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Research article

PROBLEMATIC INTERNET USE AS YOUTH'S RISKY BEHAVIOR UNDER DISTANCE LEARNING DURING THE COVID-19 PANDEMIC

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We selected Problematic Internet Use (PIU) as our research object. PIU is a behavioral addiction or a type of addictive behavior that can have negative influence on users' emotional and social functioning. In our case, these users were students who had to learn distantly.

The aim of this pilot study was to estimate use of the Internet by students and associated risks by performing the validated screening (Problematic Internet Use – PIU). The first stage was accomplished under routine full-time education; the second stage took place during the COVID-19 pandemic under the forced lockdown in the spring term 2020.

Medical students who participated in this pilot study were asked to estimate how much time they spent using the Internet on their mobile devices or PC and to report risks associated with problematic Internet use, both under ordinary circumstances and under forced self-isolation during the COVID-19 pandemic. We applied Problematic and Risky Internet Use Screening – PRIUSS, Midwestern University, USA, both paper version and Google survey, to question the participants. Overall, 230 students took part at the first stage of the survey; one year after there were 90 students participating in the survey.

The research results show it is truly vital to examine risky behavior since it can pose certain threats for young students' health due to growing volumes and shares of information obtained from information network channels and Internet resources. In addition, we established an increasing share of risky behavior when using the Internet under restrictions associated with the COVID-19 pandemic. There was a substantial growth in the number of students exposed to the intensive Internet use. The scores as per the subscales "social disorders" and "emotional disorders" grew by 2.7 and 2.1 times accordingly. The score describing risky / impulsive Internet use went up from 7.8 to 16.3. All the differences were statistically significant ($p < 0.001$).

Keywords: *preventive medicine, distance learning, COVID-19, students, risks of Internet use, behavioral addictions, Internet use screening, public health.*

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At the end of the 20th century, some reports started to appear in research works about people with certain medical and social issues occurring due to their use of a PC or the Internet. Problematic Internet use (PIU) is usually defined as excessive or risky use of the Internet [1]. Multiple contemporary studies have noted that Internet use can evoke anxiety, attention deficit and hyperactivity disorder, hostility, aggression and depression. It can produce negative effects on academic progress; moreover, it can stimulate impairments in various aspects of a person's everyday life and create elevated behavioral health risks [1–3]. Excessive Internet use by young people often involves negative social consequences including poor progress in studies, stress and risky behaviors and attitudes towards health.

Young people are especially susceptible to a risk of developing addiction to the Internet or problematic Internet use as it was reported by 5–10 % of students [4–6].

Young people see the Internet, hardware and gadgets as habitual and comfortable parts of their lives. Youth lifestyles are shaped under influence exerted by network and mobile technologies. This concerns pastime, routine activities, habitual channels to get information from, ways to work with information resources, and the nature of interpersonal relations. Young students use the Internet to search for useful data, to view the latest news or ratings, to find job, to communicate with friends, to download music and watch movies or clips, to purchase something in online shops. The Internet has become the basic information source and the major communication tool for young people. On one hand, the Internet is a powerful information field with abundant resources (interactive sites, portals, electronic libraries, databases, web-classrooms and networks societies) and variable ways to present them (from a text to multimedia). It provides an opportunity to move freely and non-linearly in a hypertext space, to promptly find, process, enrich, store and redirect any information. On the other hand, there is redundancy and variability of materials that are renewed too fast; this accelerates information exchange, makes obtaining new knowledge much easier and enlarges data communications [7].

Use of social networking services (SNS) is a most popular activity in the Internet among young people. Excessive involvement in certain online activities such as gambling, watching porn, videogames, social networking, or online purchases can lead to serious issues and create elevated risks of chaotic or even addictive Internet use [8, 9]. The COVID-19 pandemic resulted in drastic changes in lifestyles, both worldwide and in Russia. Many countries had to introduce a lockdown to prevent the infection from spreading. A lot of people had to switch to remote work or studies and, accordingly, start using the Internet as a major communication tool. They were forced to replace real communication with network one and information and communication technologies thereby became much more significant for them [10–12]. Some studies have established that social networks can also be an important tool for providing social support during self-isolation [11, 13].

Contemporary Internet use provides wide opportunities to obtain necessary data, communicate in social networks, do shopping online, play games or trade anything. There are enough studies reporting about people who have certain issues associated with using a PC or the Internet due to addictive behavior regarding electronic devices. Problematic Internet use is a topical issue for public healthcare since it can produce negative effects on emotional and social functioning. The COVID-19 pandemic that started in 2019 influenced public health all over the world and largely exerted significant negative impacts on children and teenagers, Internet abuse being among their outcomes.

For most people, use of information and communication technologies remains within natural and physiological reactions. However, when use of social networking becomes too intense, this creates an elevated risk of additive behavior. A risk of becoming addicted is caused by the fact that Internet use by young people is often impulsive in its essence and leads to adverse outcomes, in particular, for physical health, emotional state, and social relationships.

Excessive Internet use has not been recognized as a health disorder by the World Health Organization so far and it is not included into the International Classification of Diseases (ICD-11). However, gaming disorder is included into the ICD-11 but experts are still arguing about how to diagnose it. Is this disorder a specific clinical case or is it just a sign of underlying mental disorders?

At the same time, results of multiple studies addressing early detection of Internet addiction have confirmed that there are available instruments for screening of issues related to Internet use [4, 8, 14, 15]. It has also been noted, that if such issues are detected early, this can motivate people to change their behavior [16].

Teenagers are vulnerable due to incomplete morphofucntional development of their organs and systems and elevated sensitivity to factors that influence them. Teenagers often have to face unpleasant aspects related to Internet technologies [4]. Digital media can create certain unique problems regarding problematic or excessive use and teenagers have rather specific psychological vulnerability [5]. Bearing this in mind, we assume that an effort to change one's behavior given excessive Internet use is a vital issue in studies with their focus on online behavior.

Situations with high health risks are mostly associated with a significant growth in Internet use. Thus, questioning results published by the PIU research center in 2015 indicated that 24 % of young people aged from 13 to 17 years had a constant Internet connection and 56 % connected to the Internet several times a day [17]. CIBERASTUR, a survey that was conducted in Spain and covered 25,000 teenagers aged 11–18 years, established that 95.7 % of its participants had a smartphone and 86.6 % of them used it every day.

In future, a procedure for assessing health risks for young people which we suggest in this study can be included into the system for social-hygienic monitoring.

Our goal in this pilot study was to assess Internet use by medical students with a Problematic Internet Use (PIU) screening tool.

Materials and methods. ***The study design.*** This study was accomplished in a medical higher educational institution over the period from November 2019 to November 2020 in two stages. The first stage in November 2019 involved filling in a paper version of the questionnaire; in November 2020 we had to use a Google survey due to self-isolation caused by the COVID-19 pandemic.

Research object and organization. The survey took place within the research work accomplished by the Children and Teenagers Hygiene Department at F.F. Erismann's Federal Research Center for Health. The research work was entitled "Provision of hygienic safety of the information and educational environment for students in digital economy". The survey was approved by the Local Ethical Committee at Sechenov University (the meeting report No. 34-20) and aimed at identifying whether students had any risky behavior regarding Internet use under routine conditions and under self-isolation. Participants were selected randomly out of students who attended the chosen medical HE institution. They were aged from 17 to 21 years. All the participating students did not have any financial or any other interest in taking part in the survey.

The survey procedure. We used PRIUSS as a validated tool for assessing problematic Internet use[1] in adolescents and young adults.

PRIUSS consists of 18 questions and has three sub-scales that make it possible to identify social impairments, emotional impairments and risky / impulsive use (six, five and seven questions for each sub-scale accordingly).

Social impairments are revealed by questions that enable estimating problems arising in online or personal communication, developing excessive anxiety due to probable negative estimates given by other members of the Internet society, inability to enter any real relation-

[1] Jelenchick L.A., Eickhoff J., Zhang C., Kraninger K., Christakis D.A., Moreno M.A. Screening for Adolescent Problematic Internet Use: Validation of the Problematic and Risky Internet Use Screening Scale (PRIUSS). *Acad. Pediatr.*, 2015, vol. 15, no. 6, pp. 658–665. DOI: 10.1016/j.acap.2015.07.001

ships due to predominant Internet use, as well as some other consequences of excessively enthusiastic network socializing, for example, failure to participate in important events or difficulties in interpersonal communications.

Emotional impairments are estimated by analyzing answers to questions about arising irritation, anger, anxiety, vulnerability, feeling oneself isolated from the world and friends in case it is impossible to get access to the Internet. Emotional vulnerability also covers a situation when a person thinks Internet use to be more important than his or her routine activities.

Risky / impulsive Internet use was identified in case certain negative trends in students' behavior were established due to positive answers to certain questions. For example, students stated they tried to avoid any other activity so that they could stay online; they neglected their direct responsibilities, lost motivation to fulfill important tasks and had sleeping disorders due to their wish to remain online, even at night. If time spent by a user in the Internet produces negative effects on his or her academic progress, this also indicates risky and excessive Internet use.

The respondents chose answers that described how they behaved and what they felt concerning Internet use over the last six months. Questions starting with "how often?" concerned variable online contacts, emotional state caused by Internet absence, motivation to go on living in case the Internet was absent etc. The students filled in the 18-score screening scale for problematic Internet use (PRIUSS); it was a paper version in November 2019 and a Google survey in November 2020 under self-isolation. The scale had scores from 0 to 72. If a result was equal to 25 scores or higher, a respondent was included into a risk group as per problematic Internet use.

Analysis. We applied ANOVA test to compare qualitative indicators and χ^2 test for nominal data (sex, age, and a share of the respondents with the final score higher than 25).

There could be shifts in final results due to differences in the structure of two respondents' groups. To eliminate them, we performed logistic regression analysis with problematic Internet use (the final score higher than 25) as a dependent variable and the number of survey, sex and age as covariants. The analysis was performed both as per the whole scale and three sub-scales, namely, social impairments, emotional impairments, risky / impulsive Internet use.

Statistical analysis was performed with SPSS Statistics 22.0 software package.

Results and discussion. Overall, 320 students took part in our pilot study; 230 participated in the first survey and 90 in the second one. Females prevailed in both groups since they accounted for 84.3 % in the first survey group and for 86.7 % in the second one, the overall share being 85.0 %. The first stage in the screening took part in November 2019 under routine full-time education; the second one was performed during the COVID-19 pandemic and the respondents estimated their Internet use (in November 2020) considering forced self-isolation during the lockdown which was introduced in the spring term in 2020.

There were no statistically significant sex-specific differences between the groups ($p = 0.601$).

There were age-specific differences between the groups. The second group was substantially younger since 37.8 % of the participants in it were aged 17–19 years whereas people of the same age accounted for only 5.7 % in the first group. On the contrary, people aged 23–25 years accounted for 5.6 % in the second group and for 17.4 % in the first one ($p < 0.001$).

The first survey revealed only 25.2 % of the respondents with their final score being higher than 25; that is each fourth respondent had a high health risk, namely, a risk of social and emotional impairments as well as risky / impulsive Internet use.

The share of people who had the final score higher than 25 grew to 93.3 % in the second survey. The difference was statistically significant, odds ratio (OR) was equal to 41.5; 95 % CI: 17.2–100.1; $p < 0.001$. Our comparison of the survey results showed that the average final score was significantly higher in the second survey, 40.5 against 19.3 in the first

one. Statistical significance was estimated with ANOVA test (one-factor dispersion analysis). Differences were considered significant at $p < 0.001$ (Table 1).

Obviously, results of the two surveys show there is a significant and authentic growth in a health risk for students caused by intensive Internet use.

We performed profound analysis of the results obtained for three screening sub-scales: social impairments, emotional impairments, risky / impulsive Internet use. Table 2 provides the results.

The mean score was higher as per all three scales in the second survey against the first one.

We established a growth as per the sub-scale "social impairments" that included first 6 questions and the sub-scale "emotional impairments" that included the next 6 questions: from 4.7 to 12.8 and from 6.6 to 11.3 accordingly. The score reflecting risky / impulsive Internet use grew from 7.8 to 16.3. All these differences were statistically significant ($p < 0.001$). The first survey revealed only 25.2 % of the respondents with their final score being higher than 25; that is each fourth respondent had health risks associated with problematic Internet use. The share of people who had the final score higher than 25 grew to 93.3 % in the second survey. The difference was statistically significant, odds ratio (OR) was equal to 41.5; 95 % CI: 17.2–100.1; $p < 0.001$.

There could be shifts in final results due to differences in the structure of two respondents' groups. To eliminate them, we performed logistic regression analysis with problematic Internet use (the final score higher than 25) as a dependent variable and the number of survey, sex and age as covariants (Table 3).

This logistic regression analysis revealed that a share of the respondents with their final score exceeding 25 had a statistically significant association only with the number of the survey (the first or the second one)

Table 1

Comparison of the results obtained by surveys 1 and 2 addressing problematic Internet use

Survey	*N*	Mean value	Standard deviation	Standard error of the mean	Median value
The first survey (1.0)	229	19.27	9.43	0.62	18.00
The second survey (2.0)	90	40.52	11.02	1.16	39.00
Total	319	25.27	13.76	0.77	23.00

Table 2

Analysis of mean scores as per the sub-scales (social impairments, emotional impairments, risky / impulsive Internet use)

Survey	Statistical indicators	Social impairments	Emotional impairments	Risky / impulsive Internet use
1.0	N	230	229	230
	Mean value	4.7	6.6	7.8
	Standard error of the mean	0.20	0.27	0.30
	Standard deviation	3.1	4.2	4.6
	Median value	4.00	6.00	7.00
2.0	N	90	90	90
	Mean value	12.8	11.3	16.3
	Standard error of the mean	0.45	0.52	0.56
	Standard deviation	4.2	5.0	5.3
	Median value	12.00	10.00	16.00
Total	N	320	319	320
	Mean value	7.0	7.9	10.2
	Standard error of the mean	0.28	0.27	0.34
	Standard deviation	5.0	4.9	6.1
	Median value	6.00	7.00	9.00

Table 3

Results of statistical analysis as per three variables: the survey number, age and sex

Variable	*p*	Adjusted odds ratio	95 % confidence interval for OR
Survey number	< 0.001	35.60	14.52–87.28
Sex	0.89	1.05	0.47– 2.33
Age	0.15	0.64	0.35–1.18

($p < 0.001$). Adjusted odds ratio amounted to 35.6 with 95 % CI: 14.5–87.3. We did not detect statistically significant influence exerted by sex or age ($p > 0.05$).

The results obtained by the regression analysis indicate that there was a substantial decline in the share of people who did not have any health risks associated with Internet use from the first survey to the second one.

Extensive Internet use for studying, work, communication and pastime is becoming one of major concerns in public healthcare. As excessive dependence on electronic technologies is growing, its impacts are more and more likely to lead to negative health outcomes. It was especially true at that time when the world society was fighting against the COVID-19 pandemic and had to reconstruct the online environment in the process to make it more suitable for remote work, study, social relations and entertainments [11]. Students found themselves in an unusual situation when they had to study remotely under self-isolation. On one hand, they were able to communicate with their friends by using electronic teaching and learning aids. On the other hand, self-isolation induced certain strain in their emotional sphere, led to greater loads on them and impaired their health. There was a national study that addressed issues related to studying and obtaining necessary information under self-isolation during the COVID-19 pandemic. It revealed that children who had to study remotely spent more time on doing their homework in comparison with traditional full-time education; children also had to spend more time working with electronic devices with a screen and this resulted in longer exposure to them and a growing number of health complaints [18]. A study performed in China aimed to determine peculiarities of Internet use during the COVID-19 pandemic. It also established increasing Internet use including both frequency and duration, especially when the Internet was used to relax. Long periods of Internet use also became much more frequent. The study showed that female sex, age, depression and stress had an authentic correlation with total scores of Internet addiction; it was also noted that prevalence of depression, anxiety and stress with variable intensity correlated authentically with groups of addicted Internet users, problematic Internet users and adequate Internet users [19, 20].

Our pilot study made it possible to estimate how frequently the Internet was used by medical students before self-isolation and under it. Prevalence of intense Internet use among students is consistent with data obtained by other authors. Recent studies have also established growing health risks caused by longer time spent on working with electronic devices, a significant decline in physical activity, as well as with probable developing addictive online behavior [9, 16, 19, 21].

Sex-specific differences seem quite interesting in relation to Internet addiction. Some research results indicate that both women and men can become “addicted” to technologies but men and women indulge in rather different online activities [4]. However, a share of men who are addicted to electronic technologies is often higher against women [16, 22, 23]. We did not detect any authentic effects produced by sex on problematic Internet use in this study.

We should remember that the issue is urgent. It is necessary to standardize the test we applied in this study and facilitate it for use in studies on Russian students as a specific population. This will give an opportunity to examine intense and problematic Internet use among students and to develop relevant programs aimed at correcting deviations.

Conclusion. The first stage in our study was performed among full-time medical students who used the Internet and social networks in a routine situation. As a result, only each fourth student turned out to have social and emotional impairments and his or her Internet use could be described as risky / impulsive thus indicating apparent problems related to this use. The picture changed drastically during the COVID-19 pandemic when students had to switch to distant learning. At the second stage, 93.3 % of the participating students were established to be problematic Internet users. The PRIUSS survey allowed establishing a growth in risky / impulsive Internet use and social impairments, by 2.1 and 2.7 times accordingly. Logistic regression analysis revealed that students' age or sex did not have any authentic effects on problematic Internet use whereas there was an authentic association between more apparent problematic Internet use and the number of the survey, namely, higher shares of problematic Internet use were detected in the second one that was performed under self-isolation during the COVID-19 pandemic.

Various health disorders that are caused by problematic Internet use are highly prevalent among students and they are detected easily with the PRIUSS tool. This allows recommending this screening tool to perform operative diagnostics of problems, to identify risk groups with people susceptible to problematic Internet use, and to develop relevant preventive programs.

Education can move to a new qualitative level under certain conditions that make for preservation and improvement of students' health and creation of new relevant approaches to managing health risks. Our research results indicate it is important to examine risky behavior that poses threats for students' health due to due to growing volumes and shares of information obtained from information network channels and Internet resources. Besides, such risky behavior becomes much more frequent when the Internet is used under restrictions associated with the COVID-19 pandemic. This may become a huge issue for public healthcare. Activities aimed at mitigating these health risks should rely on fundamental studies and opinions of experts in protection, preservation and improvements of children's, adolescents' and young adults' health. We have shown in our study that Internet use did not only become more intense in a complicated social situation (self-isolation during the pandemic) but also involved negative emotional experiences and was risky in its essence (the average final score grew by 3 times as per the sub-scales "social impairments", "emotional impairments" and "risky / impulsive Internet use" in the second survey). It is necessary to use and standardize "problematic Internet use" screening tool to make it more suitable for population studies. This will make it possible to accomplish studies on effective correction of problematic Internet use among students. It is necessary to prevent health risks, including those associated with exposure to electronic devices with a screen, both during a pandemic and in an epidemiologically safe situation.

Active Internet use is becoming quite usual both among adolescents and even children. Doctors who are responsible for primary healthcare should have available tools to perform early screening aimed at detecting problematic or risky Internet use (PRIUSS). Such screening can become another effective tool for monitoring of adolescents' health. Use of screening tools to identify an association between problematic (excessive) Internet use and health issues will make it possible to detect health disorders at their early stages and to develop strategies for mitigating health risks. This includes, among other things, prevention of secondary victimization in relation to Internet-risks and development of variable cyber-addictions. Resistance to problematic Internet use by youth will reduce possible dysfunctions related to social, emotional and risky / impulsive behavior that can result from problematic Internet use thereby improving quality of their lives.

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