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Sociodemographic factors related to internet addiction among adolescents in Serbia

Socio-demografski faktori povezani sa zavisnošću od interneta kod adolescenata u Srbiji

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Abstract

Background/Aim. The term "internet addiction" (IA) describes a compulsive behavior associated with any online activity that disrupts everyday social interactions. The aim of this study was to determine risk factors and predictors of the development of IA in adolescents. **Methods.** Data were collected using an online form consisting of demographic data, questions related to the use of the Internet, and the Internet Addiction Test (version for adolescents). **Results.** A total of 1,669 respondents participated in this research; 1,040 of them (62.3%) were female, 590 (35.4%) were male, and 39 (2.3%) did not want to declare their gender. The average age of the respondents was 15.09 ± 1.757 years. Significant factors in the multivariate factor analysis model were age, addictive substance use frequency, purpose, and time spent on the Internet ($p < 0.05$). Analysis results indicate that the risk of developing IA was higher if an adolescent spent 1–3 hrs and more than 3 hrs daily on the Internet (2.8 and 8.2 times, respectively). With increasing age numbers for one unit (year), the risk of developing IA was decreasing by 11.3%. **Conclusion.** According to the findings of the present study, the relationship between IA and age, addictive substance use frequency, purpose, and time spent on the Internet has been proven. These results should be highlighted so that educators and all those who work with children could create targeted treatments to prevent the development of IA in adolescents.

Key words:
adolescent; internet use; surveys and questionnaires; technology addiction.

Apstrakt

Uvod/Cilj. Termin „zavisnost od interneta" (ZoI) opisuje kompulzivno ponašanje koje je povezano sa bilo kojom aktivnošću na internetu koje ometa svakodnevne društvene interakcije. Cilj rada bio je da se utvrde faktori rizika i prediktori razvoja ZoI kod adolescenata. **Metode.** Podaci u ovom istraživanju prikupljeni su uz pomoć *online* upitnika sačinjenog od demografskih podataka, pitanja u vezi sa upotrebom interneta i Testa za ispitivanje zavisnosti od interneta (verzija za adolescente). **Rezultati.** Ukupno 1 669 ispitanika učestvovalo je u ovom istraživanju; 1 040 (62,3%) ispitanika bilo je ženskog pola, 590 (35,4%) muškog i 39 (2,3%) ispitanika nije želelo da se izjasni po pitanju polne pripadnosti. Prosečno životno doba ispitanika bilo je 15,09 ± 1,757 godina. Značajni faktori u modelu multivarijantne faktorske analize bili su životno doba, učestalost upotrebe psihoaktivnih supstanci, svrha i vreme provedeno na internetu ($p < 0,05$). Rezultati analize pokazuju da su viši rizik od razvoja ZoI imali adolescenti koji su provodili 1–3 sata i više od 3 sata dnevno na internetu (2,8 i 8,2 puta, redom). Povećanjem broja godina za jednu jedinicu (godinu) rizik od razvoja ZoI smanjivao se za 11,3%. **Zaključak.** Ovim istraživanjem dokazana je povezanost između ZoI i životnog doba, učestalosti upotrebe psihoaktivnih supstanci, svrhe i vremena provedenog na internetu. Važno je istaći dobjene rezultate kako bi prosvetni radnici i svi oni koji rade sa decom kreirali ciljane programe prevencije razvoja ZoI kod adolescenata.

Ključne reči:
adolescenti; internet, korišćenje; ankete i upitnici; zavisnost od tehnologije.

Introduction

In recent years, the time spent on the Internet by adolescents has increased rapidly. Not only do schools and the educational system rely continuously more on internet activities, but the social lives of adolescents are also increasingly conducted through activities on social networks and other online applications [1]. The activities of young people

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on the Internet during the coronavirus disease 2019 (COVID-19) pandemic have significantly intensified due to the transition of the educational system to online teaching [2]. The term "internet addiction" (IA) describes a compulsive behavior associated with any online activity that disrupts everyday life and social interactions. As Shek et al. [3] stated, "problematic internet use" is a synonym for IA, which is defined as an individual's inability to maintain control over their internet use. It has become widely recognized as a serious health concern worldwide. One in eight Americans reports having trouble using the Internet [4], 2.4% of Chinese [5], 1.5% and 8.2% of Americans and Europeans [6], and 3.2% of United Kingdom citizens [7] said they were addicted to the Internet. Estimates from the World Bank indicate that Serbia has seen a rise in the number of Internet users in recent years. The percentage of people who used the Internet in 2009 was 38.1%; in 2012, it was 48.1%; however, in 2022, it was 84%. This pattern appears to be consistent with worldwide patterns of internet usage [8]. Research aimed at assessing the prevalence of internet use and IA among adolescents aged 14–18 years in the municipality of Novi Sad, Serbia, and the impact of sociodemographic variables on internet use showed that the estimated prevalence of IA was high (18,7%), mainly among younger adolescents. IA was found in every fifth adolescent [9]. These findings suggest a higher prevalence among adolescents compared to the general population, similar to a limited case study of IA in the City of Niš among the student population aged 19–23 who had a prevalence of internet use of 100% [10]. In a 2016, Dukanac et al. [11] showed that adolescents who developed IA have the lowest self-directedness and cooperativeness as character dimensions; however, they are more asocial than antisocial. Given that the internet-addicted adolescent group also scored highest in harm avoidance, the combination of the two factors may indicate genuine social anxiety, as well as a protective withdrawal into the virtual world and social avoidance. This group also had the highest scores in the two categories of exploratory curiosity, impulsivity, and novelty seeking. This aligns with the common conduct issue associated with the Internet, highlighting impulse control disorder independent of the cause of the disturbance in control. Advancements in technology may create new avenues for impulsivity to be expressed in virtual reality, or more likely, extended computer use and the consumption of violent content exacerbate irritation and encourage impulsive behavior [11]. According to previous research, the possible causes of excessive internet use are dysfunctional family, the degree of parental overprotection, parental control over the adolescent's free time, the adolescent's personality type (level of impulsivity, degree of self-control), aggressiveness, and neuroticism [6]. It has also been proven that the effects of excessive use of the Internet on the central nervous system are very similar to the effects of drug addicts, i.e., the response of the brain is very similar and is reflected in the increased secretion of dopamine. Adolescents are often shown to be the most vulnerable group in terms of developing IA; therefore, it is invaluable to examine the predictors and factors that influence the appearance and outcomes of this "new" form of addiction that has a negative impact on health, especially mental health.

In the present study, IA has been examined in adolescents in Serbia, with a correlation to differences in gender, place of residence, parent's education, and psychoactive substance use.

Methods

Sample

The sample of our research consisted of 1,669 adolescents aged 11 to 19 attending primary and secondary schools in Serbia. More detailed information on the sample structure will be provided in the Results section.

Instruments

For this study, we created an online form (Google Forms) that consisted of five parts. The first three sections of the full questionnaire were used for the current paper. The first part was related to the demographic data of the respondents (age, gender, class, level of professional education of the parents, success in the current and previous semesters, and use of psychoactive substances). The second part was related to the use of the Internet: from which device they connect to the Internet most often, how much time a day they spend on the Internet for school duties and extracurriculars, which group of applications they devote the most time to (social networks, games, viewing media, movies, music, etc.), whether their parents control them in this, and to what extent. The third part consisted of the Internet Addiction Test (IAT), a scale validated on the Croatian adolescent population that was used to diagnose IA with the author's permission and consent [12]. This scale consists of 20 questions, which can be answered with 6 answers: 0 – never, 1 – rarely, 2 – occasionally, 3 – often, 4 – very often, and 5 – always. The test taker can score 0–100 points. The classification of the points obtained is as follows: 0–19 = no signs of IA; 20–39 = low level of IA; 40–69 = medium level; 70–100 = high level of IA.

Design and procedure

In this research, a cross-sectional epidemiological study was used. The protocols used in this study followed the guidelines of the Declaration of Helsinki [13]. The study was approved by the Ethics Committee of the University of Kragujevac, Faculty of Medical Sciences, Serbia (No. 01-6816). Parents signed informed consent for minor participants (below 18 years of age). Schools were contacted randomly by email. After principal approval, a form link was forwarded to students. Responses were instantly available after form completion and presented in an Excel spreadsheet. Every response triggered a notification email in the researcher's mailbox.

Statistical analyses

Statistical data processing was performed using the standard SPSS software package, version 19.0. (SPSS Inc, version 19.0, Chicago, IL). The following descriptive statistics measures were used in this research: arithmetic mean, standard deviation, median, quartiles, frequencies, and percentages. The reliability of the measuring scales was tested using the Cronbach coefficient. The normal distribution of numerical variables was checked using the Shapiro-Wilk and Kolmogorov-Smirnov test. The correlation of category variables was examined using the Chi-square (χ^2) diagram for the contingent tables. Univariate and multivariate factor analyses were used for predicting IA.

Results

A total of 1,669 respondents participated in this research; 1,040 of them (62.3%) were female, 590 (35.4%) were male, and 39 (2.3%) did not want to declare their gender. The average age of the respondents was 15.09 ± 1.757 years, with the youngest respondent being 11 and the oldest 19 years old. Other sociodemographic data about the respondents can be found in Table 1.

Table 1

Sociodemographic characteristics

Question	Categories	Values
Do you go to primary or secondary school?	primary school	381 (22.8)
	secondary school	1,288 (77.2)
Do you have any siblings?	no	285 (17.1)
	yes	1,384 (82.9)
Which city is your place of residence (or closest)?	Belgrade	670 (40.1)
	Sombor	788 (47.2)
	Kragujevac	22 (1.3)
	Kruševac	82 (4.9)
	Niš	37 (2.2)
	other	70 (4.2)
What is the relationship of your parents?	divorced or separated	341 (20.4)
	married	1,253 (75.1)
	live together	75 (4.5)
What is your mother's education?	primary school	79 (4.7)
	secondary school	747 (44.8)
	college	188 (11.3)
	faculty	655 (39.2)
[1]What is your father's education?	primary school	99 (5.9)
	secondary school	833 (49.9)
	college	179 (11.3)
	faculty	548 (32.8)
What were your grades like last year?	acceptable (2, D)	22 (1.3)
	good (3, C)	193 (11.6)
	very good (4, B)	555 (33.3)
	excellent (5, A)	899 (53.9)
[2]Do you use any of these substances?	no, nothing	1,134 (68.0)
	e-cigars	217 (13.0)
	tobacco	100 (6.0)
	alcohol	198 (11.9)
	marihuana	4 (0.2)
	sleeping pills	13 (0.8)
	other	2 (0.1)
How often do you use the above-mentioned substances?	never	1,087 (65.1)
	rarely	176 (10.5)
	only when I go out with my friends	220 (13.2)
	every day	186 (11.1)

All values are given as numbers (percentages) of respondents.
Note: [1] Ten respondents did not answer this question, so the total number of respondents was 1,659 instead of 1,669; [2] One respondent did not answer this question, so the total number of respondents was 1,668 instead of 1,669.

Out of the total number of respondents, 1,618 (96.9%) use the Internet daily.

The distribution of answers to questions related to internet use is presented in Table 2.

After totaling/summing single IAT questions, a score for each participant was obtained. The average value of IAT was 28.90 ± 15.21, where the minimal score was 0 and the maximum 99. According to this IAT score, all participants were divided into categories as follows: 514 (30.8%) with no signs of IA, 773 (46.3%) with a low level of IA, 361 (21.6%) with a medium level of IA, and 21 (1.3%) with a high level of IA. Gender (χ^2 = 20.7. p = 0.002), attendance at primary or secondary school (χ^2 = 21.4, p < 0.001), and city of residence (χ^2 = 33.3, p = 0.004) were sociodemographic characteristics that were significantly related to IA level. Regarding the mother's education, significantly more participants without IA (39.3%), with low IA signs (42.3%), and with medium IA signs (34.9%) had a mother with university education (high education level) in relation to the ones with high IA signs (14.3%) (χ^2 = 20.7, p = 0.014). A similar result was observed concerning the father's education – respondents with high levels of IA had the lowest percentage of highly educated fathers compared to other groups (23.8%) (χ^2 = 12.1, p = 0.028). Moreover, the representation of students with excellent (A) grades was the least in the high IA level group (33.3%) relating to other groups (χ^2 = 42.3, p < 0.001). Usage of psychoactive substances that may result in developing addiction (χ^2 = 85.7, p < 0.001), same as the frequency of substance usage, was significantly related to IA level (χ^2 = 58.2, p < 0.001) as described in Table 3.

Table 2

Distribution of responses related to Internet usage

Question	Categories	Values
Usually, I access the Internet using?	computer	126 (7.5)
	smartphone	1,511 (90.5)
	laptop	32 (1.9)
Internet content mostly visited?	gaming	202 (12.1)
	social networks (Facebook, Instagram, Snapchat, TikTok, etc.)	1,060 (63.5)
	media content (YouTube, Spotify, Netflix, HBO, etc.)	371 (22.2)
	school activities	36 (2.2)
Do you use the Internet every day?	no	51 (3.1)
	yes	1,618 (96.9)
If used every day, approximately for how long?	max 1 hr	109 (6.5)
	1–3 hrs	617 (37.0)
	more than 3 hrs	943 (56.5)
Do your parents control the time you spend on the Internet?	no	700 (41.9)
	sometimes	694 (41.6)
	yes	275 (16.5)
Do you use the Internet for school activities?	never	81 (4.9)
	sometimes	748 (44.8)
	often	840 (50.3)

All values are given as numbers (percentages) of respondents.

Table 3

Sociodemographic characteristics related to the Internet addiction presence

Parameters	No signs	Low level	Medium level	High level	Chi-square/*p*-value
Gender					
female	299 (58.2)	504 (65.2)	227 (62.9)	10 (47.6)	
male	204 (39.7)	253 (32.7)	125 (34.6)	8 (38.1)	**20.7/0.002**
undeclared	11 (2.1)	16 (2.1)	9 (2.5)	3 (14.3)	
School					
primary	152 (29.6)	152 (19.7)	70 (19.4)	7 (33.3)	**21.4/< 0.001**
secondary	362 (70.4)	621 (80.3)	291 (80.6)	14 (66.7)	

Table 3 (continued)

Parameters	No signs	Low level	Medium level	High level	Chi-square/*p*-value
Siblings					
no	91 (17.7)	121 (15.7)	69 (19.1)	4 (19.0)	2.4/0.500
yes	423 (82.3)	652 (84.3)	292 (80.9)	17 (81.0)	
Nearest city of residence?					
Belgrade	184 (35.8)	344 (44.5)	138 (38.2)	4 (19.0)	**33.3/0.004**
Sombor	265 (51.6)	329 (42.6)	180 (49.9)	14 (66.7)	
Kragujevac	5 (1.0)	15 (1.9)	1 (0.3)	1 (4.8)	
Kruševac	26 (5.1)	34 (4.4)	22 (6.1)	0 (0.0)	
Niš	11 (2.1)	18 (2.3)	6 (1.7)	2 (9.5)	
Other cities	23 (4.5)	33 (4.3)	14 (3.9)	0 (0.0)	
Parents' relationship					
divorced or separated	91 (17.7)	155 (20.1)	90 (24.9)	5 (23.8)	9.6/0.143
married	403 (78.4)	583 (75.4)	253 (70.1)	14 (66.7)	
live together	20 (3.9)	35 (4.5)	18 (5.0)	2 (9.5)	
Mother's education					
primary school	26 (5.1)	32 (4.1)	18 (5.0)	3 (14.3)	**20.7/0.014**
secondary school	240 (46.7)	327 (42.3)	169 (46.8)	11 (52.4)	
college	46 (8.9)	87 (11.3)	51 (14.1)	4 (19.0)	
university degree	202 (39.3)	327 (42.3)	123 (34.9)	3 (14.3)	
[1]Father's education					
primary school	31 (6.0)	39 (5.0)	27 (7.5)	2 (9.5)	**12.1/0.028**
secondary school	262 (51.0)	344 (47.1)	196 (54.3)	11 (52.4)	
college	59 (11.5)	92 (11.9)	35(9.7)	3 (14.3)	
university degree	162 (31.5)	278 (36.0)	103(28.5)	5 (23.8)	
Last-year school grades					
acceptable (2, D)	4 (0.8)	9 (1.2)	7 (1.9)	2 (9.5)	**42.3/< 0.001**
good (3, C)	61 (11.9)	70 (9.1)	58 (16.1)	4 (19.0)	
very good (4, B)	161 (31.3)	245 (31.7)	141 (39.1)	8 (38.1)	
excellent (5, A)	288 (56.0)	449 (58.1)	155 (42.9)	7 (33.3)	
[2]Addictive substance use					
no	392 (76.3)	531 (68.8)	197 (54.6)	14 (66.7)	**85.7/< 0.001**
e-cigars	39 (7.6)	88 (11.4)	85 (23.5)	5 (23.8)	
tobacco	31 (6.0)	40 (5.2)	28 (7.8)	1 (4.8)	
alcohol	49 (9.5)	103 (13.3)	46 (2.7)	0 (0.0)	
marihuana	2 (0.4)	2 (0.3)	0 (0.0)	0 (0.0)	
sleeping pills	1 (0.2)	8 (1.0)	3 (0.8)	1 (4.8)	
other drugs	0 (0.0)	0 (0.0)	2 (0.6)	0 (0.0)	
Frequency of addictive substance use					
never	383 (74.5)	506 (65.5)	187 (51.8)	11 (52.4)	**58.2/< 0.001**
rarely	45 (8.8)	82 (10.6)	48 (13.3)	1 (4.8)	
only when I go out with friends	43 (8.4)	107 (13.8)	67 (18.6)	3 (14.3)	
every day	43 (8.4)	78 (10.1)	59 (16.3)	6 (28.6)	

All values are given as numbers (percentages) of respondents.
Note: [1] Twenty respondents did not answer this question, so the total number of respondents was 1,649 instead of 1,669; [2] One respondent did not answer this question, so the total number of respondents was 1,668 instead of 1,669.

Significant relatedness or connection (in terms of spending time) in all characteristics of internet use and IA level was observed ($p < 0.001$), as described in Table 4.

All respondents with high levels of IA signs declared using the Internet each day ($\chi^2 = 15.4$, $p = 0.002$), the same as the usage of the Internet for more than 3 hrs *per* day

(χ^2 = 250.1, p < 0.001). In the group of respondents who did not receive any warning from their parents regarding the time they spent on the In-ternet, the results were as follows: 38.5% of respondents had no signs of IA, 42.3% showed a low level of IA, medium level of IA was present in 44.3%, and 71.4% of respondents had a high level of IA) (χ2 = 14.9, p = 0.021) (Table 4).

After univariant logistic regression, all variables that showed significance (p < 0.05) were integrated into the multivariant model. This model clarifies the 17.6–24.8% variance of the dependent variable and has good predictive power according to the results of the Hosmer-Lemeshow tests (p > 0.05). The accuracy of this model was 73.8%. Significant factors in this model were age, addictive substance use frequency, purpose, and time spent on the Internet (p < 0.05). Other variables that were significant in the univariate model lost their significance in the multivariate model after impact assessments of other variables. Analysis results indicate that the risk of developing IA is higher if an adolescent spends 1–3 hrs and more than 3 hrs daily (2.8 and 8.2 times, respectively). With the age increasing by one unit (year), the risk of developing IA decreases by 11.3%. Other statistically significant variables are described in Table 5.

Table 4

Characteristics of Internet usage associated with Internet addiction

Question	No signs	Low level	Medium level	High level	Chi-square/ *p*-value
Usually, I access the Internet *via*?					
computer	43 (8.4)	41 (5.3)	40 (11.1)	2 (9.5)	
smartphone	457 (88.9)	724 (93.7)	311 (86.1)	19 (90.5)	**20.1/0.003**
laptop	14 (2.7)	8 (1.0)	10 (2.8)	0 (0.0)	
[1]Usually, I spend the time on the Internet for?					
gaming	58 (11.3)	73 (9.4)	65 (18.0)	6 (28.6)	
social networking (Facebook, Instagram, Snapchat, TikTok, etc.)	282 (56.2)	510 (66.0)	248 (68.7)	13 (61.9)	**75.0/< 0.001**
media (YouTube, Spotify, Netflix, HBO, etc.)	143 (27.8)	180 (23.3)	47 (13.0)	1 (4.8)	
for school activities	24 (4.7)	10 (1.3)	1 (0.3)	1 (4.8)	
Do you use the Internet every day?					
no	28 (5.4)	18 (2.3)	5 (1.4)	0 (0.0)	**15.4/0.002**
yes	486 (94.6)	755 (97.7)	356 (98.6)	21 (100.0)	
If used every day, how much time approximately would that be?					
1 hr max	76 (14.8)	28 (3.6)	5 (1.4)	0 (0.0)	
1–3 hrs	266 (51.8)	288 (37.3)	63 (17.5)	0 (0.0)	**250.1/< 0.001**
more than 3hrs	172 (33.5)	457 (59.1)	293 (81.2)	21 (100.0)	
Do your parents control the time you spend on the Internet?					
Do they warn you?					
no	198 (38.5)	327 (42.3)	160 (44.3)	15 (71.4)	
sometimes	214 (41.6)	331 (42.8)	145 (40.2)	4 (19.0)	**14.9/0.021**
yes	102 (19.8)	115 (14.9)	56 (15.5)	2 (9.5)	
Do you use the Internet for school activities and learning?					
never	22 (4.3)	31 (4.0)	24 (6.6)	4 (19.0)	
sometimes	206 (40.1)	344 (44.5)	187 (51.8)	11 (52.4)	**29.9/< 0.001**
often	286 (55.6)	398 (51.5)	150 (41.6)	6 (28.6)	

All values are given as numbers (percentages) of respondents.
Note: [1] Seven respondents did not answer this question, so the total number of respondents was 1,662 instead of 1,669.

Table 5

Univariate and multivariate factor analysis for Internet addiction prediction

Variable	Logistic regression			
	univariate		multivariate	
	OR	*p*-value	OR	*p*-value
Age, years				
11–19	1.105 (1.042–1.173)	**0.001**	0.887 (0.791–0.895)	**0.040**
Gender				
female	1	ref	1	ref
male	0.764 (0.615–0.948)	**0.015**	0.975 (0.748–1.271)	0.850
School				
primary	1	ref	1	ref
secondary	1.698 (1.338–2.155)	< **0.001**	1.501 (0.980–2.300)	0.062
Parents' relationship				
separated or divorced	1	ref	1	ref
married	0.768 (0.587–0.965)	**0.05**	0.899 (0.665–1.215)	0.487
City of residence				
Belgrade	1	ref	1	ref
Sombor	0.747 (0.597–0.936)	**0.011**	0.807 (0.600–2.138)	0.157
Addictive substance use				
none	1	ref	1	ref
e-cigars	2.411 (1.670–3.482)	< **0.001**	0.657 (0.295–1.461)	0.303
alcohol	1.606 (1.138–2.269)	**0.007**	0.607 (0.267–1.379)	0.233
How often do you use the addictive substances?				
never	1	ref	1	ref
rarely	1.584 (1.104–2.272)	**0.012**	2.087 (0.941–4.628)	0.070
only when going out with friends	2.239 (1.569–3.196)	< **0.001**	2.490 (1.106–5.605)	**0.028**
each day	1.809 (1.259–2.601)	**0.001**	2.022 (0.948–4.315)	0.069
What Internet content do you most often spend your time on?				
games	1	ref	1	ref
media (YouTube, Spotify, Netflix, HBO, etc.)	0.642 (0.444–0.929)	**0.019**	0.616 (0.399–0.951)	**0.029**
school activities	0.201 (0.094–0.429)	< **0.001**	0.261 (0.110–0.620)	**0.002**
Do you use the Internet every day?				
no	1	ref	1	ref
yes	2.836 (1.617–4.973)	< **0.001**	1.116 (0.581–2.142)	0.742
How much time do you spend on the Internet daily?				
1 hr max	1	ref	1	ref
1–3 hrs	3.039 (1.960–4.712)	< **0.001**	2.775 (1.706–4.512)	< **0.001**
more than 3 hrs	10.323 (6.644–16.042)	< **0.001**	8.205 (4.962–13.568)	< **0.001**
Do your parents control the time you spend on the Internet?				
no	1	ref	1	ref
yes	0.669 (0.498–0.898)	**0.008**	0.984 (0.695–1.393)	0.927

OR – odds ratio; ref – reference category; HBO – Home Box Office.

Discussion

The main aim was to determine which variables included in the research have the greatest predictive power for the development of IA. In this research, it was shown that 96.9% of the surveyed adolescents use the Internet daily, which is in line with previous studies conducted around the world [14]. Based on the IAT score, adolescents in our research were divided into the following groups: 30.8% had no signs of IA, 46.3% had a low level of IA, 21.6% had a moderate level of IA, and 1.3% had a high level of IA. These findings are consistent with those obtained on a population of 352 students in Croatia, where the results showed that 3.4% of high school students reported high levels of IA, while 35.4% of respondents reported some signs of addiction. It is important to note that for the assessment of IA in that research, an identical instrument was used as in our study [12]. Results for 31 nations were reported in a meta-analysis of 164 independent samples (n = 89,281) by Cheng and Li [15]. According to the findings of their research, the Middle East has the highest incidence of high IA (10.9%). The countries of North and West Europe have the lowest prevalence of IA

(2.6%), followed by Southeast European countries with a frequency of 6.1%.

In this study, a significant correlation was observed in all characteristics of internet use with the degree of IA because all respondents with a high level of IA stated that they use the Internet every day or use the Internet for more than 3 hrs a day, while 71.4% of respondents with a high level of IA stated that their parents do not control the time they spend on the Internet. Our findings are consistent with research conducted on a sample of 426 students in Saudi Arabia. The same instrument as in our study (20-item IAT) was used to measure IA, and it was shown that 40.8% of respondents used the Internet 5–7 hrs a day, mainly for social networking (88.5%) and to download media files. Approximately 6% were classified as internet addicts, and 42% had occasional problems. IA was significantly higher in those who used the Internet for more than 10 hrs a day [16]. In our research, after conducting univariate logistic regression, the following were identified as significant factors predicting addiction to the Internet: age, frequency of use of addictive substances, purpose of spending time on the Internet, and time spent on the Internet, which is in agreement with the results of other research [17]. The association between IA and frequency of substance use is expected because characteristic features of both physical and psychological addictions, including fluctuating emotions, tolerance, withdrawal, interpersonal conflict, and relapse, are evident in "behavioral" addictions, i.e., syndromes analogous to substance addiction but with a behavioral focus other than ingestion of a psychoactive substance [18]. The "self-medication hypothesis" states that patients typically utilize drugs to manage their cognitive deficiencies, lessen excruciating anxiety, and alter undesirable temperamental positions [19]. This may be seen in IA, which is a behavioral addiction, as well as in other behavioral issues that young people face, such as substance abuse. Nevertheless, the research from 2016 clearly showed the difference in the personality structure of chemical and behavioral, non-chemical addictions in adolescents. Adolescents abusing psychoactive substances had low harm avoidance and self-transcendence, while adolescents with IA were characterized by high novelty seeking (impulsivity and curiosity), low self-directedness, and the lowest cooperativeness [11]. The results of the aforementioned study from Serbia, in which, in addition to other instruments, the IAT consisting of 20 items for self-assessment of problems related to the use of the Internet was applied, showed that adolescents with the problem of IA have the most extreme results in personality dimensions, which could represent a significant psychopathological risk factor [11]. Some variables that showed significance in the univariate model lost it in the multivariate model after assessing the influence of other variables, and, in the final addiction prediction model, the results of the analysis showed that the risk of developing addiction to the Internet is greater if the child spends more than 1–3 hrs and more than 3 hrs a day on the Internet (2.8 and 8.2 times, respectively), and that with an increase in the number of years by one, the risk of IA decreases by 11.3%. These findings are expected and in accordance with the research conducted by Kolaib et al. [16].

Limitations and future directions

This study has some limitations that should be considered when interpreting the findings and conclusions. First, this is a descriptive, cross-sectional study, which limits the possibility of establishing cause-and-effect relationships between the examined variables. Second, the validation of the used test (IAT) of the Croatian population is not entirely adequate for the validation of the Serbian population. Additionally, response biases, which can often be difficult to eliminate in self-reported survey research like this one, may have influenced respondents' opinions, thus limiting the results of this study.

In addition to the mentioned limitations, it should be kept in mind that this research has important theoretical and practical significance when it comes to understanding the predictors of IA among adolescents. The preventative efforts ought to center on helping adolescents make good use of their own leisure time. The areas of emotional and social competence, responsible use of media content, and current technology should be the focus of prevention initiatives as well as treatment for youth with high levels of internet dependence. Early program interventions on appropriate and safe internet use are essential to lower the likelihood of high levels of IA during the adolescent years.

Conclusion

According to the findings of the present study, the relationship between IA and age, addictive substance use frequency, purpose, and time spent on the Internet has been proven. The largest number of respondents had a moderate addiction to the Internet. Adolescents with IA will more likely have lower grades in school. The use of psychoactive substances was not a significant predictor of developing IA.

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Conflict of interest

The authors declare no conflict of interest.

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