S2. Changes in the daily routines during pandemic ($n = 3913$).

Table S3. Findings on problematic internet use, sleep quality and perceived social support.

Table S4. Demographic and internet use factors affecting problematic internet use and sleep quality (categorised variables).

Table S5. Factors affecting problematic internet use and sleep quality (continuous variables).

Table S6. Changes in the daily routines affecting problematic internet use and sleep quality.

Table S7. The findings of the multivariate logistic regression analysis.

References

Ağargün, M. Y., Kara, H., & Anlar, Ö. (1996). The validity and reliability of the Pittsburgh sleep quality index. *Turkish Journal of Psychiatry*, *7*, 107–115.

An, J., Sun, Y., Wan, Y., Chen, J., Wang, X., & Tao, F. (2014). Associations between problematic Internet use and adolescents' physical and psychological symptoms: Possible role of sleep quality. *Journal of Addiction Medicine*, *8*, 282–287.

Bartel, K. A., Gradisar, M., & Williamson, P. (2015). Protective and risk factors for adolescent sleep: A meta-analytic review. *Sleep Medicine Reviews*, *21*, 72–85.

Bayraktar, F. (2001). İnternet kullanımının ergen gelişimindeki rolü [The role of internet use in adolescent development]. [Unpublished master's thesis]. Ege University Social Sciences Institute.

Benham, G. (2020). Stress and sleep in college students prior to and during the COVID-19 pandemic. *Stress and Health*, *37*, 504–515.

Buysse, D. J., Reynolds, C., Monk, T., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Research*, *28*, 193–213.

Cam, H. H., & Top, F. U. (2020). Prevalence and risk factors of problematic internet use and its relationships to the self-esteem and health-related quality of life. *Journal of Addictions Nursing*, *31*, 253–260.

Chen, H., Chen, C. Y., Pakpour, A. H., Griffiths, M. D., & Lin, C. Y. (2020). Internet-related behaviors and psychological distress among schoolchildren during COVID-19 school suspension. *Journal of the American Academy of Child & Adolescent Psychiatry*, *59*, 1099–1102.

Choi, J., Park, Y., Kim, H. E., Song, J., Lee, D., Lee, E., … & Lee, Y. (2021). Daily life changes and life satisfaction among Korean school-aged children in the COVID-19 pandemic. *International Journal of Environmental Research and Public Health*, *18*, 3324.

Dong, H., Yang, F., Lu, X., & Hao, W. (2020). Internet addiction and related psychological factors among children and adolescents in China during the Coronavirus Disease 2019 (COVID-19) epidemic. *Frontiers in Psychiatry*, *11*, 751.

Eker, D., & Akar, H. (1995). Factorial structure, validity, and reliability of revised form of the multidimensional scale of perceived social support. *Turk Psikoloji Dergisi*, *10*, 45–55.

Eker, D., Arkar, H., & Yaldız, H. (2001). Factorial structure, validity, and reliability of revised form of the multidimensional scale of perceived social support. *Turkish Journal of Psychiatry*, *12*, 17–25.

El Refay, A. S., Hashem, S. A., Mostafa, H. H., Kamel, I. H., & Sherif, L. S. (2021). Sleep quality and anxiety symptoms in Egyptian children and adolescents during COVID-19 pandemic lockdown. *Bulletin of the National Research Center*, *45*, 134.

Elsaesser, C., Russell, B., Ohannessian, C. M., & Patton, D. (2017). Parenting in a digital age: A review of parents' role in preventing adolescent cyberbullying. *Aggression and Violent Behavior*, *35*, 62–72.

Fegert, J. M., Vitiello, B., Plener, P. L., & Clemens, V. (2020). Challenges and burden of the Coronavirus 2019 (COVID-19) pandemic for child and adolescent mental health: A narrative review to highlight clinical and research needs in the acute phase and the long return to normality. *Child Adolescent Psychiatry Mental Health*, *14*, 20.

Genta, F. D., Rodrigues Neto, G. B., Sunfeld, J. P. V., Porto, J. F., Xavier, A. D., Moreno, C. R. C., … & Genta, P. R. (2021). COVID-19 pandemic impact on sleep habits, chronotype, and health-related quality of life among high school students: A longitudinal study. *Journal of Clinical Sleep Medicine*, *17*, 1371–1377.

Grey, I., Arora, T., Thomas, J., Saneh, A., Tohme, P., & Abi-Habib, R. (2020). The role of perceived social support on depression and sleep during the COVID-19 pandemic. *Psychiatry Research*, *293*, 11345.

Gruber, R., Gauthier-Gagne, G., Voutou, D., Somerville, G., Saha, S., & Boursier, J. (2021). Pre-pandemic sleep behavior and adolescents' stress during Covid-19: A prospective longitudinal study. *Child Adolescent Psychiatry and Mental Health*, *15*, 43.

Guessoum, S. B., Lachal, J., Radjack, R., Carretier, E., Minassian, S., Benoit, L., & Moro, M. R. (2020). Adolescent psychiatric disorders during the COVID-19 pandemic and lockdown. *Psychiatry Research*, *291*, 113264.

Hamilton, J. L., Hutchinson, E., Evankovich, M. R., & Ladouceur, C. D. (2022). Daily and average associations of physical activity, social media use, and sleep among adolescent girls during the COVID-19 pandemic. *Journal of Sleep Research*, *31*, e13611.

Hu, T., Wang, Y., Lin, L., & Tang, W. (2021). The mediating role of daytime sleepiness between problematic smartphone use and post-traumatic symptoms in COVID-19 home-refined adolescents. *Children and Youth Service Reviews*, *126*, 106012.

Kaess, M., Durkee, T., Brunner, R., Carli, V., Parzer, P., Wasserman, C., … & Wasserman, D. (2014). Pathological internet use among European adolescents: Psychopathology and self-destructive behaviours. *European Child & Adolescent Psychiatry*, *23*, 1093–1102.

Király, O., Potenza, M. N., Stein, D. J., King, D. L., Hodgins, D. C., Saunders, J. B., … & Demetrovics, Z. (2020). Preventing problematic internet use during the COVID-19 pandemic: Consensus guidance. *Comprehensive Psychiatry*, *100*, 152180.

Leung, L., & Lee, P. S. N. (2012). Impact of internet literacy, internet addiction symptoms, and internet activities on academic performance. *Social Science Computer Review*, *30*, 403–418.

Lin, M. P. (2020). Prevalence of internet addiction during the COVID-19 outbreak and its risk factors among junior high school students in Taiwan. *International Journal of Environmental Research and Public Health*, *17*, 8547.

Meng, S., Dong, P., Sun, Y., Li, Y., Chang, X., Sun, G., et al. (2020). Guidelines for prevention and treatment of internet addiction in adolescents during home quarantine for the COVID-19 pandemic. *Heart Mind*, *4*, 95–99.

Owens, J., Adolescent Sleep Working Group, & Committee on Adolescence. (2014). Insufficient sleep in adolescents and young adults: An update on causes and consequences. *Pediatrics*, *134*, e921–e932.

Panchal, U., de Pablo, G. S., Franco, M., Moreno, C., Parellada, M., Arango, C., & Fusar-Poli, P. (2021). The impact of COVID-19 lockdown on child and adolescent mental health: Systematic review. *European Child & Adolescent Psychiatry*, *18*, 1–27.

Pillion, M., Gradisar, M., Bartel, K., Whittall, H., Mikulcic, J., Daniels, A., … & Kahn, M. (2022). Wi-Fi off, devices out: Do parent-set technology rules play a role in adolescent sleep? *Sleep Medicine*, *4*, 100046.

Robillard, R., Dion, K., Pennestri, M. H., Solomonova, E., Lee, E., Saad, M., … & Kendzerska, T. (2021). Profiles of sleep changes during the COVID-19 pandemic: Demographic, behavioural and psychological factors. *Journal of Sleep Research*, *30*, e13231.

Santos, J. S., & Louzada, F. M. (2022). Changes in adolescents' sleep during COVID-19 outbreak reveal the inadequacy of early morning school schedules. *Sleep Science*, *15*, 74–79.

Sayılı, U., Vehid, S., & Erginöz, E. (2021). Problematic internet use in Turkish high school students: Prevalence and related factors. *American Journal of Health Behavior*, *45*, 31–43.

Shaw, M., & Black, D. W. (2008). Internet addiction: Definition, assessment, epidemiology and clinical management. *CNS Drugs*, *22*, 353–365.

Siste, K., Hanafi, E., Sen, L. T., Murtani, B. J., Christian, H., Limawan, A. P., … & Adrian, A.. (2021). Implications of COVID-19 and lockdown on internet addiction among adolescents: Data from a developing country. *Frontiers in Psychiatry*, *12*, 665675.

Sivertsen, B., Glozier, N., Harvey, A. G., & Hysing, M. (2015). Academic performance in adolescents with delayed sleep phase. *Sleep Medicine*, *16*, 1084–1090.

Stone, J. E., Phillips, A. J. K., Chachos, E., Hand, A. J., Lu, S., Carskadon, M. A., … for the CLASS Study Team. (2021). In-person vs home schooling during the COVID-19 pandemic: Differences in sleep, circadian timing, and mood in early adolescence. *Journal of Pineal Research*, *71*, e12757.

Tam, L. T. (2014). Risk factors of internet addiction and the health effect of internet addiction on adolescents: A systematic review of longitudinal and prospective studies. *Current Psychiatry Reports*, *16*, 508.

Tokiya, M., Itani, O., Otsuka, Y., & Kaneita, Y. (2020). Relationship between internet addiction and sleep disturbance in high school students: A cross-sectional study. *BMC Pediatrics*, *20*, 379.

Troxel, W. M., Palimaru, A. I., Klein, D. L., Dong, L., Dickerson, D. L., Brown, R. A., … & D'Amico, E. J. (2022). Changes in sleep-wake patterns and disturbances before and during COVID-19 in urban American Indian/Alaska native adolescents. *Behavioral Sleep Medicine*, *20*, 343–356.

Weingart, R., Bryan, C., Olson, D., Gazmararian, J., Rosati, B., Hale, L., & Van Gilder, M. (2021). Adolescent sleep duration and timing during early COVID-19 school closures. *Sleep Health*, *7*, 543–547.

Wu, C. S. T., Wong, H. T., Yu, K. F., Fok, K. W., Yeung, S. M., Lam, C. H., & Liu, K. M. (2016). Parenting approaches, family functionality, and internet addiction among Hong Kong adolescents. *BMC Pediatrics*, *16*, 130.

Young, K. S. (1998). *Caught in the net: How to recognize the signs of internet addiction – and a winning strategy for recovery*. New York: John Wiley & Sons.

Zhou, S. J., Wang, L. L., Yang, R., Yang, X. J., Zhang, L. G., Guo, Z. C., … & Chen, J. X. (2020). Sleep problems among Chinese adolescents and young adults during the coronavirus-2019 pandemic. *Sleep Medicine*, *74*, 39–47.

Zimet, G. D., Dahlem, N. W., Zimet, S. G., & Farley, G. K. (1988). The multidimensional scale of perceived social support. *Journal of Personality Assessment*, *52*, 30–41.

Accepted for publication: 28 November 2022