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Anxiety and depression and their relation to the use of electronic devices among secondary school students in Al-Khobar, Saudi Arabia, 2018–2019

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Abstract:

BACKGROUND: Adolescence is a critical transitional period for the development of mental illnesses such as depression or anxiety, and these days, adolescents spend less time playing outside than they do using electronic devices. The aim of this study was to examine the relationship between the use of electronic devices and anxiety and depression in female secondary school students in Al-Khobar City, KSA.

MATERIALS AND METHODS: This cross-sectional study included 903 female students selected from the four educational districts (Al-Khobar, Al-Thuqbah, Al-Dhahran and Al-Rakah). Data was collected using a self-administered anonymous questionnaire that included questions related sociodemographics and the use of electronic devices, the Beck Depression Inventory, and the Generalized Anxiety Disorder 7-item scale. Data analysis included descriptive statistics frequencies and percentages for categorical variables, and mean and standard deviation for continuous variables. Chi-square test was performed to test for significance for association between categorical variable. Odds ratios were calculated for association of anxiety and depression with various independent variables including the use of electronic devices. A binary logistic regression model was used to determine factors associated with anxiety and depression. All test were performed at 5% significance level.

RESULTS: The mean age of the participants was 16.29 years (SD=0.84). About 98% reported using electronic devices; 67.3% used electronic devices 2 or more hours daily, and 81.5% used them at bedtime. About 66% students had moderate-to-severe anxiety and 70/5% had mild-to-severe depression. The logistic regression model showed that users of electronic devices at bedtime were 1.524 more likely to have anxiety ($P=0.026$), while spending more than 2 hours on the devices at bedtime were significantly associated with depression.

CONCLUSION: The high prevalence of anxiety and depression among female students is worrisome. Finding suggests that adolescents might benefit from a restricted use of electronic devices. It is necessary to develop age-specific guidelines regarding duration of the use of electronic devices and to integrate the development of psychosocial skills into the school curriculum.

Keywords:

Adolescent, anxiety, depression, electronic devices, mental health

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Introduction

Adolescence is a period of life that involves many changes for young people and is portrayed as a time of emotional, behavioral, and psychological confusion.^[1]

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Anxiety disorders, the most common disorders diagnosed in adolescence, are defined as “excessive worry and fear that are difficult to control.”^[2] Depression in adolescents is a common condition affecting physical, emotional, and social development.^[3] Many studies have found

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that adolescent females suffer from depression and other mental health problems more than males.^[4]

The 2011 report on the State of World Child reports that around 20% of the world's adolescents have mental health or behavioral problems.^[4] It was reported that the prevalence of mental problems in children and adolescents in the Eastern Mediterranean is between 10% and 36%.^[5]

The World Health Organization predicts that by the year 2020, mental health disorders will become one of the leading causes of morbidity, mortality, and disability in children and adolescents worldwide.^[6]

Although adolescence is a time when young people need good mental health to develop normally emotionally and deal with real-life challenges, it is also the time where the use of the media increases and susceptibility to poor mental health rises.^[5,7] Young people nowadays spend less time playing outdoors and more time using computers and mobile phones or playing electronic games than the youth of previous generations.^[8,9]

Electronic devices such as computers, tablets, smart phones, and video games have become an important part of daily life in many communities and all age groups in recent years.^[10] The rate of ownership of smartphones has skyrocketed.^[7] In 2015, the use of computer devices in Saudi Arabia was reported to be 73% for the age group of 12–65 years, and it was reported that those aged 12–29 years used computer devices more than any other age group.^[11]

The effects of frequent and prolonged use of electronic devices have been studied in different countries and have shown an increased risk of negative physical and psychosocial outcomes, such as obesity, headaches, musculoskeletal pain, decreased levels of physical activity, stress, sleep disorders, anxiety, and depression.^[12,13]

Several cross-sectional studies have examined the relationship between excessive use of electronic devices and mental health and reported a significant relationship between addiction to video games and symptoms of depression and anxiety.^[14-19]

Despite the widespread use of computer technology and mobile phones in Saudi business and society, only a few published reports have examined the associations between the use of electronic devices and the mental health of adolescents. The aims of this study were to discover the prevalence of anxiety and depression, identify the pattern of electronic device use, and investigate the relationship between anxiety and depression and the use of electronic devices by secondary school girls in Al-Khobar, Saudi Arabia.

Materials and Methods

A cross-sectional study was conducted in the governmental female secondary schools in Al-Khobar, Saudi Arabia. The 1st- and 2nd-year secondary students (Grades 10 and 11) made up the study population; the 3rd-year secondary students (Grade 12) were excluded as they were in their final year and might have already been under a great deal of stress.

A list of all governmental secondary girls' schools in the four Al-Khobar educational districts (Al-Khobar, Al-Thuqbah, Al-Dhahran, and Al-Rakah) was obtained from the local directorate of education. The multistage random sampling technique was used to select one school from every district except in the Al-Khobar district where three schools were selected because of the large number of students in that district. The number of students (*n*) was estimated by using 54.9% prevalence of anxiety in Saudi female secondary school students in Al-Taif, assuming 50% prevalence of problematic electronic uses the odds ratio (OR) at 1.5. The sample size was calculated at 840 by using Epi Info 7 (Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia), with study power 80% and at a confidence level of 95%.^[4,5] A total of 950 questionnaires were distributed, 903 of which were recovered, which resulted in a response rate of 95%. The sample size was distributed proportionally to the number of students in each district [Table 1].

A pilot study was conducted on thirty secondary school girls different from the sample, and the estimated time for the completion of the questionnaire by the students was 10–15 min.

Ethical considerations for the study were approved by the Ethical Committee of the Ministry of Education, and written consent was taken from all participants. The students were briefed on the aim of the study and were also assured that the questionnaire was anonymous and confidential.

Data collection started in January 2019 with a self-administered questionnaire designed by the researchers. The first part of the questionnaire on sociodemographic profile of students included age, school grade, family background (education level, occupation, and family income) and academic performance in the

Table 1: Sample size from each district

District	Total number of students (<i>n</i> =7252) <i>N</i> (%)	Number of selected students (<i>n</i> =840-903) <i>N</i> (%)
1. Al-Khobar	3666 (50.0)	425-456
2. Al-Thuqbah	1312 (18.0)	152-164
3. Al-Dhahran	1356 (19.0)	157-168
4. Al-Rakah	918 (13.0)	106-115

previous year. The second part was on data related to the use of electronic devices such as type, purposes, duration of use, and use at bedtime. A 2-hour cutoff was used as the limit recommended for screen-based activities for the day.^[20] The third part measured the psychological profile by using the Beck Depression Inventory, which is currently one of the most widely used measures in both research and clinical practice for assessing depression (scoring 0–4: normal, 5–7: mild, 8–15: moderate, and 16 or more: severe), and the Generalized Anxiety Disorder 7-Item Scale, which is a valid (Cronbach's alpha = 0.92) and reliable (intraclass correlation = 0.83) tool for screening generalized anxiety disorder (scoring 0–5: mild, 6–10: moderate, 11–15: moderately severe, and 15–21: severe).^[21,22]

Data were analyzed using the Statistical Package for the Social Sciences software version 24 (IBM Corp, Armonk, NY). Descriptive analysis using frequencies, percentages, mean, and standard deviation were displayed and for the bivariate analysis, Chi-square test was used to measure the association between the anxiety or depression and different variables including the use of electronic devices. A binary logistic regression model was used to identify different factors predicting anxiety or depression. $P < 0.05$ was considered statistically significant.

Results

The sample size was 903 students from different randomly selected secondary girls' schools with a mean age of 16.29 ± 0.84 years ranging from 14 to 19 years. They were nearly equally divided between Grade 10 (47.8%) and Grade 11 (52.2%).

Table 2 shows different socioeconomic variables: with regard to their fathers' education, only 1.4% were illiterate and 14.4% had higher education, whereas 4.1% of the mothers were illiterate and 7.6% had higher education.

A higher percentage (30.6%) of the students had fathers who were government employees and 68% had nonworking mothers. The majority of students (88.9%) reported that they lived with both parents, and 89.4% lived with more than four family members.

First-order children made up 21.4% of the girls, and more than half of them (59.7%) had a family income of more than 10,000 SR.

The majority of the students had had no previous academic failure (97%) and had a mean grade point average of 90.9 ± 7.67 ranging from 61 to 100. Slightly more than half of the students were not satisfied with their study efforts (55.7%) and 79% of them reported

being stressed by school. Different stressful life events had been encountered by students in various percentages; the highest reported being emotional (43.7%) and health problems being the least (11%); 62.5% of the students exhibited one or more stressful life events.

Regarding the use of electronic devices, almost all students reported that they used electronic devices (98.7%). Mobile phones were the most commonly

Table 2: Sociodemographic characteristics of secondary school students in Al-Khobar (n=903)

Sociodemographic characteristics	N (%)
Father's education	
Illiterate	12 (1.4)
Read and write	49 (5.4)
Elementary	131 (14.5)
Secondary	300 (33.2)
University	281 (31.1)
Higher	130 (14.4)
Mother's education	
Illiterate	37 (4.1)
Read and write	61 (6.8)
Elementary	175 (19.4)
Secondary	276 (30.6)
University	285 (31.6)
Higher	69 (7.6)
Father's occupation	
Not working	17 (1.9)
Governmental	276 (30.6)
Private	235 (26.0)
Free work	128 (14.2)
Retired	247 (27.4)
Mother's occupation	
Not working	614 (68.0)
Governmental	166 (18.4)
Private	48 (5.3)
Free work	38 (4.2)
Retired	37 (4.1)
Living with	
Parents	803 (88.9)
Mother only	64 (7.2)
Father only	23 (2.5)
Others	13 (1.4)
Family size (members)	
2	4 (0.4)
3	23 (2.5)
4	69 (7.7)
>4	807 (89.4)
Birth order	
First	193 (21.4)
Second	162 (17.9)
3 rd -5 th	326 (36.1)
>5 th	222 (24.6)
Family income (SR)	
<5000	110 (12.2)
5000-<10,000	254 (28.1)
≥10,000	539 (59.7)

used (91.7%), laptop use was 25.6%, whereas tablets and video gaming were the least used by students (20% and 16.9%, respectively). Nearly three-quarters of the students (73.1%) used the devices for social media followed by the watching of movies (63.2%) and for educational purposes (37.4%). More than two-thirds of the students (67.3%) used electronic devices 2 hours daily or more; those who spent 3 hours daily or more on electronic devices were 56.3% and only 3.6% spent <30 min [Figure 1], and the majority of students (81.5%) used their devices at bedtime.

Different factors have been associated with the use of electronic devices ($P \leq 0.05$); parents' education, occupation, living status, and income were significantly associated with the use of electronic devices by students. Higher percentages of users were those whose parents were university graduates or highly educated, had a working father, lived with both parents, or had a family income of more than 10,000 SR.

As regards anxiety, an equal percentage of mild and moderate anxiety was encountered (34.3% and 34.6%, respectively) in the students: moderate to severe in 21.5% and severe anxiety was observed in 9.6% [Figure 2]. As regards depression, different degrees of depression from mild (21.1%), moderate (30.5%), and severe (18.9%) were observed. Nondepressed students constituted only 29.5% [Figure 3].

There was a significant statistical association between anxiety and the living status and family income. Higher percentages of moderate-to-severe anxiety were encountered in students who did not live with both parents $X_{21} = 8.863, P = 0.003$ and had a family income of <5000 SR; $X_{21} = 8.231, P = 0.016$.

On the factors associated with depression, family income was the only statistically significant one. A higher percentage of depression was observed in those with a family income of <5000 SR; $X_{21} = 7.255, P = 0.027$.

With regard to the relation between anxiety and the use of electronic devices, a higher percentage of moderate-to-severe anxiety was encountered among users of electronic devices than nonusers (65.8% vs. 58.3%) with no statistically significant association. Those who used electronic devices for more than 2 hours exhibited moderate-to-severe anxiety in higher percentages than those who used them for <2 hours (67.3% vs. 62.5%). A statistically significant association was found regarding the use at bedtime. Here, a higher percentage of moderate-to-severe anxiety was encountered among those who used electronics at bedtime; $X_{21} = 6.964, P = 0.008$.

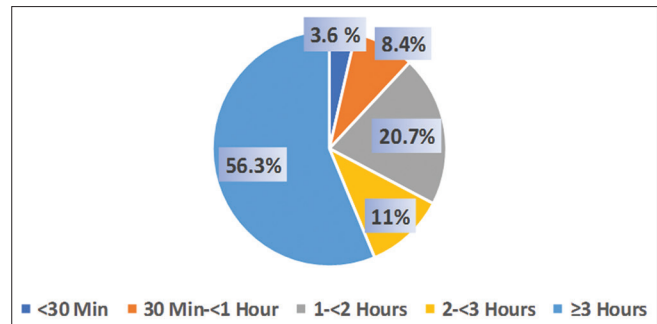


Figure 1: Daily hours spent in using electronic devices

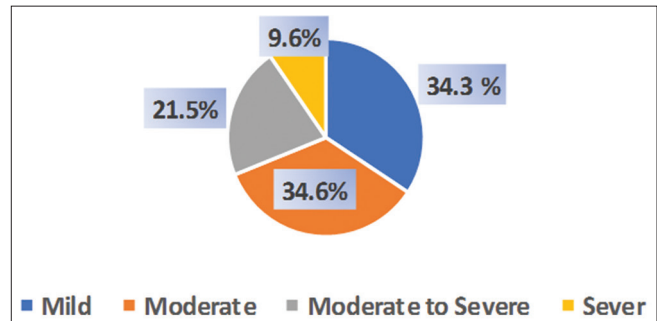


Figure 2: Distribution of students by severity of anxiety

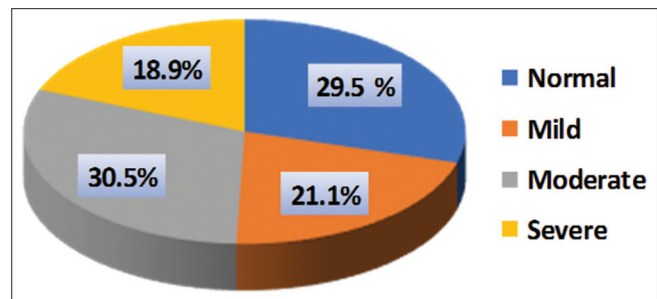


Figure 3: Distribution of students by severity of depression

Regarding depression, a statistically significant association was observed with the duration of the use of electronics and the times used. Higher percentages of depression were encountered in those who used them for more than 2 hours (78.2% vs. 66%), $X_{21} = 15.199, P = 0.000$, and those who used electronics at bedtime (76.7% vs. 63%) $X_{21} = 13.160, P = 0.000$.

Applying the binary logistic regression model to identify different predictors to anxiety and depression resulted in:

- Students whose mothers had elementary or preparatory education were 2.540 times more likely to have anxiety than those with illiterate mothers, $P = 0.045$
- Students who did not live with both parents were 1.957 times more likely to have anxiety ($P = 0.011$) and those who were users of electronic devices at bedtime were 1.524 more likely to develop anxiety ($P = 0.026$) [Table 3]

Table 3: Logistic regression analysis: Factors related to anxiety among secondary school students

Independent variable (parameter)	P-Value	Exp β (OR)	95% CI for Exp β (OR)	
			Lower	Upper
Father's education				
Higher than university	0.779	1.069	0.673	1.698
University	0.579	1.141	0.716	1.818
Secondary	0.922	1.030	0.574	1.848
Elementary and preparatory	0.139	0.577	0.252	1.320
Read and write	0.306	3.113	0.35	027.36
Illiterate		-	-	-
Mother's education				
Higher than university	0.244	1.406	0.792	2.497
University	0.333	1.352	0.735	2.487
Secondary	0.116	1.722	0.875	3.391
Elementary and preparatory	0.045	2.540	1.019	6.329
Read and write	1.659	0.606	4.539	0.325
Illiterate		-	-	-
Father's occupation				
Working	0.573	0.673	0.170	2.497
Not working		-	-	-
Mother's occupation				
Working	0.991	1.002	0.709	1.416
Not working		-	-	-
Living with				
Not with both parents	0.011	1.957	1.164	3.292
Both parents		-	-	-
Birth order				
Other than first	0.151	0.771	0.541	1.099
First birth order		-	-	-
Family income (SR)				
$\geq 10,000$	0.236	1.233	0.872	1.742
5000-<10,000	0.089	1.596	0.931	2.736
<5000		-	-	-
Use of electronic devices				
Yes	0.449	1.629	0.461	5.757
No		-	-	-
Daily spent hours				
≥ 2	0.285	1.188	0.866	1.630
<2		-	-	-
Use at bedtime				
Yes	0.026	1.524	1.051	2.208
No		-	-	-

OR=Odds ratio, CI=Confidence interval

- Regarding depression, the predictors revealed from the model were students with a family income of 5000 to <10,000 SR, those who spent more than 2 hours, and bedtime users of electronic devices were likely to develop depression [Table 2].

Discussion

Adolescence is a critical transitional period for the development of a mental illness such as depression or anxiety, resulting in serious negative effects on life.^[23] The prevalence of anxiety in this study was estimated at 65.7%, which is higher than was reported on

secondary school girls in Taif (54.9%).^[5] This observed prevalence is less than in an Indian study in 2017 with a reported prevalence of anxiety at 80.85% of adolescent participants.^[24] The explanation for this difference could be the exclusion of 3rd secondary year students from our sample.

In the current study, 70.5% of the participants were found to be depressed (mild to severe), and it was observed to be higher in students from families with lower incomes (<5000 SR). This percentage is high compared to earlier studies conducted in 2015 on Saudi adolescent girls in Al-Taif, in which depression was

reported at 42.9%, and that in Riyadh (2015) which reported the prevalence of depression at 30% of the participants.^[4,5] Different studies done in Arab countries to determine the prevalence of depression in school-age adolescents revealed 19% in Oman (2006) and 17% in Egypt (2007).^[25,26] A study in Malaysia also reported that approximately 17.7% of respondents had depressive symptoms.^[27] A possible explanation of the relatively higher rate for depression in the current study compared to other studies is the difference in the scale used to determine the diagnosis of depression.

Electronic devices play an important part in adolescent life and they are considered the most important factors affecting their psychological well-being.^[18] Almost all participants (98.7%) in our study reported that they used one or more electronic devices, a result consistent with an Australian school-based population study which confirmed high levels (99.9%) of the use of electronic devices by adolescents.^[28] The higher percentages of users were observed among students with highly educated parents and busy parents (working parents) as they were allowed to use electronic devices without supervision and among those with family incomes of more than 10,000 SR as they could easily afford those devices, hence their increased rate of use.

Students in our study used mobile phone more than any other types (91.7%) possibly because of its small size and ease of holding it. On the other hand, German students watched television (90%) more than using other electronic devices.^[29]

Our results showed that 67.3% of adolescents used electronic devices 2 h or more, and 81.5% of our sample students used them at bedtime. Similarly, 81.1% of Korean students used electronic media before sleep, and 60.5% of Swiss adolescents used smartphone before bed.^[7,30] Another Swiss study reported that 18.4% of adolescents played electronic games 5 or more days per week at night.^[31] A study in Japan found adolescent female bedtime use of the mobile phone to be 40.2%.^[32]

Our results reported that a higher percentage of anxiety was associated with the use of electronic devices for 2 h or more, and it was a predictor (logistic regression model) for anxiety by 1.188 times. Similarly, results from the Australian and Chinese studies showed a significant association between screen time and anxiety.^[28,33]

The logistic regression model showed that adolescents who used electronic devices for more than 2 h are 1.71 times more likely to have depression ($P = 0.002$). This finding is consistent with results from several studies from the USA (2009) which reported significantly greater odds of developing depression for each additional hour

of daily use, and in China (2011), 26.1% of adolescents who were exposed to the screen for more than 2 hours/day were at risk of depressive symptoms.^[33,34] Kremer *et al.* in Australia concluded that lower levels of screen time exposure were associated with lower depressive symptoms.^[35] A Canadian study (2015) by linear multiple regression model affirmed that the duration of screen time was associated with the severity of depression ($P < 0.001$).^[18] However, Casiano *et al.* showed no association between the duration of the use of electronic devices and depression, which may be because only major depressive disorders were considered to the exclusion of other levels of depression.^[36]

Bedtime use of electronic devices is an important predictor of anxiety and depression as shown in Tables 3 and 4 (OR = 1.52; 95% confidence interval [CI] = 1.05–2.20; $P = 0.026$ for anxiety and OR = 1.79; 95% CI = 1.21–2.65; $P = 0.003$ for depression). This is in line with a study conducted in Japan (2009) which used the General Health Questionnaire-12 that concluded that the use of mobile phones at bedtime was significantly associated with poor mental health, suicidal feelings, and self-harm.^[32] Their logistic regression reported the association between nocturnal mobile phone use and poor mental health, compared to those who did not use their mobile phones at bedtime (OR = 1.65; 95% CI = 1.43–1.92; $P < 0.001$).^[32] The regression models of Swiss study (2011) revealed that electronic media use in bed before sleep was related to higher levels of depressive symptoms.^[7] Multiple logistic regression analyses studied playing computer games at night and depression and found that the increased risk of depression scores among adolescents was associated with playing games at bedtime (OR = 1.65; 95% CI = 1.05–2.60, $P = 0.03$), whereas playing at other times was not significantly associated with the risk of increased depression scores.^[31]

In our study, adolescents who were heavy users of electronic devices may be isolating themselves from others. This has a detrimental effect on their ability to maintain relationships, which in turn may negatively impact on their psychological well-being. Adolescents who spend more time using electronic devices have more sleeping problems, and using them at bedtime may lead to sleep deprivation which itself will affect their psychological well-being. They might experience stress or negative emotions when talking or chatting with their friends on the mobile phone just before going to sleep which can prevent them from coping with stress, thereby increasing the feeling of depression and anxiety.^[31]

The higher percentage of smartphone users in our study indicates that adolescents are encouraged to go to bed later, spend a long time on their mobiles while resting

Table 4: Logistic regression analysis: Factors related to depression among secondary school students

Independent variable (parameter)	P-Value	Exp β (OR)	95% CI for Exp β (OR)	
			Lower	Upper
Father's education				
Higher than university	0.407	0.808	0.489	1.337
University	0.593	1.152	0.686	1.933
Secondary	0.466	0.788	0.416	1.493
Elementary and preparatory	0.745	1.167	0.461	2.953
Read and write	0.982	0.981	0.173	5.572
Illiterate		-	-	-
Mother's education				
Higher than university	0.804	1.082	0.581	2.016
University	0.725	1.127	0.580	2.188
Secondary	0.095	1.905	0.894	4.061
Elementary and preparatory	0.915	0.950	0.371	2.432
Read and write	0.794	1.155	0.391	3.415
Illiterate		-	-	-
Father's occupation				
Working	0.365	0.471	0.092	2.400
Not working		-	-	-
Mother's occupation				
Working	0.977	0.994	0.683	1.448
Not working		-	-	-
Living with				
Not with both parents	0.575	1.166	0.682	1.992
Both parents		-	-	-
Birth order				
Other than first	0.547	0.889	0.607	1.303
First birth order		-	-	-
Family income (SR)				
$\geq 10,000$	0.366	1.190	0.816	1.734
5000-<10,000	0.016	2.148	1.154	3.999
<5000		-	-	-
Use of electronic devices				
Yes	0.927	1.068	0.260	4.384
No		-	-	-
Daily spent hours				
≥ 2	0.002	1.719	1.227	2.408
<2		-	-	-
Use at bedtime				
Yes	0.003	1.795	1.216	2.652
No		-	-	-

OR=Odds ratio, CI=Confidence interval

in bed, as mobiles are smaller, weigh little, and are more convenient to use than other devices.

Study revealed that social media use is associated with depression and anxiety. Anxious students use the media as an escape mechanism to regulate their mood disturbances. Similarly, depressed adolescents may use social media more in order to regulate their low mood, in light of evidence that children and adults view television to regulate their emotions.^[37]

It should be noted that data were collected only from female Saudi students because female researchers are not allowed by the educational authorities in Saudi

Arabia to conduct studies on male students. Data were self-reported, and the study did not include information on sleep patterns and sleep problems, which might have confounded anxiety and depression.

Conclusion

The high prevalence of anxiety and depression in female students is worrying. In our study, anxiety and depression were significantly associated with duration and bedtime use of electronic devices.

This suggests that parents, health-care professionals, teachers, and social workers should pay more attention

to adolescents and protect them from the negative influences of the use of electronic devices. Age-specific guidelines on the duration of the use of electronic devices should be developed.

As adolescents spend a large proportion of their life in school, the education curriculum should include psychosocial development in order to protect them from developing mental disorders.

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Conflicts of interest

There are no conflicts of interest.

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