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Research Article

Predictors of Severe Problematic Internet Use in Adolescent Students

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Abstract

Recent literature draws attention to the fact that problematic Internet use is a growing health issue among adolescents worldwide. This study aimed to find the potential demographic, physical and psychopathological risk factors associated with severe problematic Internet use of adolescents. A total of 1,347 adolescents (45.1% males) were recruited from five high schools in three settlements. Students completed an online questionnaire and provided data about socio-demographics, physical activity, physical and psychopathological health, as well as about their Internet use habits (Problematic Internet Use Questionnaire). 1.9% of the respondents appeared to be severe, 20.4% moderate problematic Internet users. The complexity of the problem is manifested in the multifaceted relationships of factors. The multinomial regression analysis identified four significant risk factors for severe problematic internet use, namely depressive symptoms, loneliness, low level of father's education level and low level of physical activity. The real severe problematic Internet use is not so common in adolescent students, however, together with moderate problematic Internet users, this number has significance. Psychopathological factors such as elevated depressive symptoms and loneliness should be considered when preventive programs are implemented and more attention should be taken on physical activity as an effective tool against addictive behavior.

Keywords: adolescents, depressive symptoms, loneliness, physical activity, problematic Internet use

INTRODUCTION

Young people use the Internet as an integral part of their daily life with its advantages and disadvantages. Zoomers, or Generation Z have grown up in digital environment, have access to various smart electronic devices and can access Internet almost universally. According to the Internet Stats and Facebook Usage in Europe June 2019 Statistics, 89% of the Hungarian population is Internet user, especially adolescents and young adults (https://www.internetworldstats.com/stats4.htm). It is expected that proportion of problematic Internet users will increase as the Internet in general is expanding. Based on the latest literature, there is evidence that a minority of adolescents shows problematic patterns of Internet use, leading to detrimental effects for the users (Anderson et al., 2017; Xu et al., 2014). First, Ivan Goldberg psychiatrist drew attention to this maladaptive behavior in 1995 and called it "Internet addiction disorder" (later redefined as "pathological Internet-use disorder"), and put the diagnostic criteria (Wallis, 1997), however, it is still not mentioned in the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5) (In **Appendix**, Internet Gaming Disorder as behavioral addiction was included for further empirical and clinical discussion). Young (1996, 1998) and Griffiths (1996) investigated this pathological problem in more depth and used term "Internet addiction" (IA). There is a great debate about the terminology. There is a widespread use of excessive Internet use, compulsive Internet use, Internet addiction, pathological Internet use, Internet-related disorders, problematic Internet use, and scientists use them interchangeably. In this study, problematic Internet use (PIU) was utilized for describing adolescents' behaviour for two reasons. First, the

concept of IA is not fully conceptualized; second, as a result of it, the cut-off point for addictive behavior is not or not clearly defined.

A series of studies draw attention to the complexity of the PIU. It is often comorbid with other psychiatric disorders (Ho et al., 2014; Ko et al., 2012; Reed et al., 2015), physical health (Tsitsika et al., 2016) and a variety of psychological comorbidities (Adalier & Balkan, 2012). Besides that, studies indicated that PIU was associated with social isolation (Ang et al., 2012), low social support (Prievara et al., 2019), low self-esteem (Wiederhold, 2016; Yang & Tung, 2007), improper eating habits (Gür et al., 2015), sleeping problems (Punamaki et al, 2007), cognitive defection (Park et al., 2011), poor interpersonal relationships (Milani et al., 2009), dissatisfaction with life (Van den Eijnden et al., 2008), and low physical activity (PA) (Durkee et al., 2016; Peltzer et el., 2014). Kuss and Griffiths (2012) in their systematic literature review with 18 studies used neuroimaging techniques concluded that Internet and gaming addiction led to functional and structural changes of brain that makes this problem especially serious in adolescents. Since adolescents are in the process of physical, emotional and cognitive development they are considered vulnerable population to the adverse effects of the Internet (Hurd et al., 2014; Kuss et al., 2014; Leung, 2007; Luengo Kanacri et al., 2014).

According to meta-analysis of Cheng and Li (2014), the prevalence of IA is estimated 6% [95% CI: 5.1-6.9] globally. High (~20%) prevalence is observed in Asia where IA has great public concern (Adams, 2016). Kuss et al. (2014) found 0.8% prevalence rate in Italy and 26.7% in Hong Kong in adolescents. Durkee et al. (2012) evaluating almost 12 thousands adolescents in 11 European countries found this number approximately 4.4% including Hungary (1.6%), and this study also demonstrated high variation by countries. There is evidence this problem exists and has negative consequences, and the prevalence of PIU is increasing among European adolescents, further research is required to consider it as a full disorder (Kaess et al., 2016).

Taking into account the growing prevalence and the wide range of factors that characterize the PIU, as well as the uncertainty in the complex official formulation of the problem (APA, 2013), this study aims to examine the potential demographic, physical and psychopathological risk factors associated with severe PIU of Hungarian adolescents in the Northeast region using the 18-item Problematic Internet Use Questionnaire (PIUQ).

METHODOLOGY

Procedure and Ethics

Students attending grade 9-12 were recruited from five high schools of three settlements in the Northeast region of Hungary. All students were invited to take part in the study. Parents were informed about the purpose and procedure of the study and voluntary nature of the participation via electronic logbook. Parents could give their consent using this official electronic documentation. Students completed an online battery of standardized questionnaires in the school that took approximately 15 minutes. All the students were eligible who were present on the survey day, had their parents' consent, and showed a willingness to complete the questionnaire clicking the consent button before starting the online survey. The research project was approved by the Borsod-Abaúj-Zemplén Regional Ethics Committee and the Institutional Ethics Committee of the University of Miskolc, and the managements of all high schools agreed to collect data.

Participants

Of the 1391 students taking part in the survey, data for 44 respondents were dropped out because of the incomplete responses. The final sample included 1347 participants. Descriptive statistics of the participants are presented in **Table 1**.

Table 1. Demographics of participants (M = 1349)

Mean (SD), percentage	Adolescent students
Sample	1347
Age (years)	16.49 (1.46)
Sex – males : females : M/D	45.1 : 54.3 : 0.6
Financial situation – below : average : above : M/D	2.7 : 84.0 :12.8 : 0.5
Mother's education – lower than secondary: secondary : higher than secondary : M/D	6.6 : 47.6 : 38.9 : 6.9
Father's education – lower than secondary: secondary : higher than secondary : M/D	6.5 : 52.1 : 29.9 : 11.5

M/D – missing data

Outcome Measures

Sociodemographic. Students provided data about their age, sex, mothers and fathers' education level (lower secondary education, secondary education, higher then secondary education), financial situation of their family (below average, average, above average) as well as their weight and height for calculating BMI.

Problematic internet use. PIU was assessed by the 18-item Problematic Internet Use Questionnaire (PIUQ) developed by Demetrovics et al. (2008) using factor and psychometric analysis. The questionnaire consists of three six-item factors, namely obsession (being obsessed with internet activities and mental withdrawal symptoms caused by the lack of internet activity (Koronczai et al., 2011), neglect (neglecting non-Internet activities), and control disorder (unable stopping to use the Internet). Items were rated on a 5-point Likert scale from never (1) to always (5). Chronbach's alpha in the study sample is 0.86 indicating good internal consistency (Nunnally, 1994). There are no any cut-off points for when the internet use becomes of addictive concerns. Higher scores indicate more problems. For evaluating covariates, scores were trisected as no problem (18-41), moderate problem (42-65) and severe problem (66-90) in internet use. The validity and reliability of the PIUQ in adolescent and adult population is verified by Koronczai et al. (2011).

Social support. The Multidimensional Scale of Perceived Social Support (MSPSS) was used to evaluate subjectively assessed social support from family, friends and a significant other. The questionnaire comprised of a total of 12 items, with 4 items for each subscale on a 7-point Likert scale from very strongly disagree (1) to very strongly agree (7). Higher mean scores reflect high support (Zimet et al., 1988). Hungarian validation was conducted by Papp-Zipernovszky et al. (2017). Chronbach's $\alpha = .91$ in this study population.

Well-being. WHO-5 Well-Being Index was used to evaluate students' emotional profile (WHO, 1998; Topp et al., 2015). Answers were reverse-scored and linearly transformed to a 0-100 scale. All scores were calculated by dividing the sum of the items and the number of items answered. The higher scores refer to better well-being. The index has previously been validated for Hungarian usage (Susánszky et al., 2002) (Chronbach's $\alpha = .79$).

Loneliness. Adolescent students' loneliness was evaluated using the UCLA Loneliness Scale. This scale contained questions measuring three dimensions of loneliness: relational and social connectedness, as well as self-perceived isolation. The possible answer categories are hardly ever (1), some of the time (2) and often (3). Higher summed score indicated more loneliness (Hughes et al., 2004). Internal consistency of the questionnaire in our sample was Chronbach's $\alpha = 0.85$.

Depression. 6-item Kutcher Adolescent Depression Scale is a psychological self-rating scale to assess depressive symptoms in adolescents. Scores on the test range from 0 to 18, higher scores indicate more severe current depressive symptoms (Brooks et al. 2003; LeBlanc et al., 2002) (Chronbach's $\alpha = .78$).

Self-esteem. The Rosenberg's Self-Esteem Scale was used to evaluate students' self-esteem (Rosenberg, 1965). It has ten items of which five are reversed scored. Respondents answered on a 4-point Likert scale (from strongly agree to strongly disagree). Higher scores indicate higher self-esteem. Cronbach's α was found .77 in this study population.

Life satisfaction. Satisfaction with Life Scale by Diener et al. (1985, 2013) is a five-item questionnaire assessing the subjective experience of satisfaction with the life as a whole. Respondents can indicate their

degree of agreement with the statements on a 7-point scale from 1 (unsatisfied) to 7 (satisfied). The score on the scale is given by summing the responses to the items, with a higher score indicating higher life satisfaction (Chronbach's α in this population is .80). Hungarian adaptation of the scale was performed by Martos et al. (2014).

Perceived health status and anxiety. Perceived health and anxiety was displayed using Visual Analog Scale (VAS) of 0 to 100, where 0 represents "worst imaginable health"/"not at all anxious" and 100 indicates "best imaginable health."/"most anxious".

Physical activity. PA was measured with an item, where adolescents were asked to report the number of days over the previous week during which they were physically active for a total of at least 60 minutes that increases the heart rate and makes them get out of breath some of the time. Answers ranged from 0 to 7.

Statistical Analysis

SPSS statistical software (IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY, USA) was used for analysis. Significance level at $p \leq 0.05$ was accepted. Descriptive statistics reported median and interquartile range (IQR), or mean and SD for quantitative variables, and proportion for qualitative variables. Cronbach's alphas were calculated to estimate internal consistency of scales used in the study. Due to violation of normality in PIUQ scores, bivariate correlation was illustrated by Spearman's coefficient (Sr). Multinomial regression was applied to create predictions to determine which socio-demographic psychologic and physical health variables predict severe PIU. In the logistic model, the reference category (Y = 0) was the group without problems of internet use and the other two categories [Y = 1 (moderate) and Y = 2 (severe problem in internet use)] were compared to this group. Explanatory variables included categorical (sex, financial situation, physical activity level, mother's and father's education level) and continuous variables (age, social support, self-esteem, well-being, depressive symptoms, anxiety, loneliness, overall life satisfaction, perceived health status). Variable selection and model fitting were performed following Hosmer's approach (2013). Multicollinearity was checked with variance inflation factors (VIF), all variables were between 1.027 – 2.038.

RESULTS

Adolescents' Internet Use

1.9% of the participants are considered severe, whereas, 20.4% are considered moderate problematic Internet users without sex difference ($\chi^2 = 1.67$, df = 2; p = .43). Adolescent students had a median score of 31 (IQR 14) [obsession: 9 (IQR 5), neglect: 11 (IQR 6), control disorder: 11 (IQR 6)]. Regarding the group with severe PIU, the PIUQ median score was 68.5 (IQR 8.25), [obsession: 24 (IQR 5.25), neglect: 24 (IQR 4), control disorder: 23 (IQR 5.5)]. The most common problem for students were sleep deprivation, spending more time online than expected, neglect of household chores, and unable to reduce time spent online.

Inter-Correlation of the Variables

In general, increase in PIUQ score was significantly associated with decrease in physical activity level, perceived health status, well-being, life satisfaction, social support in general, self-esteem, as well as increase in loneliness and depressive symptoms. Age (13-22) did not show any correlations with scores. Depressive symptoms significantly correlated with anxiety, age, PA level, perceived health status, social support, life satisfaction, loneliness, well-being and self-esteem. **Table 2** presents inter-correlations of the variables.

Table 2. Inter-correlations of the variables

Variables	1	2	3	4	5	6	7	8	9	10
1 PIU score	1									
2 Age	.02	1								
3 PA level	-.16***	-.08**	1							
4 Percieved health	-.18***	-.09**	.18***	1						
5 Social support	-.28***	-.08**	.18***	.26***	1					
6 Life satisfaction	-.22***	-.14***	.22***	.45***	.52***	1				
7 Loneliness	.29***	.13***	-.15***	-.29***	-.48***	-.45***	1			
8 Well-being	-.21***	-.09**	.26***	.36***	.33***	.51***	-.39***	1		
9 Self-esteem	-.33***	-.07*	-.07*	.33***	.45***	.50***	-.51***	.46***	1	
10 Anxiety	-.08	-.06*	-.06*	.15***	.09**	.11***	-.12***	.07*	.14***	1
11 Depressive symptoms	.34***	.14***	-.14***	-.38***	-.42***	-.53***	.56***	-.57***	-.60***	-.11***

Note: *p < .05; **p < .01; ***p < .001

Table 3. Logistic regression predicting likelihood of severe problematic internet use

		95% CI for OR*			
Variables	B (SE)	Lower	OR	Upper	Sig.
Depressive symptoms	.24 (.08)	1.10	1.27	1.47	.001
Loneliness	.38 (.13)	1.14	1.46	1.88	.003
Father's education level (0)**	1.79 (.74)	1.39	5.97	25.63	.016
Physical activity level	-.25 (.12)	.61	.78	.98	.036

*95% Confidence Interval for Odds Ratio

**0 = less than secondary education

Predicting Likelihood of Severe Problematic Internet Use

Multinomial logistic regression (MLR) was undertaken to explore estimation of the net effects of a set of explanatory variables on the dependent variable (severe PIU). The Likelihood Ratio chi-square test ($\chi^2_{(34)}$ = 181.09, p < .001) indicated that the final logistic model was statistically significant, and 75.0% of cases were correctly classified. Parameter estimation referred four factors (depressive symptoms, loneliness, father's education level and physical activity level) contributed meaningfully to the full effect (**Table 3**).

DISCUSSION

This study investigated explanatory variables of severe PIU in adolescents in the Northeast region of Hungary. Since diagnostic criteria were not established and the applied questionnaire had no clinically relevant cut-off points for determine IA, three groups were formed based on continuum of PIUQ scores. Results demonstrated low prevalence of risky behavior that is in line with earlier study including Hungarian adolescents using different measure (Durkee, 2012). It should be mentioned there is still no widely acceptable measure to determine PIU, and data with different variances about the prevalence of PIU provided by various studies, leave uncertainty behind them, primarily for different assessment tools, different cut-off points even when using the same measurement, and different social and cultural context (Kuss et al., 2014; Mamun & Griffiths, 2019).

Some studies identified sex difference, males tended to be at risk for developing addiction (Lam et al., 2009; Tsitsika et al., 2009). This study cannot confirm this finding; it is in line with Khazaal's (2008) and Wang's (2011) results that sex is not a real risk factor for PIU. Both sexes equally need to take part in prevention programs against PIU.

Findings of this study revealed four factors included depressive symptoms, loneliness, father's education level and physical activity level that explained the relationship between the severe PIU and a set of variables including socio-demographic, physical, and psychological variables. It is well-known, depressive symptoms are common in adolescence. Result of this study is in agreement with other studies indicated positive

association between PIU and depression in adolescents (Saikia et al, 2019; Yang et al, 2014). This relationship is also demonstrated in university students (Akin & Iskender, 2011), and in general population (Morrison & Gore, 2010). As this study design was not appropriate to determine the casualty effect, this effect likely works as a vicious cycle resulting PIU, which further generates depression. The relationship between depressive symptoms and PIU appears to be bi-directional, as a precursor and predictor (Ciarrochi et al., 2016; Dong et al., 2011; van den Eijnden et al., 2008), and there is evidence about its association with loneliness (Mahon et al., 2006). Vanhalst's longitudinal study (2012) revealed that loneliness is more consistent predictor of depressive symptoms than vice versa indicating that loneliness predicts later depressive symptoms. Erzen and Çikrikci's meta-analysis (2018) also confirms effect of loneliness on depression assessing different population. Adolescents with psychopathological symptoms are prone to use internet in excessive and compulsive way as they find relief in the cyber world on their problems they cannot cope with (Caplan, 2003). However, directionality of depression and loneliness in this study cannot be addressed with PIU, their clinical treatment seems to be important step in the fight against PIU.

Noteworthy is the observation that fathers of adolescents with severe PIU have low education level. Studies indicate low level of parental monitoring (Brighi et al., 2019; Khurana et al., 2015) and increased parent-child conflict as risk factors for PIU (Siomos et al., 2012) while good parental communication can lower the risk (van den Eijnden et al., 2010; Yu & Shek, 2013). Only a few studies indicate association between risks for PIU and low level of parental education. Chandrima et al. (2020) found association between PIU and lower education level of both parents explaining this result with dysfunctional family environment where adolescents used Internet as a maladaptive avoidance strategy. It is conceivable that any negative effects the children experiences from the paternal side can push them maladaptive behavior. Generally, the influence of father has a greater emphasis on parenting than mother. Father with lower intellectual abilities has a narrow spectrum of leisure activities that can affect the family members' everyday life. Potential explanation might be the environmental factors when parents with lower education are less aware of disadvantages and negative effect of Internet use and as a result, the parental control is missing. Protective effect of parental monitoring for younger and older adolescents of both sexes was confirmed by previous studies (Brighi et al., 2019; Khurana et al., 2015).

Another explanatory factor of severe PIU was physical activity which can be a way out of the problem. A child engaged with physical activity reduces the amount of time spent online. The data of an American study evaluating 2108 college students showed negative association between time spent on internet use and physical activity (Derbyshire et al., 2013). Another study evaluating adolescents and young adults from the Arabian Gulf Culture also found that moderate and mild physical activity were negatively associated with PIU (Bener et al., 2013). The recent paper about the Turkish high school students found lower rate of PIU in students who performed physical activities at least 2 days a week (Sayılı et al., 2021). This relationship between physical activity and PIU should be considered when developing prevention programs, or even more a treatment program. It seems an applicable tool against PIU and other addictive behavior (Lynch et al., 2010).

Despite the relatively large sample size and the use of validated measure, some limitations should be mentioned. This study cannot make definitive claims about causality due to cross-sectional study design. Since the subjects are limited to the Northeast region of the country, the results cannot be generalized to the whole Hungarian adolescent population. Furthermore, physical activity, which has become an explanatory factor of PIU, was measured with a single item, that is widely used in research studies (O'Halloran et al., 2020). To avoid method bias in applying single item measures, students were motivated to give accurate answers to the questions. Single item questions were clear and easy to complete, however frequency of PA was retrospectively self-reported making it prone to recall bias (Podsakoff et al., 2012).

CONCLUSION

In this paper broad range of variables were examined, including socio-demographics, psychological health and physical activity to find the associated factors with PIU in adolescents. The complexity of the problem is manifested in the multifaceted relationships of factors, only four of them (depressive symptoms, loneliness,

father's education level and physical activity) predicted likelihood of severe PIU in a relatively large sample size. Contrary to the claims of other studies, relatively low number of students proved highly problematic internet users, however, together with moderate problematic internet users, this number has significance. Only a few studies indicated the parents' low education level as a risk factor for PIU, perhaps because it was not in the focus of research. Family environment seems an important factor investigated maladaptive behavior. PA has also been less studied. There is indisputable evidence that higher level of PA prevents against several chronic diseases, maintains favorable well-being, and it seems an effective tool in the primary and secondary prevention against abnormal psychological behaviors such as PIU. In order to promote the health of these populations, further investigation can provide interventions how to implement increased physical activity in prevention of PIU in education institutions.

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