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Relation Between Sociodemographic Factors and Increased Internet Usage During the First Three Waves of the COVID-19 Pandemic and Earthquakes: Croatian Online Survey

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Keywords

Sociodemographic factors; Internet use; COVID-19; earthquakes

Abstract

Aim: To determine the effect of COVID-19 pandemic and earthquakes on the overall Internet usage (IU) and Internet-specific activities (ISA) among adult Croatian population and their relation with sociodemographic factors. **Subjects and Methods:** A total of 1,118 participants (220 men and 898 women; mean age: 35.14 ± 12.31 years; range 18 - 78) participated in an online self-report survey providing sociodemographic data and replying to questions on COVID-19 and earthquake-related stress factors and overall IU and ISA before and during the period of the first three pandemic waves and earthquakes. **Results:** Overall IU ($p < 0.001$), online gaming (OG) ($p < 0.001$), pornography viewing (PV) ($p < 0.001$), social media use (SM) ($p < 0.001$), and online shopping (OS) ($p < 0.001$) during the pandemic and earthquakes were significantly increased in the group that used the Internet before this prolonged stress experiences. Furthermore, overall IU increased in women ($p < 0.001$), less educated ($p = 0.001$), and single participants ($p = 0.027$). OG was associated with younger age ($p = 0.001$), lower education ($p < 0.001$), single status ($p = 0.006$), child-free status ($P = 0.001$), and urban residence ($p = 0.032$). Increased PV was associated with younger age ($p < 0.001$), male sex ($p < 0.001$), lower education ($p < 0.001$), single status ($p = 0.001$) and child-free status ($p < 0.001$). Increased SM was associated with female sex ($p < 0.001$) and lower education ($p < 0.001$). **Conclusion:** To reduce the negative impacts of prolonged stress, clinicians and public health authorities should take into consideration sociodemographic risk factors associated with IU and ISA.

Introduction

In the last two years, the pandemic of coronavirus disease 2019 (COVID-19) has substantially disrupted normal daily life of people worldwide, creating enormous social, economic, and healthcare pressures, and

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causing mental health (anxiety and depression symptoms, posttraumatic stress disorder) and psychological problems in many [1-6]. Emotional responses to trauma are recognized risk factors for the development or relapse of addictive behavior, including substance abuse and behavioral addictions, particularly in adolescents [7,8]. Social distancing strategies aimed at controlling the spread of pandemic increased the use of Internet, which exposed many vulnerable individuals to a potential development of Internet addiction [9]. The reasonable use of Internet is beneficial, but when in excess and unchecked, it may lead to addiction where a person is unable to control their use of Internet. Internet addiction has thus become a serious global public health problem, especially in Asia [10]. The Internet addiction behavior may be categorized on the basis of Internet content or activities, such as online shopping (OS), social media activities (SM), online gambling (OGB), online gaming (OG), and pornography viewing (PV) [11].

In Croatia, the first COVID-19 wave was mild and lasted from mid-March to early May 2020; the second one was severe and lasted from the end of September to mid-February 2021, reaching its peak in early December 2020; and the third wave was moderate and lasted from mid-February to early June 2021, reaching its peak in mid-April 2021. The pandemic period in Croatia was additionally aggravated by two strong earthquakes, the first one in Zagreb on March 22, 2020 at 6:24 a.m. (magnitude of 5.5 on the Richter scale) and the second one in Petrinja (aroud 80 kilometers SE from Zagreb) on December 29, 2020, at 12:19 p.m. (magnitude of 6.3 on the Richter scale). As Croatia is a small country, when compatriots suffer or a catastrophe brings major devastation, the whole nation is affected. Thus, the earthquakes directly affected around 40 % of the population, and indirectly the entire population in Croatia. The findings after the earthquakes suggested significant levels of psychological distress [12,13].

Our aim was to assess how the prolonged stressful situation (COVID-19 social isolation and earthquakes) influenced the Internet usage and specific Internet-related behavior in general population in Croatia. We developed a questionnaire to collect the data on the amount of Internet usage and specific Internet-related behaviors before and during the period of the first three waves of COVID-19 pandemic and Zagreb and Petrinja earthquakes. The hypothesis was that the increase in the overall Internet usage (IU) and Internet-specific activities (ISA), such as OGB, OG, PV, SM, and OS, during the pandemic and earthquakes period was related to the IU and ISA before that period. We also analyzed the relationship between sociodemographic factors and IU and ISA in the surveyed sample of Croatian general population.

Subjects and Methods

Potential participants were invited to participate voluntarily in the survey without financial compensation. To be included in the study, the participants had to meet the following criteria. They had to be Croatian residents in the period of the three pandemic waves in Croatia and Zagreb and Petrinja earthquakes; aged 18 years or more; and respond correctly to the attention check item (i.e., replying "completely agree" or skip the question). Participants who did not understand the written Croatian language and did not sign the informed consent were excluded from the study.

A total of 1,286 respondents completed the online survey, of whom 168 were excluded because they were minors or questionnaires were invalid. The analyzed sample consisted of 1,118 participants (220 men and 898 women; mean age: 35.14 ± 12.31 years; range 18 - 78). Participants were from the following regions of Croatia: 621 (55.6 %) from the City of Zagreb (Croatia's capital), 190 (17 %) from Northern Croatia, 162 (14.5 %) from the coastal Croatia, and 145 (13.0 %) from the Pannonian Croatia. With respect to education, 63.7 % had a tertiary, 36.0 % secondary, and 0.3 % primary education level. Their length of service was 10.40 ± 10.95 years; 62.5 % were employed, 11.6 % were unemployed, and 2.6 % retired. With respect to relationship status, 64.5 % were married or in a relationship, 28.7 % single, 5.6 % divorced, and 1.2 % widowed. Almost two-thirds (64.8 %) reported being child-free, and 35.2 % had children. With respect to place of residence, 60.8 % of participants resided in towns with > 70 000 inhabitants and 39.2 % in towns with < 70 000 inhabitants. In relation to the COVID-19 pandemic, 3.9 % of participants lost their job due to COVID-19, 27.0 % had a diagnosis of COVID-19, 47.0 % were in self-isolation due to COVID-19, and 12.1 % experienced death of significant others due to COVID-19. Most participants (85.7 %) perceived the COVID-19 pandemic as stressful, and half of them (50.9 %) experienced the Zagreb and Petrinja earthquakes as very stressful.

The data were obtained through a broader project designed to examine the impact of stressful events on the use of psychoactive substances (PS) and the Internet, anxiety, depression, and quality of life in adults during the COVID-19 pandemic and earthquakes period. The survey link was distributed through mailing lists, social media (WhatsApp, Facebook, and Instagram), and personal contacts from September 30 to October 17, 2021, along with a brief description of the purpose of the survey. After reading detailed privacy terms with instructions for completing the questionnaires and signing a written consent, participants could access an anonymous online questionnaire.

The study was approved by the Ethics Committee of the University Hospital Vrapče (Prot. 23-1064/3-21), following the Helsinki Declaration standards.

Sociodemographic characteristics included age, sex, education, working status, marital status, length of service, parenthood, number of children, residential region, and the urbanity

of the place of residence. Overall Internet usage and Internet-specific activities before and during the first three pandemic waves and earthquakes. The overall IU and ISA were self-reported according to the modified criteria proposed by Tao and associates [14]. Detailed description of the applied criteria is described in method section of our previous study [15]. First, the participants were asked if they engaged in OGB, OG, PV, SM, and OS before the COVID-19 pandemic and earthquakes. If they responded affirmatively, the change in their previous behavior related to OGB, OG, PV, SM, and OS was assessed. To evaluate the behavioral changes in ISA, the participants were asked if they increased their OG, OGB, PV, SM, and OS activities during the first three pandemic waves and earthquakes period. All variables were dichotomous (no/yes).

Statistical Analysis

The normality of distribution was tested with the Shapiro–Wilk test. To determine the increase in the overall IU and ISA compared with the IU habits and sociodemographic characteristics before the pandemic, Pearson's chi-square test with Bonferonni correction (or the Fisher's exact test if the expected value was less than 5) was used for dichotomous variables, whereas the Mann–Whitney U test was used for quantitative variables. Data were presented as a median ± interquartile range for quantitative variables and frequencies (percentage) for qualitative variables. The reported effect sizes included *r* for the Mann-Whitney U test and Phi for the chi-square test. We considered r ± 0.1 as low, 0.3 as medium, and > 0.5 as large strength of association between the groups, and Φ = 0.1 as low, 0.3 as medium, and 0.5 as large strength of association between dichotomous variables [16]. Statistical significance was set at $p < 0.05$. All statistical analyses were performed with JASP, version 0.16 [17].

Table 1. Descriptive statistics of the overall Internet usage and Internet-specific activities before and during the pandemic and earthquakes period (N = 1,118)

	The usage before the pandemic and earthquakes n (%)		The usage during the pandemic and earthquakes n (%)	
	No	Yes	No	Yes
OGB	1091 (97.6)	27 (2.4)	1103 (98.7)	15 (1.3)
OG	761 (68.1)	357 (31.9)	1000 (89.4)	118 (10.6)
PV	758 (67.8)	360 (32.2)	1047 (93.6)	71 (6.4)
SM	86 (7.7)	1032 (92.3)	578 (51.7)	540 (48.3)
OS	375 (33.5)	743 (66.5)	811 (72.5)	307 (27.5)
IU	57 (5.1)	1061 (94.9)	532 (47.6)	586 (52.4)

OGB - online gambling; OG - online gaming; PV - pornography viewing; SM - social media; OS - online shopping; IU - overall Internet usage.

Results

The overall IU and ISA before and during the pandemic and earthquakes are shown in Table 1. Most participants (94.9 %) engaged in IU before the pandemic

Table 2. Differences in the overall increase in Internet usage and Internet-specific activities during the pandemic and earthquakes period compared with prior Internet usage habits (N = 1,118)

	Internet usage prior to the pandemic and earthquakes					
	No	Yes				
	n (%)	n (%)	χ^2	df	Φ	p
OGB$^+$	9 (0.8)^a	6 (22.2)^b	–	1	0.29	< 0.001
OG	9 (1.2)^a	109 (30.5)^b	221.73*	1	0.45	< 0.001
PV	6 (0.8)^a	65 (18.1)^b	122.32*	1	0.33	< 0.001
SM	17 (19.8)^a	523 (50.7)^b	30.38*	1	0.17	< 0.001
OS	47 (12.5)^a	260 (35.0)^b	63.11*	1	0.24	< 0.001
IU	16 (28.1)^a	570 (53.7)^b	14.27*	1	0.11	< 0.001

OGB - online gambling; OG - online gaming; PV - pornography viewing; SM - social media; OS - online shopping; IU - overall Internet usage. $^+$ Fisher's Exact Test; *p < 0.001.

Table 3. Differences in sociodemographic characteristics related to the increased overall Internet usage and Internet-specific activities during the pandemic and earthquakes period (N = 1,118)

		Increased usage during the pandemic and earthquakes n (%)				
		OG	PV	SM	OS	IU
Age[+]	Increase in usage - No	33.00 ± 19	33.00 ± 20	33.00 ± 18	32.00 ± 19	33.00 ± 19
	Increase in usage - Yes	27.50 ± 19	25.00 ± 12	32.00 ± 20	33.00 ± 20	32.00 ± 20
	z;r	-3.27*; 0.10	-5.19*; 0.16	-1.07; 0.03	-1.11; 0.03	-1.25; 0.04
	P	0.001	< 0.001	0.286	0.269	0.211
Sex	Men	31 (14.1)[a]	27 (12.3)[a]	77 (35.0)[a]	30 (13.6)[a]	86 (39.1)[a]
	Women	87 (9.7)[a]	44 (4.9)[b]	463 (51.6)[b]	277 (30.8)[b]	500 (55.7)[b]
	χ^2;Φ	3.63; -0.06	16.15*; -0.12	19.40**; 0.13	26.28*; 0.15	19.50*;0.13
	P	0.057	< 0.001	< 0.001	< 0.001	< 0.001
Education level	Lower	74 (14.1)[a]	49 (9.3)[a]	288 (54.8)[a]	157 (29.8)[a]	304 (57.8)[a]
	Higher	44 (7.4)[b]	22 (3.7)[b]	252 (42.6)[b]	150 (25.3)[a]	282 (47.6)[b]
	χ^2;Φ	12.99*; -0.11	14.68*; -0.12	16.56*; -0.12	2.84; -0.05	11.53*; -0.10
	P	< 0.001	<0.001	< 0.001	0.092	0.001
Working status	Unemployed	15 (11.5)[a]	7 (5.4)[a]	57 (43.8)[a]	29 (22.3)[a]	61 (7.4)[a]
	Employed	61 (8.7)[a]	33 (4.7)[a]	318 (45.5)[a]	197 (28.2)[a]	350 (42.2)[a]
	χ^2;Φ	1.04; -0.04	0.11; -0.01	0.12;0.01	1.9; 0.05	0.44;0.02
	P	0.308	0.746	0.729	0.167	0.510
Marital status	Single	48 (15.0)[a]	34 (10.6)[a]	168 (52.3)[a]	91 (28.3)[a]	184 (57.3)[a]
	Married	66 (9.2)[b]	36 (5.0)[b]	331 (45.9)[a]	199 (27.6)[a]	360 (49.9)[b]
	χ^2;Φ	7.67*; -0.09	11.11*; -0.10	3.68; -0.06	0.06; -0.01	4.86*; -0.07
	P	0.006	0.001	0.055	0.803	0.027
Parents	No	92 (12.7)[a]	62 (8.6)[a]	348 (48.1)[a]	187 (25.8)[a]	383 (52.9)[a]
	Yes	26 (6.6)[b]	9 (2.3)[b]	192 (48.7)[a]	120 (30.5)[a]	203 (51.5)[a]
	χ^2;Φ	10.08*; -0.10	16.91*; -0.12	0.05;0.01	2.74; 0.05	0.19; -0.01
	P	0.001	< 0.001	0.832	0.098	0.659
Urbanity	<70K people	57 (13.0)[a]	33 (7.5)[a]	223 (50.9)[a]	129 (29.5)[a]	235 (53.7)[a]
	>70K people	61 (9.0)[b]	38 (5.6)[a]	317 (46.6)[a]	178 (26.2)[a]	351 (51.6)[a]
	χ^2;Φ	4.61*; -0.06	1.70; -0.04	1.97; -0.04	1.44; -0.04	0.44; -0.02
	p	0.032	0.193	0.161	0.231	0.506

OGB - online gambling; OG - online gaming; PV - pornography viewing; SM - social media; OS - online shopping; IU - overall Internet usage. [+] For Age Median±Interquartile range are reported for "increase" and "no increase in usage" of a Internet-specific activities during the pandemic and earthquakes; Different subscript letters indicate statistically significant differences between the categories in different rows; *P < 0.05; Values with * and in bold are P < 0.01.

and earthquakes. Also, approximately half (52.4 %) of participants increased the overall IU during the pandemic and earthquakes. Before the pandemic and earthquakes, where ISA is concerned, participants mostly engaged in SM (92.3 %) and OS (66.5 %) and less often in PV (32.2 %), OG (31.9 %), and OGB (2.4 %). Participants also increasingly used SM (48.3 %) and OS (27.5 %) during the pandemic and earthquakes. At the same time OG (10.6 %), OGB (1.3%), and PV (6.4 %) did not increase as much as SM and OS.

Participants who used the Internet before the pandemic and earthquakes increased their overall use of the Internet during the pandemic and earthquakes period significantly more than those who did not use the Internet before this prolonged stress period (54 % vs 28 %, respectively, $\Phi = 0.11$, $p < 0.001$; Table 2). The same was found for all ISA, i.e., participants who engaged in such activities before the pandemic and earthquakes increased their use of OGB (22 % vs 1 %, $\Phi = 0.29$, $p < 0.001$), OG (31 % vs 1 %, $\Phi = 0.45$, $p < 0.001$), PV (18 % vs 1 %, $\Phi = 0.33$, $p < 0.001$), SM (51 % vs 20 %, $\Phi = 0.17$, $p < 0.001$), and OS (35 % vs 13 %, $\Phi = 0.24$, $p < 0.001$) significantly more than those who did not use the Internet before the pandemic and earthquake period.

During the pandemic and earthquakes period, increased overall IU was reported by significantly more women, participants with lower education, and single participants (Table 3). Since very few participants (2.4 %) engaged in OGB before the pandemic, it was be excluded from separate analysis related to sociodemographic characteristics. Of all mentioned ISA, the increase in OG during the pandemic and earthquakes period was associated with somewhat younger age (Mdn = 27.50 vs 33.00, U = 48174.50, P = 0.001, r = 0.10). Also, this increase was associated with lower education level (14 % vs 7%, $P < 0.001$, $\Phi = -0.11$), single status (15 % vs 9 %, P = 0.006, $\Phi = -0.09$), child-free status (13 % vs 9 %, P = 0.001, $\Phi = -0.10$) and residence in less urban places (13 % vs 9 %, P = 0.032, $\Phi = -0.06$). Increase in PV during the pandemic and earthquakes period was also associated with younger age (Mdn = 25.00 vs 33.00, U = 23515.00, $P < 0.001$, r = 0.16). PV increased significantly more among men (12 % vs 5 %, $P < 0.001$, $\Phi = -0.12$), participants with lower education level (9 % vs 4 %, $p < 0.001$, $\Phi = -0.12$), single participants (11 % vs 5 %, P = 0.001, $\Phi = -0.10$), and child-free participants (9% vs 2%, $P < 0.001$, $\Phi = -0.12$). Finally, the reported use of SM (52 % vs 35 %, $P < 0.001$, $\Phi = 0.13$) and OS (31 % vs 14 %, $P < 0.001$, $\Phi = 0.15$) during the pandemic and earthquakes period increased significantly more among women than among men. The reported use of SM also increased significantly more among participants with lower education level (55 % vs 43, $P < 0.001$, $\Phi = -0.12$).

Discussion

The main finding of our survey was that the use of the Internet (IU) and Internet-specific activities (ISA) overall increased during the pandemic and earthquakes period, with more than half of the participants reporting increased IU, SM, and OS. The reported OG, OGB, and PV were less increased during the same period. Participants who used the Internet before the pandemic and earthquakes period reported increased overall IU significantly more often during the pandemic and earthquakes period than those who did not use it. The reported OG, OGB, PV, SM, and OS increased significantly more among participants who were engaged in such activities before the pandemic and earthquakes period. The overall IU increased more for women, less educated, and single participants. Those who reported increased OG and PV during the first three COVID-19 pandemic waves and Zagreb and Petrinja earthquakes were younger, less educated, single participants with no children. Furthermore, OG increased more for persons from less urban places of residence and PV for men. SM and OS use increased more for women and SM for the less educated. The use of SM showed a significant increase and a relatively high prevalence in the pandemic and earthquakes period. The same as in the Chinese study women and less educated participants in our study reported increased use of SM [18]. Keeping social contacts through SM during stressful situations such as the pandemic and earthquakes has temporary gratifying effects [19,20]. However, long-term consequences are a risk factor for social media addiction (SMA) and relational problems [21]. A previous study showed that OG and PV were especially relevant Internet-based behaviors during the stressfull period of COVID-19 and earthquakes because these were relaxing and stimulating virtual experiences that provided escape and replaced interpersonal face-to-face or sexual contacts, thus alleviating feelings of boredom, stress, or loneliness due to limited and restricted social interactions [22]. In our study, the main risk factors for increased OG and PV during the first three pandemic waves and earthquakes were younger age, lower education level, single status, and child-free status. Less significant risk factors were urban place of residence for OG and male sex for PV. Our results are in line with other findings related to demographic factors (age and sex) associated with OG and PV during the COVID-19 pandemic and before the pandemic [22-27]. Furthermore, previous studies showed that women were more intensely using SM, whereas men were more engaged in OG during the pandemic [28]. In our study, OS increased among women, probably because of the fear of infection, although live shopping was not restricted during the two waves. In our survey, younger individuals, less educated

persons, singles, and those with no children increasingly engaged in OG and PV. PV increased more among men, and OG increased more among persons from less urban places. Younger age and men are known demographic factors associated with problematic OG and PV [29]. Sallie and associates found that younger individuals and men exhibited more severe current use of OG and PV, and changes in their weekly use of both OG and PV during the lockdown were more pronounced [22]. Also, men use pornography for stress relief more frequently than women [26]. Being single and child-free probably allowed more free time and privacy for a person to use OG and PV to escape loneliness and increase personal socialization [30]. Although many people worked from home and used the Internet during the COVID-19 outbreak, it is likely that the less educated people the did not do so and thus had more time to use OG, PV, and SM.

Our study has several limitations. It was a cross-sectional, retrospective study, so it was not possible to draw a causal conclusion. In a survey, recall is a potential source of bias because retrospective reporting involves memory issues. Moreover, there was a selection bias, which is why these findings cannot be extrapolated to the general population.

Our survey was performed in line with the recommendations for conducting online research [31]. When selecting participants for the survey, we used the most appropriate method in conducting this type of research described in the literature - a combined approach to the distribution of questionnaires: e-mail and Web-based surveys [32]. Although online surveys have remarkable advantages, especially during the isolation imposed by epidemiological restrictions, they also have disadvantages like selection bias [33]. Furthermore, even though IU is on the rise, online research is still more accessible to the young or students than, for example, to the older or poorer population [34]. Also, the response rate on online surveys might be sex-biased, in favor of women, which is probably associated with sex-related differences in online behaviors mentioned previously (e.g., social networks are used more by women) [28,35]. Similarly, according to the limitations, the average age of individuals in our survey was 35 years, four-fifths were women, and almost two-thirds had tertiary level education. Only 12 participants reported online gambling (OGB), so we could not make any inferential analysis regarding the differences in sociodemographic characteristics. However, another study showed the impact of the COVID-19 confinement on OGB [36]. Our survey was not completed by 10 % of participants, possibly due to its length (i.e., 15 - 20 min) and no financial compensation. A future online survey should consider offering financial incentive upon the survey completion to reduce dropout rates and response bias.

To conclude, our findings showed that overall IU and ISA among Croatian adults was increased during the three waves of the COVID-19 outbreak and the Zagreb and Petrinja earthquakes and that there was an association with sociodemographic factors. Since the COVID-19 pandemic and earthquakes influence IU in various ways, this may indicate how different stress experiences have different effects on Internet behavior. Our survey serves as a preliminary step toward understanding the association between excessive IU and ISA and sociodemographic factors (age, sex, marital and working status, parenting) during prolonged stressful experiences. Further research focused on types of stressors and their association with sociodemographic characteristics and problematic IU in prolonged stress situations is needed, as well as prospective studies to confirm these relationships. Our data suggest that persons with prior excessive overall IU and ISA are at higher risk for increased IU and ISA during prolonged stressful situations. We need to identify individuals prone to developing problematic IU in order to provide support and treatment of mental health issues associated with IU and ISA. Furthermore, we need to highlight protective sociodemographic factors that clinicians and public health authorities should consider because such factors reduce the negative impact of prolonged stress experience.

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Conflict of Interest

None to declare.

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