

Gender moderates the partial mediation of impulsivity in the relationship between psychiatric distress and problematic online gaming

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Gender moderates the partial mediation of impulsivity in the relationship between psychiatric distress and problematic online gaming

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Abstract

Background: Research has shown that some individuals can develop problematic patterns of online gaming, leading to significant psychological and interpersonal problems. Psychiatric distress and impulsivity has been suggested to contribute to problematic online gaming (POG).

Objective: The underlying mediating and/or moderating mechanism of impulsivity as well as gender differences in possible associations between psychiatric distress and POG are largely unknown, which guides this current study

Methods: To address this gap, the current study examined relationships between self-reported impulsivity, psychiatric distress, and POG in a sample of matched Hungarian female and male online gamers (n=596, 50% males).

Results: showed that psychiatric distress directly predicted POG, and impulsivity partially mediated the relationship between psychiatric distress and POG. However, this mediation effect was found only for the impatience subscale. Impulsivity did not moderate the relationship between psychiatric distress and POG. A moderating effect of gender was not found in the direct relationship between psychiatric distress and POG. However, a moderated mediation analysis revealed that impatience mediated the association between psychiatric distress and POG in males, whereas the indirect effect of impatience was not significant in females.

Conclusions: Future implications are discussed in light of these results. Clinical Trial: N/a

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Original Manuscript

Original Paper

Gender moderates the partial mediation of impulsivity in the relationship between psychiatric distress and problematic online gaming

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Abstract

Background: Research has shown that some individuals can develop problematic patterns of online gaming, leading to significant psychological and interpersonal problems. Psychiatric distress and impulsivity have been suggested to contribute to problematic online gaming (POG).

Objective: The current study investigated the potential mediating and/or moderating mechanisms of impulsivity and gender-related differences in possible associations between psychiatric distress and POG.

Methods: A total of 596 matched female and male participants, ranging in age from 14 to 38 years ($M = 21.4$, $SD = 4.5$), were chosen from a large cross-sectional nation-wide Hungarian online gaming sample. Participants completed online questionnaires about self-reported impulsivity, psychiatric distress, and POG.

Results: Psychiatric distress directly predicted POG, and impulsivity partially mediated the relationship between psychiatric distress and POG. However, this mediation effect was found only for the impatience factor of impulsivity. Impulsivity did not moderate the relationship between psychiatric distress and POG. A moderating effect of gender was not found in the direct relationship between psychiatric distress and POG. However, a moderated mediation analysis revealed that impatience mediated the association between psychiatric distress and POG in males, whereas the indirect effect of impatience was not significant in females.

Conclusions: The results of this work highlight gender-related difference among online gamers in the mediation effect of impulsivity between psychiatric distress and POG, and provide novel insights regarding clinical implications for preventing or treating POG.

Keywords □ Problematic Online Gaming; Problematic Internet Gaming; Internet Gaming Disorder; Psychiatric Distress; Brief Symptom Inventory; Impulsivity; BIS; impatience; Gender

Introduction

Problematic online gaming (POG) may be defined as the persistent and recurrent use of the Internet to play video games leading to clinically significant impairment or distress. Internet gaming disorder was included as a “condition for further study” in the DSM-5 section III [1]. Furthermore, gaming disorder, including online gaming, has been formally included along with gambling disorder as a disorder due to addictive behaviors in the recently released listing of conditions in the International Classification of Diseases 11th Revision (ICD-11) [2]. Some have considered POG to be a global public health problem due to its relevant high prevalence and significant negative outcomes in worldwide populations, particularly among adolescents [3, 4]. A recent review suggested that the overall prevalence of POG ranged from 0.7–15.6% in studies of naturalistic populations, with an average percentage of 4.7% [5].

Psychiatric symptoms such as depression have been associated with POG and problematic Internet use more broadly [6, 7]. POG has been positively correlated with psychiatric symptom dimensions including depressed mood, loneliness, social anxiety and negative self-esteem [8–11]. Individuals (particularly females) may engage in potentially addictive behaviors to escape from negative mood states or other psychiatric distress (negative reinforcement motivations), and this may lead to problematic or addictive engagement. While previous research has focused primarily on the direct association between psychiatric distress and POG, fewer studies have examined how specific factors may moderate relationships between psychiatric distress and POG or how the relationships between psychiatric distress and POG may operate through intervening variables via mediation effects. To address these gaps, the present study constructed a moderated mediation model to test the mediating role of impulsivity and the moderating role of gender in the relation between psychiatric distress and POG. Such studies could advance our understanding of how and when psychiatric distress might lead to greater POG and may have implications for the prevention and treatment of POG.

Impulsivity as a Mediator or Moderator

Impulsivity has been described as being characterized by “actions that are poorly conceived, prematurely expressed, unduly risky, or inappropriate to the situation and that often result in undesirable outcomes” [12]. Although Impulsivity is a multidimensional construct, impatience is an important component of impulsiveness that may result from relative disregard of future outcomes and/or oversensitivity to immediate rewards [13]. Impulsivity has been related to substance use, gambling, and gaming [14]. Impulsivity has been proposed to contribute significantly to the development and/or maintenance of addictions [3, 15]. It has also been linked to poor addiction treatment outcomes [16]. Furthermore, impulsivity has been associated with problematic Internet use and POG. For instance, adolescents with Internet addiction exhibited more impulsivity than those without [17], and the severity of Internet addiction was positively correlated with the level of impulsivity in individuals with Internet addiction [18]. Greater impulsivity among Internet users was associated with poorer control over the use of the Internet [19]. Similarly, individuals with POG have been found to score high on measures of impulsivity [20].

Psychiatric symptoms may relate to impulsivity. Negative emotional states may lead individuals to focus more on their feelings, which may trigger poor self-control [21]. Semple et al [22] found that depression scores could best discriminate between substance users with high and low impulsivity. Depression and loneliness scores have also correlated with low self-control and problematic Internet use [6].

Prior studies have shown that impulsivity may mediate the relation between psychiatric distress and addictive behaviors. For example, impulsivity has been shown to mediate the influence of life stress on pathological gambling [23] and the relationship between depression and problematic gambling [24]. However, mixed findings have been reported in moderation analyses. Although a moderating effect of impulsivity was also observed in a study by Tang and Wu [23], in which a positive association between life stress and pathological gambling was significant among those with low impulsivity only, and pathological gambling remained high regardless of the stress level among those with high impulsivity, this moderating effect was not supported by Clarke [24]. Although studies have examined the relationship between impulsivity and problematic Internet use [17, 18], and the mediating and/ or moderating effects of impulsivity on psychiatric distress and pathological gambling [23, 24], few studies have examined a role for impulsivity in relationships between psychiatric distress and POG. Internet addiction has been reported to have comparable levels of impulsivity compared with pathological gambling [18], and POG may be characterized by high impulsivity like other addictive disorders including gambling disorder [20]. Therefore, previous studies of pathological gambling may shed light on mechanisms of how psychiatric distress may relate to POG. The present study thus investigated the extent to which impulsivity would mediate and/or moderate a hypothesized relationship between psychiatric distress and POG. Based on the findings above, we proposed the following hypotheses.

Hypothesis 1 (H1). POG would correlate positively with impulsivity with a moderate effect size (H1a) and psychiatric distress with a large effect size (H1b).

Hypothesis 2 (H2). According to the mediation model, impulsivity would mediate the relationship between psychiatric distress and POG. Psychiatric distress would relate to POG directly, as well as indirectly through impulsivity.

Hypothesis 3 (H3). According to the moderation model, impulsivity would moderate the relation between psychiatric distress and POG, with the relationship being stronger for individuals with lower impulsivity.

Gender as a Moderator

Although psychiatric distress may relate to impulsivity and POG, it is possible that not all individuals are equally influenced. The present study examined whether the direct effect of psychiatric distress on POG and the indirect effect of impulsivity would be moderated by gender.

Gender may relate importantly to Internet gaming behaviors. First, boys have been found to be more likely than girls to report having played video games [25-27], and also to report more problematic gaming than girls [28]. Second, being male was a strong predictor of problematic game use [26], and POG was strongly associated with being male [29]. Third, gender-related

differences may extend to gaming motivation. Female gamers scored significantly higher on fantasy, escape, social, and recreation motives, whereas male gamers reported significantly higher scores on competition motives [9]. Male players also reported a greater need for gaming-related friendships than did females [30].

Gender-related differences may also exist in impulsivity's relationship to addictive behaviors. Gender was found to moderate the relationship between sensation-seeking/impulsivity and alcohol use; in particular, males and females were found to have comparable alcohol use frequencies under conditions of low sensation-seeking/impulsivity, and males were found to have a higher frequency of alcohol use than females under conditions of high sensation-seeking/impulsivity [31]. A moderating effect of gender on the association between impulsivity and alcohol-use problems was also found by Stoltenberg and colleagues [32]. Similarly, impulsivity was found only to associate with levels of alcohol use in males [33]. Given that urges/cravings in POG and substance-use disorders may share similar neurobiological mechanisms [34], gender-related differences in prior studies of alcohol use may extend to POG, and this possibility should be tested directly.

Together, both the association between psychiatric distress and POG and the association between impulsivity and POG may be moderated by gender. Furthermore, if impulsivity were to mediate the relation between psychiatric distress and POG, and gender were to moderate the association between impulsivity and POG simultaneously, the mediating effect of impulsivity would be moderated by gender. In other words, there would be a moderated-mediation model involving impulsivity and gender in the relation between psychiatric distress and POG. We sought to test this model. Thus, we put forward the following hypotheses (see Figure 1):

Hypothesis 4 (H4). Gender would moderate the relationship between psychiatric distress and POG, with the relation being stronger for males.

Hypothesis 5 (H5). Gender would moderate the mediating effect of impulsivity in the relationship between psychiatric distress and POG, with the mediating effect only being significant among males.

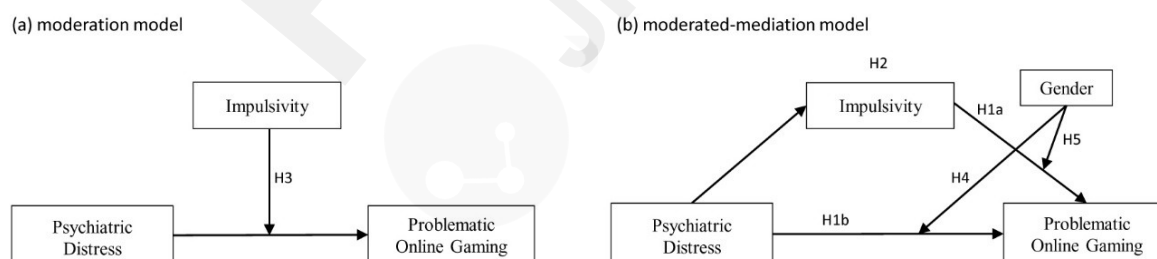


Figure 1. Conceptual model of hypotheses

Methods

Participants and Procedure

We used data from a nation-wide Hungarian online gaming sample. Participants were recruited via gaming-related websites and Facebook pages. Three calls containing the link to the

questionnaire were posted on a popular gaming magazine's (i.e., GameStar) website and Facebook page in August and September of 2014. The magazine's Facebook page had approx. 65,000 followers at the time of the data collection. The post was liked more than 800 times and shared more than 130 times during this period, reaching a wide circle of Hungarian gamers. A shopping voucher of approx. 300 euros was drawn and offered to one study participant as an incentive to boost participation. For more details of the data collection process, see [35]. Participants were informed about the aim of the study, the time necessary for completion and confidentiality of the data. Every participant included in the current analysis provided informed consent by ticking a checkbox indicating agreement before starting the questionnaire. Participants between 14 and 17 years of age needed to indicate the approval of their parents with an affirmative response from the parent to the question stating, "I allow my child to participate: parent". The study was approved by the Institutional Review Board of Eötvös Loránd University, Budapest, Hungary. The Institutional Review Board of Yale University approved the use of de-identified data in the current analyses. The study was performed in line with the Helsinki Declaration. We used the larger sample in two previous studies, which did not include data analysis findings reported in the current study [35, 36].

A total of 7757 gamers started the survey. To verify unique entries (i.e., emanating from different individuals), email addresses were checked for uniqueness, and cases having the same email address were removed from the dataset. Furthermore, we checked for invalid answer patterns (e.g., the impulsivity scale had several reversed items - if a person gave the same values for all items, the answers were considered as invalid). We deleted responses from individuals with invalid answer patterns. After excluding cases reflecting duplicate submissions, severe incompleteness or inconsistencies on the current variables, 5222 online gamers remained in the current sample (4830 males, 384 females). Due to the overrepresentation of males that is frequent in specific video gamer samples, we identified a matched sample of males based on the female participants (298 males, 298 females) for further analysis. The matching method is described in the Statistical Analysis. In the current sample, the mean age was 21.4 years ($SD=4.5$, age range 14-38). Most participants were either single (41.6%) or in a relationship but living separately (39.3%), and most were students (68.9%). For further details on sample demographics, see Table 1.

Measures

Problematic Online Gaming Questionnaire (POGQ). The POGQ is an 18-item scale assessing problematic online gaming [37], showing good psychometric properties in both adult and adolescent samples (Pápay et al., 2013). The scale is comprised of six factors: social isolation, interpersonal conflicts, overuse, withdrawal, immersion, and preoccupation. Participants responded on a five-point Likert scale (1= "never", 5 = "almost always/always") to each item (e.g., "How often do you get irritable or upset when you cannot play?" and "How often do you neglect other activities because you would rather be gaming?"), with higher scores indicating greater POG. The scale was originally developed in the Hungarian context and showed good psychometric properties in other cultures as well (e.g., [10]). The internal consistency of this scale was 0.89 in the current study.

Brief Symptom Inventory (BSI). The BSI assesses psychiatric distress with 53 items on nine self-reported clinically relevant psychological symptoms: somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism [38]. Respondents rank the distress level of each item (e.g., "Having to check and

double check what you do,” “Feeling fearful,” and “Trouble falling asleep”) on a 5-point Likert scale (0 = “not at all”, 4 = “extremely”) during the past 7 days. Rankings characterize the intensity of distress during the past seven days. In the present study, a global index of *Global Severity Index (GSI)*, namely the mean for all 53 items, was used to assess the level of general distress. Higher GSI scores indicate stronger psychiatric distress. The scale was previously adapted to the local (Hungarian) culture and showed good psychometric properties [39]. The internal consistency of this scale was 0.96.

Barratt Impulsiveness Scale (BIS). The BIS-21, revised from the original Barratt Impulsiveness Scale [40], has been tested in three different Hungarian adult samples, including a representative one, and assesses impulsivity with 21 items comprising three components of impulsivity: self-control, impulsive behavior, and impatience [41]. Participants indicated their responses on a four-point Likert scale (1 = “rarely/never”, 4 = “almost always/always”) to each item (e.g., “I am future oriented,” “I do things without thinking,” and “I am restless at the theater or lectures,”), with higher scores indicating greater impulsivity. The internal consistency (Cronbach’s α) was 0.74 for the Self-control subscale, 0.78 for the Impulsive Behavior subscale, and 0.63 for the Impatience subscale, whereas it was 0.80 for the whole scale.

Statistical Analysis

We used the case-control matching tools in Medcalc v17.8 to obtain matched data from the sample pool ($N=5222$). Female status was set to be the matching target group, and male cases were chosen from the pool to match each female case by case. The matching condition was set to include a maximal allowable difference in age of one year and required both paired individuals to be the same on measures of education, marital relationship and work status. This approach generated 298 pairs of cases satisfying the matching conditions.

Description analysis, correlation analysis, and T-tests were performed with SPSS 19. Internal consistencies were assessed by Cronbach’s alpha coefficient (α). Cohen’s d was used to measure the effect size.

Mediation and moderation effects were tested using SPSS PROCESS (v3.0) for bootstrapping as described by Hayes [42]. PROCESS is a computational tool for path analysis-based moderation and mediation analysis as well as for their combination [42]. We first tested a mediation model (model no. 4 in PROCESS) for H2 using the total score of the BIS-21; we then tested a moderation model (model no. 1 in PROCESS) for H3. If positive mediation and/or moderation effects of impulsivity were observed, then a series of post-hoc analyses were used to examine specific subscales of the BIS-21 separately. We further tested the moderated mediation model (model No.15 in PROCESS) for H4 and H5. Values of variables were standardized before calculating the models in PROCESS for the purpose of obtaining the standardized regression coefficient. Age, education, and working status were included as covariates in all models. Significant interactions in the moderated-mediation model were followed-up with simple slopes analysis at high (+1SD) and low (-1SD) values of the moderator variable [42]. Indirect mediating effects were evaluated with 95% confidence intervals using the percentile method based on 5,000 bootstrap samples. If the confidence interval did not contain zero, then the indirect effect was considered statistically significant [42]. If the presence of such an indirect effect depended on the value of a moderating variable, then it was considered an indication of moderated mediation.

Results

Sample Description

Given the matching process, males and females in the subsample had precisely the same demographic characteristics with respect to age, education, marital status and working status. Student status was also largely similar. Chi-square testing revealed that a higher percentage of males played games for more than 14 hours per week compared with females ($\chi^2=14.33$, $P=.006$, *Odds ratio*=1.64).

Table 1. Demographics and weekly gaming time of sample participants

Demographics	Male (n=298)	Female (n=298)
Age; Mean (SD)	21.4 (4.5)	21.4 (4.5)
Education (number of years completed) Mean (SD)	13.0 (2.6)	13.0 (2.6)
Marital status		
Single	124 (41.6%)	124 (41.6%)
In a relationship but living separately	117 (39.3%)	117 (39.3%)
Living in a partnership	51 (17.1%)	51 (17.1%)
Married	6 (2.0%)	6 (2.0%)
Divorced	0 (0.0%)	0 (0.0%)
Widowed	0 (0.0%)	0 (0.0%)
Currently a student ^a	203 (68.6%)	206 (69.1%)
Working status		
Does not work	165 (55.4%)	165 (55.4%)
Has a part-time job	58 (19.5%)	58 (19.5%)
Has a full-time job	75 (25.2%)	75 (25.2%)
Weekly gaming time ^b		
Less than 7 hours	48 (16.2%)	57 (19.2%)
7-14 hours	52 (17.5%)	78 (26.3%)
15-28 hours	109 (36.7%)	100 (33.7%)
29-42 hours	57 (19.2%)	49 (16.5%)
More than 42 hours	31 (10.4%)	13 (4.4%)

Note: ^a two missing values in males; ^b two missing values (one male and one female respectively).

The descriptive statistics and zero-order correlations for demographic variables and psychological measures are presented in Table 2. GSI was positively and strongly correlated with POG ($r=0.52$, $P<.001$), whereas impulsivity was moderately related to POG ($r=0.33$, $P<.001$); thus, H1 was confirmed.

Table 2. Mean, standard deviation, correlation of overall variables

	1	2	3	4	5	6	7	8	9
1. Age	1.00								
2. Education	0.66**	1.00							
3. Working status	0.64**	0.42**	1.00						
4. Problematic Online Gaming	-0.18**	-0.16**	-0.18**	1.00					
5. Global Severity Index	-0.20**	-0.21**	-0.15**	0.52*	1.00				
6. BIS Self-control	-0.06	-0.06	-0.08	0.19*	0.16*	1.00			

				*	*				
7. BIS Impulsive behavior	-0.09*	-0.12**	-0.04	0.25*	0.13*	0.37*	1.00		
8. BIS Impatience	-0.06	-0.03	-0.03	0.36*	0.33*	0.22*	0.43*	1.00	
9. BIS Total score	-0.09*	-0.09*	-0.06	0.33*	0.27*	0.78*	0.76*	0.70*	1.00
M	21.38	13.00	1.70	0.74	12.85	17.37	9.96	12.56	39.70
SD	4.48	2.55	0.85	0.66	3.76	4.40	3.06	3.43	8.02

Note: BIS= Barratt Impulsiveness Scale (version 21); working status was coded as 1 = “does not work”, 2 = “has a part-time job” and 3 = “has a full job”.

* $P < .05$, ** $P < .01$.

Gender-related Differences

We examined gender-related differences using T-tests (see Table 3). Statistically significant gender-related differences were not observed in impulsivity. Females scored higher in immersion ($t = -3.52$, $P < .001$, $d = 0.30$) but lower in overuse ($t = 2.10$, $P = .036$, $d = -0.18$) than males on subscales of the POGQ. GSI scores were higher in females than males ($t = -5.40$, $P < .001$, $d = 0.49$), but males spent more weekly time gaming than did females ($t = 3.14$, $P = .002$, $d = -0.26$).

Table 3. Gender differences in overall variables ($M \pm SD$)

	Male	Female	<i>t</i>	<i>P</i>	<i>d</i>
Impulsivity					
Self-control	17.15±4.34	17.60±4.46	-1.18	.240	0.10
Impulsive behavior	9.82±3.11	10.09±3.00	-1.03	.303	0.09
Impatience	12.42±3.43	12.69±2.43	-0.89	.374	0.08
Total score	39.22±7.99	40.18±8.04	-1.38	.169	0.12
Problematic online gaming					
Preoccupation	5.24±1.83	5.33±2.03	-0.56	.574	0.05
Immersion	11.87±3.51	12.93±3.65	-3.52	<.001	0.30
Withdrawal	6.89±3.24	6.85±3.44	0.16	.870	-0.01
Overuse	6.05±2.67	5.58±2.72	2.10	.036	-0.18
Social isolation	5.08±2.40	5.09±2.70	-0.03	.978	0.00
Total score	39.22±11.15	39.73±11.74	-0.53	.600	0.04
Global Severity Index	0.58±0.55	0.89±0.73	-5.40	<.001	0.49
Weekly game time ^a	2.90±1.19	2.61±1.10	3.14	.002	-0.26

Note: ^a five point scale: 0=“none”, 1=“less than 7 hours”, 2=“7-14 hours”, 3=“15-28 hours”, 4=“29-42 hours”, 5=“more than 42 hours”.

Impulsivity

To test the hypothesis regarding a mediating role for impulsivity (H2), the mediating effect of impulsivity as well as indirect effects, and direct effects of psychiatric distress on POG were calculated with 5,000 bootstrap samples. Age, education, and working status were controlled as covariates. The bootstrap results showed that impulsivity partially mediated the effect of GSI on POG. In particular, the total (non-mediated) effect of GSI was significant and strong ($\beta = .54$, $SE = 0.04$, $t = 13.95$, $P < .01$). After controlling for impulsivity, the direct effect of psychiatric distress was weakened but remained significant and strong ($\beta = .51$, $SE = 0.04$, $t = 12.50$, $P < .01$).

The indirect effect of GSI through impulsivity was significant, with a small effect size estimate (0.04 with a 95% bootstrap CI of 0.01 to 0.06; see Figure 2a).

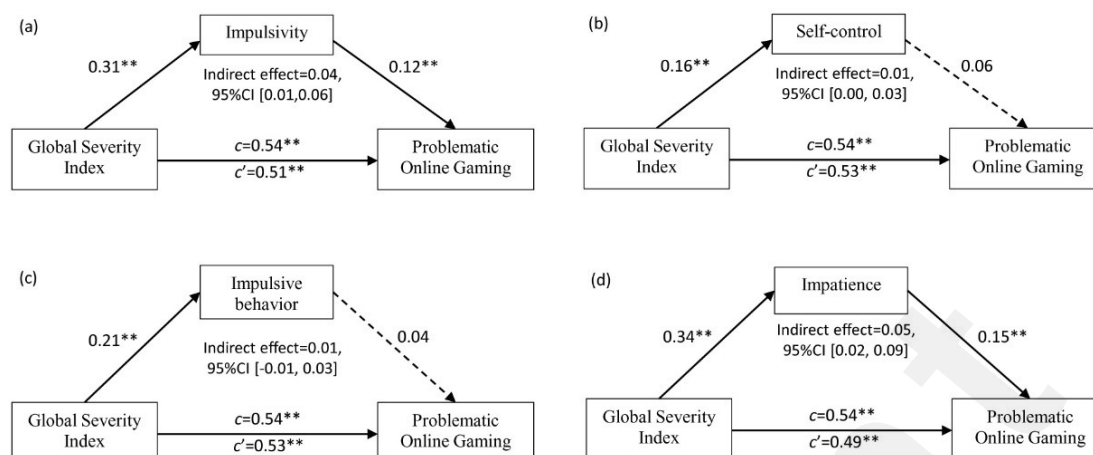


Figure 2. Results of models testing for mediating effects of impulsivity and its dimensions in the relationship between measures of global severity index and problematic online gaming ($N=5000$ bootstrapping resamples). Note: Path c = total (non-mediated) effect; Path c' = direct (controlling mediator) effect; all paths are quantified with standardized regression coefficients. * $P < .05$, ** $P < .01$;

In post-hoc analyses, we examined the specific subscales of the BIS-21 in mediation analyses. In the model of self-control and impulsive behavior (see Figure 2b, Figure 2c), the 95% bootstrap CI of the indirect effect included zero, so the mediation effect was not significant. However, the mediation effect of impatience was significant with an effect size estimate of 0.05 with a 95% bootstrap CI of 0.02 to 0.09 (see Figure 2d).

To test the moderation effect of impulsivity (H3), a multiple regression analysis was conducted to determine main and interaction effects of impulsivity and GSI on POG. As shown in Table 4, main effects of GSI ($\beta = .53$) and impulsivity ($\beta = .12$) were both significant ($P < .01$), but their interaction term (GSI \times Impulsivity) was not significant ($P = .102$). Thus, the moderation effect of impulsivity was not supported in the study.

Table 4. Summary of multiple regression analyses for the moderated analysis

Predictors	β	SE	t	P	95% Bootstrap CI
Age ^a	-.06	0.06	-1.04	.298	-0.18, 0.06
Education ^a	-.06	0.05	-1.25	.213	-0.16, 0.04
Work status ^a	.03	0.05	0.60	.549	-0.07, 0.13
GSI	.53	0.04	12.52	<.001	0.44, 0.61
Impulsivity	.12	0.04	3.02	.003	0.04, 0.20
GSI \times Impulsivity	-.06	0.04	-1.64	.102	-0.13, 0.01

Note: ^a Covariate variables; $N=5,000$ bootstrapping resamples; GSI= Global Severity Index. Dependent variable: Problematic online gaming.

Test of Moderated Mediation

Since only the impatience subscale of BIS-21 was significant in the mediation model, we further

tested H4 and H5 with respect to impatience by adding gender as a moderator into the model. The result revealed that gender significantly moderated the relationship between impatience and POG, but its moderation effect in the direct path between GSI and POG was not significant (see Table 5).

Graphs of the interaction (Gender \times Impatience) are presented in Fig. 3 with simple slopes, derived from the regression equations, where high and low values of impatience were specified as one standard deviation above and below the mean. Results indicate a significant positive association between impatience and POG for males ($\beta=.24$, $P<.001$) but not for females ($\beta=.05$, $P=.358$). In females, impatience and POG were not associated. Testing the indirect effect of psychiatric distress on POG via impulsivity revealed that impatience scores mediated the association between GSI and POG, but only in males and not in females (see Table 6).

Table 5. Summary of multiple regression analyses for the moderated mediation analysis

Dependent variables	β	SE	T	P	95% Bootstrap CI
Impatience					
Age ^a	-.02	0.07	-0.23	.819	-0.15, 0.12
Education ^a	.02	0.06	0.27	.790	-0.10, 0.13
Work status ^a	.04	0.06	0.69	.488	-0.07, 0.15
GSI	.34	0.04	7.52	<.001	0.25, 0.42
Problematic online gaming					
Age ^a	-.04	0.06	-0.73	.469	-0.16, 0.07
Education ^a	-.07	0.05	-1.50	.135	-0.17, 0.02
Work status ^a	.02	0.05	0.32	.746	-0.08, 0.11
GSI	.53	0.04	12.32	<.001	0.44, 0.61
Impatience	.14	0.04	3.64	<.001	0.07, 0.22
Gender	.17	0.08	2.25	.025	0.02, 0.32
Gender \times GSI	.08	0.08	0.96	.336	-0.08, 0.25
Gender \times Impatience	.19	0.08	2.35*	.019	0.03, 0.34

Note: ^a Covariate variables; N=5,000 bootstrapping resamples; GSI= Global Severity Index

Table 6. Conditional direct and indirect effects of Global Severity Index (independent variable) on Problematic Online Gaming (outcome variable) via Impatience (mediator) and gender (moderator)

Values of the moderator	Direct effects				Indirect effects		
	β	SE	T	P	Effect (bootstrap estimate)	SE (bootstrap estimate)	95% bootstrap CI
Male	.57	0.07	8.41	<.001	0.08	0.02	0.04, 0.13
Female	.49	0.05	9.42	<.001	0.02	0.02	-0.02, 0.06

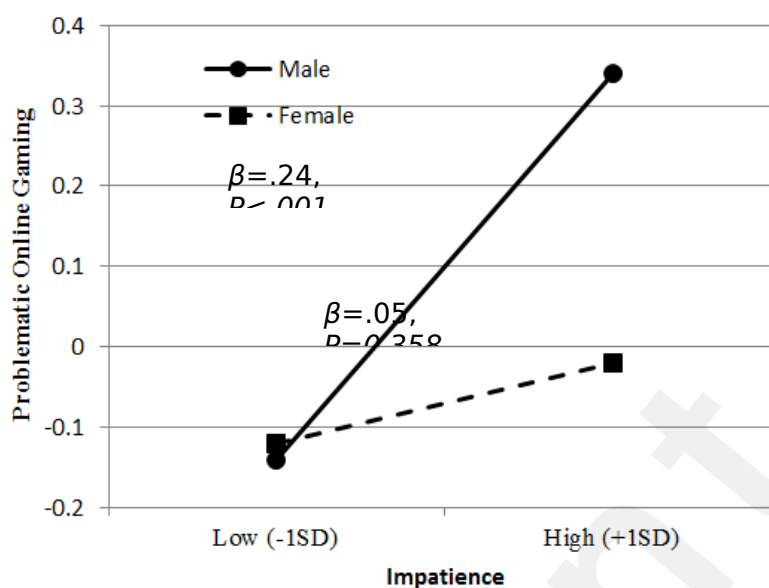


Figure 3. Simple slopes probing the interaction between gender and impatience in the prediction of problematic online gaming (z score).

Discussion

While several studies have examined links between psychiatric distress and POG [8-11], the current study is the first to provide empirical evidence investigating the extent to which impulsivity and facets thereof may mediate and/or moderate this relationship in a gender-sensitive fashion. Our *a priori* hypotheses were partially supported in that impulsivity mediated the relationship between psychiatric distress and POG. However, this relationship seemed most relevant for impatience and was moderated by gender such that the mediating relationship was evident in males but not females. These findings provide insight into possible mechanisms by which psychiatric distress may influence POG.

The finding that POG was related to psychiatric distress supported H1 and is consistent with prior findings in POG [8-10, 43], as well as findings in other behavioral addictions [44, 45]. The present findings expand upon prior ones through exploration of a role for impulsivity. As hypothesized (H2), the relationship between psychological distress and POG was mediated partially through impulsivity, consistent with studies of problematic gambling [23, 24]. However, the hypothesized moderation effect of impulsivity was not observed, consistent with findings from Clarke [24] but not Tang and colleagues [23]. For POG, psychological distress and impulsivity did not interact to account for POG beyond the main effects. As distress increased, the likelihood of experiencing POG symptoms increased, partially through impulsivity. The results resonate with the pathways model of problematic gambling described by Blaszczynski and colleagues [46]. According to the third path in the model, the effect of impulsivity may be increased when experiencing negative emotions or when feeling pressured or stressed, and impulsivity is proposed to mediate the effects of emotional disturbances on problem and pathological gambling symptoms through an interactive process [46]. Further analysis revealed that this mediation effect only appeared in the dimension of impatience. Previous studies have found that impatience is related to increased substance use [47], pathological

gambling [48] and POG [49]. The current findings suggest an important role of psychiatric distress that may influence POG indirectly through impatience; therefore, helping to develop skills in specific impatience-related domains (emotion regulation, behavioral control) may be important when treating patients with POG.

Earlier studies have reported that boys were more likely to play online games than girls and also more likely to be problematic players [11, 28]. Our results indicate that males did spend more time online playing games compared with females; however, there was no gender-related difference in overall POG (as assessed by POGQ total scores) in the current sample. Possible reasons may be related to the current sample which was recruited from gaming-related websites and Facebook pages; therefore, both gender groups may have been comprised of highly engaged gamers [50]. In the current study, females had higher psychological distress than males, but the groups did not differ in levels of impulsivity. Moreover, results provided some support for gender as a moderator among the association between impatience and POG in the mediation model. Specifically, as predicted in H5, the indirect effect of impatience was significant in males, but not in females. The result is consistent with prior findings in alcohol-use behaviors, in which impulsivity was correlated with alcohol use in males, but not in females [33]. The present findings suggest that males may be more vulnerable to POG triggered by impulsivity. However, gender did not moderate the direct effect of psychological distress and POG as hypothesized in H4, which suggests both males and females may exhibit POG symptoms in relation to psychiatric distress.

The present research should be viewed in light of several limitations. First, male players are overrepresented (92.5%) in the original sample of gamers ($N=5222$) recruited online. Therefore, a new matched sample based on the female cohort was used for the current study, and the results may not extend to the general population. Second, this study involved cross-sectional survey data. Thus, it does not permit identification of cause-and-effect associations. For example, we could not determine whether psychiatric distress increased POG or whether POG led to distress. It is also possible that there was a reciprocal influence between distress and POG. Future studies should utilize longitudinal methods to examine the directionality of relationships among POG, psychiatric distress and impulsivity. Third, despite the advantage of a larger sample size, the self-selected data collected online from a Hungarian sample are derived from a convenience sample, thus limiting the generalizability of our findings. The sample likely over-represents active and highly engaged gamers, as suggested elsewhere [50]. Nevertheless, data from this sample has both limitations and strengths and may be particularly suitable for examining potential roles of impulsivity and psychiatric distress in problematic gaming. The use of different anchor points for Likert scales across instruments in the study also has both strengths and limitations, with strengths including the use of values employed in the originally described and validated instruments and weaknesses including potential complexities in comparing findings internally across instruments. Finally, the self-report nature of the data may introduce certain biases (e.g., memory recall bias, social desirability bias) that should be considered.

Despite the above limitations, the results have significant clinical implications. Co-occurring features of POG (e.g., depression, impulsivity) should be considered in its treatment [51]. The findings in the present investigation suggest that because distress affects impulsivity; thus, it may be appropriate to treat emotional distress experienced by problematic gamers in addition to treating impulsivity, as suggested by Clarke [24]. Moreover, targeting impulsivity, and particularly impatience, may be helpful to weaken the link between psychiatric distress and POG, especially for males. Cognitive-behavioral therapy, by itself or in conjunction with medication, might be helpful in treating associated impatience/restlessness and emotional distress [52]. As video games are attractive to and accepted by those at risk of POG, they may be considered in novel approaches to help control impulsivity and improve emotion regulation. For example in other disorders, some video games (e.g., PlayMancer) may be effective as additional therapy tools to help improve emotional regulation and impulse control in cases with bulimia nervosa [53] and gambling disorder [54]. The potential therapeutic effect of video games in POG may be worth exploring in future studies. However, one should also consider the potential triggering effects of exposing individuals with POG to online games, especially if abstinence is being targeted. Since males with high impulsivity may be more vulnerable to POG than females, future interventions for POG should consider gender-related differences in this domain. Further, given that attention-deficit/hyperactivity disorder (ADHD) has been linked to online gaming [55] and greater impatience/restlessness during abstinence from gaming [56], medications that reduce impulsive behaviors (e.g., stimulants like methylphenidate or non-stimulants like atomoxetine) may be helpful in reducing POG, particularly in males. As relationships between ADHD and problematic Internet use more broadly have been observed, especially in young adults [57], the extent to which the findings and corresponding intervention-related considerations are relevant to a broader range of problematic online behaviors (gambling, shopping, pornography viewing) warrants direct investigation. Among females, the higher GSI scores suggest that psychopathology may be a greater consideration related to POG in females as compared with males. Given that females more frequently than males exhibit anxiety, receive more mental health treatment and engage in addictive behaviors like gambling for negative reinforcement motivations [58-60], future studies should assess these domains as they relate to POG, particularly in females.

In conclusion, this study provides some of the first empirical data investigating the extent to which impulsivity and its dimensions may mediate and/or moderate relationships between psychiatric distress and POG in a gender-sensitive fashion. The study suggests that impulsivity (specifically impatience) acts as a mediator rather than a moderator in the relationship between psychiatric distress and POG. A moderating effect of gender was not found in the direct relationship between psychiatric distress and POG. However, a moderated mediation analysis suggested that impatience mediated the association between psychiatric distress and POG in males, whereas the indirect effect of impatience was not significant in females. The findings suggest important implications for preventing or treating POG in online gamers. Future studies should examine other individual differences (e.g., with respect to age or race/ethnicity) that may also help understand different populations and potentially advance prevention and treatment efforts.

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Conflicts of Interest

The authors report that they have no financial conflicts of interest with respect to the content of this manuscript. Dr. Potenza has consulted for Ironwood, Lundbeck, Shire, INSYS, Rivermend Health, Opiant/Lightlake Therapeutics, and Jazz Pharmaceuticals; has received research support (to Yale) from Pfizer, Mohegan Sun Casino and the National Center for Responsible Gaming; has participated in surveys, mailings or telephone consultations related to drug addiction, impulse-control disorders or other health topics; has consulted for gambling and legal entities on issues related to impulse-control/addictive disorders; provides clinical care in a problem gambling services program; has performed grant reviews for the National Institutes of Health and other agencies; has edited journals and journal sections; has given academic lectures in grand rounds, CME events and other clinical or scientific venues; and has generated books or book chapters for publishers of mental health texts. The other authors have no disclosures. The views presented in this manuscript represent those of the authors and not necessarily those of the funding agencies who had no input into the content of the manuscript.

Abbreviations

POG: problematic online gaming

DSM-5: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition

ICD-11: International Classification of Diseases 11th Revision

POGQ: Problematic Online Gaming Questionnaire

BSI: Brief Symptom Inventory

GSI: Global Severity Index

BIS: Barratt Impulsiveness Scale

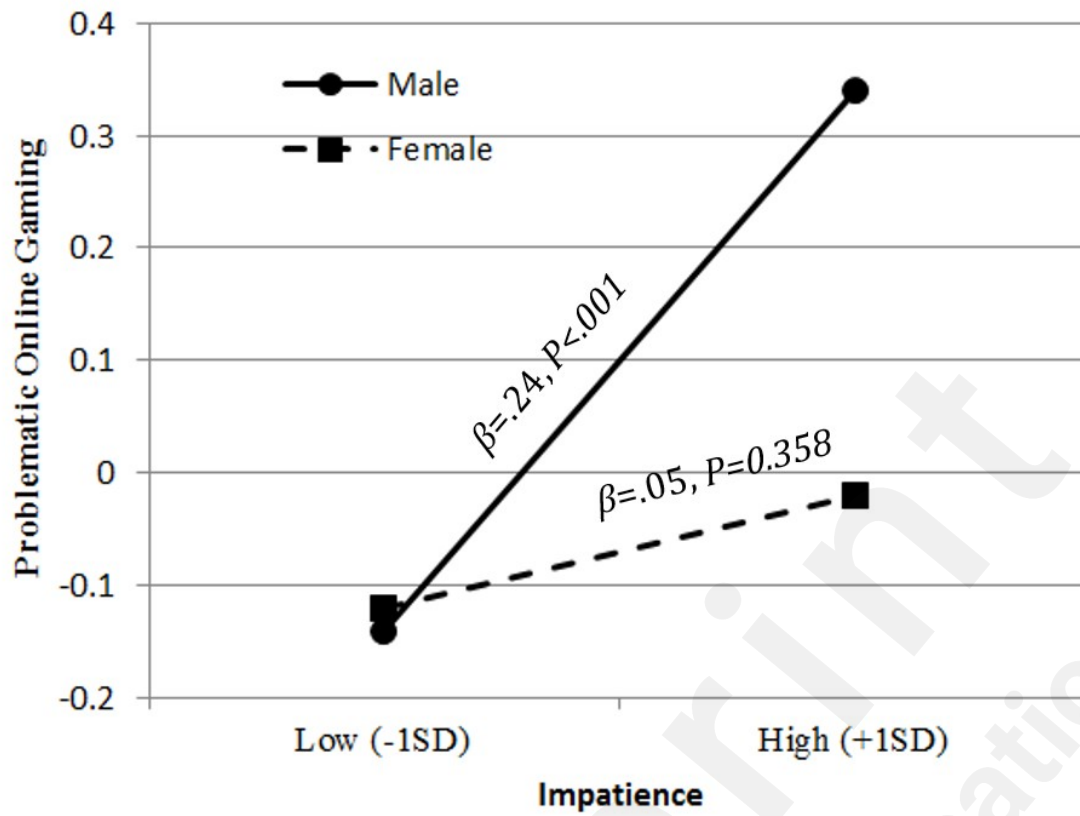
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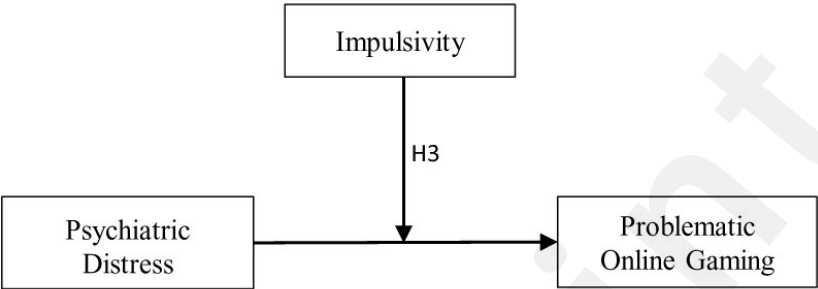
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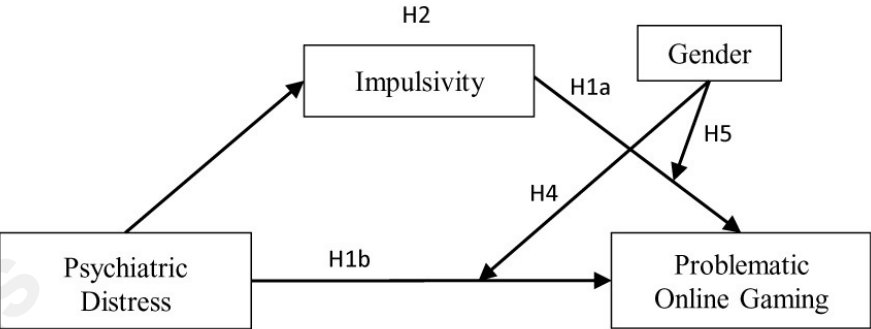
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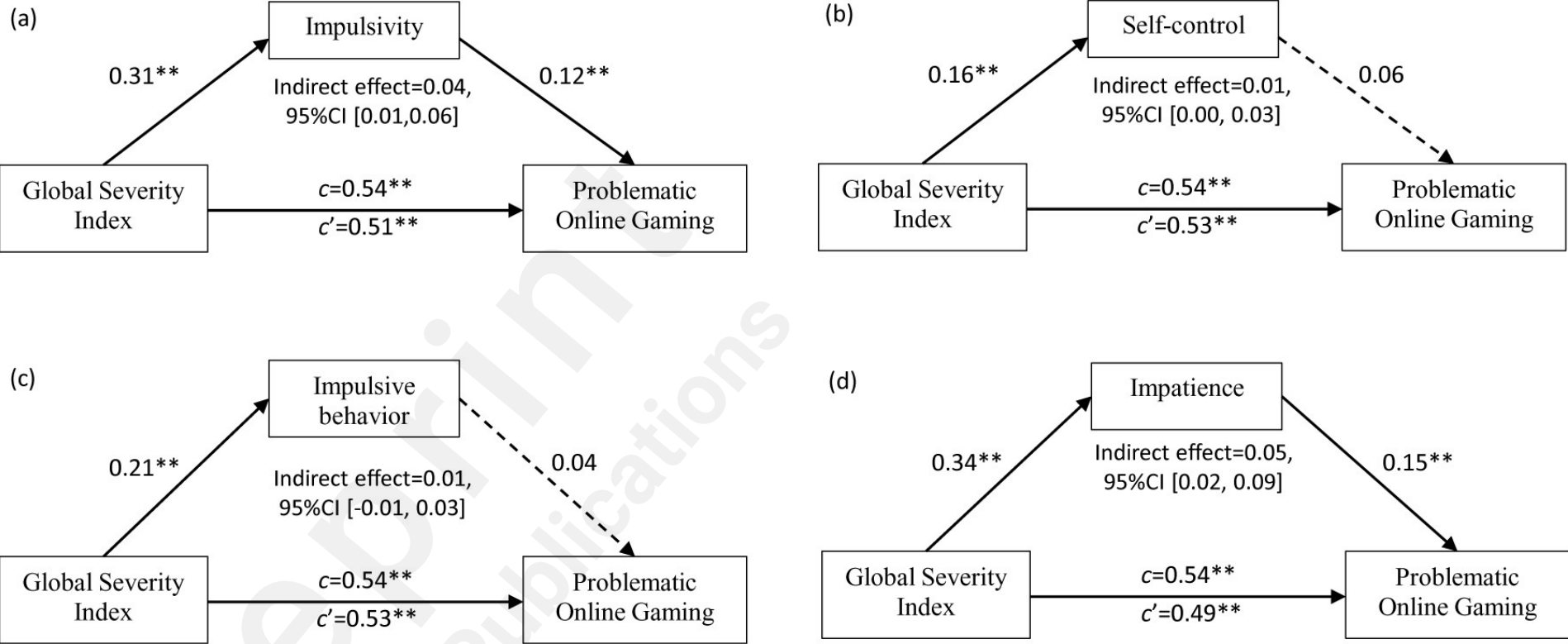


(a) moderation model



(b) moderated-mediation model





Supplementary Files

Figures

Simple slopes probing the interaction between gender and impatience in the prediction of problematic online gaming (Z score).

