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Psychological predictors of the co-occurrence of problematic gaming, gambling, and social media use among adolescents

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Psychological predictors of the co-occurrence of problematic gaming, gambling, and social media use among adolescents

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Abstract

The aim of the present study was to explore which psychosocial predictors are associated with different co-occurrence patterns of three different behavioral addictions (i.e., problematic gaming, problematic social media use, and problematic gambling) among adolescents. A total of 2390 Iranian adolescents – 835 males and 1555 females aged between 13 and 18 years ($M = 16.01$ years, $SD = 1.38$) – participated in a cross-sectional online survey. Latent profile analysis produced four latent classes: a ‘non-problematic behavior’ class ($N=1766$; 73.89% [Class 1]), a ‘problematic gambling’ class ($N=183$; 7.66% [Class 2]), a ‘problematic social media use with gaming disorder’ class ($N=407$; 17.03% [Class 3]), and a ‘disordered gambling with problematic social media use’ class ($N=34$; 1.42% [Class 4]). Adolescent problem gamblers (Class 2) reported higher social support and lower self-esteem; adolescents with co-occurring problems for social media use and gaming (Class 3) had higher internalizing symptoms, higher sensation seeking and higher social anxiety; and adolescents with co-occurring problems of disordered gambling with problematic social media use (Class 4) had higher internalizing symptoms, lower social support and lower self-esteem. The ‘non-problematic behavior’ class (Class 1) had the lowest levels of internalizing psychopathological symptoms, loneliness, and social anxiety symptoms. Different psychological risk factors in the co-occurrence of problematic gambling, problematic social media use, and problematic gaming among adolescents were found that could help to identify adolescents who are vulnerable to more than one addictive behavior. More specialized prevention as well as treatment programs should be developed for these different types of addictive behavior.

Keywords: behavioral addictions, gaming disorder; problematic social media use; gambling disorder; psychopathology; co-occurrence

1. Introduction

Adolescents are one of the most at-risk groups for addictive behaviors such as problematic internet gaming, gambling, and social media use (Delfabbro, King, & Derevensky, 2016, Griffiths & Kuss, 2017; Floros, 2018; Torres-Rodriguez et al., 2018). Moreover, there is an interactive relationship between biopsychosocial factors and addictive behaviors (Dailey et al., 2020; Skewes & Gonzalez, 2013). However, further clarification is needed concerning the distinctive risk factors for co-occurring addictive behaviors, an issue which the present study provides some insight into. Previous studies indicated that the co-occurrence of addictive behaviors is relatively prevalent (Sussman et al., 2011).

Co-occurrence of potentially addictive behaviors can have detrimental impact on affected individuals' mental health as well as on treatment services. Individuals with co-occurring addictive behaviors are likely to show increased rates of adverse mental health outcomes, and associated clinical symptoms (e.g., craving). Moreover, treatment of these individuals might be more complicated and difficult for service providers due to difficulties regarding assessment, worse prognosis (e.g., relapses), and elevated healthcare costs (Burleigh et al., 2019, Di Nicola et al., 2015). Consequently, the present study investigated the co-occurrence of three addictive behaviors (i.e., problematic social media use [PSMU], problematic gaming, and problematic gambling) because of the relatively high prevalence rates for these problematic behaviors among adolescents. There are numerous reports on the prevalence rates of these behavioral addictions worldwide; for example, Fam (2018) reviewed the prevalence rates of Internet gaming disorder (IGD) among adolescents in 16 studies. The prevalence of IGD among adolescents was 4.6% with male adolescents showing a higher prevalence rate (6.8%) than female adolescents (1.3%). In a systematic review, Calado et al. (2017) reported 0.2-12.3% of adolescents meet the criteria for

problematic gambling worldwide, notwithstanding assessment and psychometric differences. In a meta-analysis of PSMU, Cheng et al. (2021) reported pooled prevalence rate of 5% among 63 samples across 32 countries worldwide. Although many of these studies comprised convenience samples of young people, adolescents were not examined separately.

There is also evidence for comparable prevalence rates of problematic gambling and gaming among youth in non-Western cultures such as in Africa and Southeast Asia (Odame et al., 2021; Yu & Ma, 2019). In Iran (where the present study was carried out), the prevalence rate of problematic gaming was 5.9% and 2.5% for PSMU (Allah-Mousavi, 2020; Namdar Arashtanab et al., 2021). In another study, Davoudi et al. (2022) found that the prevalence of online gambling in Iran was 8.9% and where 26.6% of these online gamblers experienced moderate to severe degrees of problem gambling (Davoudi et al., 2022). Furthermore, Sussman et al. (2014) evaluated the prevalence of more than one addictive behavior as more than 50% among high school students in the U.S. In another study, the past 30-day prevalence rate of more than one addictive behavior among Russian adolescents was 32.2% (Tsai et al., 2016).

Cultural differences between non-western and western countries regarding these potentially addictive behaviors (e.g., approval of gambling by family, friends, and the government) might influence the pattern of co-occurrences of addictive behaviors. Also, similar settings of these addictive behaviors (e.g., social media platforms, internet availability, etc.) exist in the Iranian context. However, there are no previous studies addressing the co-occurrence patterns of these addictive behaviors and related risk factors in the Iranian cultural context. Therefore, the present study investigated the factors associated with the co-occurrence of PSMU, problematic gaming, and problematic gambling among Iranian adolescents.

1.1. Problematic gambling, problematic gaming, and problematic social media use as disorders

Gamblers can show different severity levels of gambling, including occasional or non-problematic gambling, at-risk gambling, and pathological gambling (Floros, 2018), the latter now renamed gambling disorder (GD) in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association [APA], 2013). Widespread internet access in many societies has significantly impacted gambling and its prevalence has increased (Auer & Griffiths, 2022; Stange et al., 2017). IGD was included as a tentative disorder in the appendix of the DSM-5 (APA, 2013), and gaming disorder was officially included in the 11th revision of the *International Classification of Diseases* (ICD-11; World Health Organization [WHO], 2019) among “disorders due to addictive behaviors”. The use of social media platforms, such as *Twitter*, *Instagram*, and *Facebook*, is widespread among adolescents because they can create individual public and/or private profiles on their social networks (Bányai et al., 2017). PSMU is a type of internet addiction, in individuals have a compulsion to use social media excessively (Van den Eijnden et al., 2016). Although, there is no official recognition of the disorder for PSMU, based on the component model of addiction (Griffiths, 2000; 2005), PSMU is characterized by the salient nature of social media use in the affected individual’s life (e.g., total preoccupation, constant craving), the use of social media as a means for mood modification, increasing tolerance (i.e., increasing use of social media over time), withdrawal symptoms when unable to use social media, interpersonal and intrapersonal conflicts due to social media use, and relapse (i.e., returning to using social media problematically after a period of abstinence).

1.2. Co-occurrence of problematic gaming, problematic social media use, and problematic gambling

Studies have shown that individuals sometimes engage in more than one behavioral addiction (Martin et al., 2014; Walther et al., 2012). Moreover, previous studies have reported positive associations and co-occurrences between problematic gaming, PSMU, and problematic gambling (Burleigh et al., 2020; Kotyuk et al., 2020; Marmet et al., 2019). Co-occurrence of problematic gaming, PSMU, and problematic gambling occurs for a variety of reasons. For example, using maladaptive coping strategies, such as emotional avoidance and intrusive thoughts, have a key role in the co-occurrence of addictive behaviors (Burleigh et al., 2019). In fact, similar motivational mechanisms can be shared between these addictive behaviors, such as using a particular behavior to reinforce a positive feeling or to avoid or reduce a negative one (Deleuze et al., 2015).

There is also overlap between the neurological theories concerning these behavioral addictions (Blaszczynski & Nower, 2002; Goudriaan et al., 2004; Wei et al., 2017; Dong & Potenza, 2014). The neurological basis of the development and maintenance of addictive behavior can be summarized as the development of imbalance between increasing limbic/reward structures and decreasing situation-specific inhibitory control over the urges of behavior (Brand et al., 2019). Furthermore, when individuals become involved in two or more addictive behaviors, a reciprocal cycle may occur where mutual intensification arises between them (Burleigh et al., 2019). Finally, some personality traits have also been associated with the co-occurrence of addictive behaviors. For example, Walther et al. (2012) reported that individuals with gambling disorder and gaming disorder showed similar personality characteristics, such as high impulsivity which may explain the co-occurrence of them. Other studies have also highlighted the similarities in personality traits among different addictive behaviors (e.g., Andreassen et al., 2013)

The present study explores subgroups of adolescents and whether there are different profiles and patterns in terms of co-occurring severity levels of problematic gambling, PSMU, and problematic gaming. Person-oriented analytical approaches, such as latent profile analysis or cluster analysis are suitable in identifying such profiles. However, there are only a few studies that have examined the co-occurrence of different addictive behaviors with similar approach to the present study (e.g., Atroszko et al., 2021; Charzyńska et al., 2021; Deleuze et al., 2015; Konkoly-Thege et al., 2016). However, these studies did not investigate the specific patterns on the co-occurrence between PSMU, problematic gaming and problematic gambling but focused on a larger set of addictive behaviors, which may have impeded the capture of more accurate and specific patterns of the co-occurrence between PSMU, problematic gambling and gaming. Also, to the best of the present authors' knowledge, there are no previous studies concerning the co-occurrence of addictive behaviors in Iranian culture because the aforementioned studies were all conducted using samples from Europe or North America typically comprising samples of university students. Therefore, the present study adds to the current understanding and cross-cultural generalizability on the association between PSMU, problematic gaming, and gambling by examining the co-occurrence of these potentially addictive behaviors among Iranian adolescents.

1.4. Similar risk factors in problematic gaming, problematic social media use, and problematic gambling

Problematic gaming, PSMU, and problematic gambling also share similar psychosocial risk factors. The present study examines the possible role of sensation seeking, self-esteem, social support, loneliness, internalizing psychopathological symptoms, social anxiety, and ADHD on the co-occurring profiles of problematic gaming and gambling, and PSMU. In the Interaction of Person-Affect-Cognition-Execution (I-PACE) model, Brand et al. (2019) indicated that specific

biopsychological characteristics such as personality constructs can make individuals vulnerable to specific addictive behaviors. For example, sensation seeking can be conceptualized as the trait that is indicated by the need for novel, complex, and intense experiences (Zuckerman, 1990). Adolescents with higher sensation seeking have higher severity levels of gambling (Tani, Ponti, & Ghinassi, 2020). A recent systematic review showed that sensation seeking as a personality trait is a risk factor for IGD (Şalvarlı & Griffiths, 2021). Sensation seeking has also been observed to be associated with PSMU (Pawar & Shah, 2019).

According to Rosenberg (1965) self-esteem is defined as an individual's positive or negative attitude about themselves and their overall evaluation of their own thoughts and feelings towards themselves. Low self-esteem is considered a predisposing factor in addictive behaviors (Wang et al., 2018; Yucens & Uzer, 2018). Moreover, there is empirical evidence concerning the negative association between self-esteem and PSMU (Andreassen et al., 2017), problematic gaming (Beard et al., 2017), and problematic gambling (Choi & Kim, 2021; Kaare, Mottus & Konstabel, 2009).

Social support and loneliness are among the psychosocial concepts that have received considerable attention in the addiction field (Esen & Gündoğdu, 2010; Tudorel et al., 2018). According to the literature, many studies have indicated that low social support and high loneliness is associated with problematic gaming, PSMU, and problematic gambling (Akbari et al., 2021; Savolainian et al., 2020, Sirona et al., 2019; Zhang et al., 2019).

Problematic gaming, PSMU, and problematic gambling also share similar psychopathological risk characteristics. For example, there is a high comorbidity between psychological distress (depression, anxiety and/or depression) and (i) problematic gaming (Andreassen et al., 2017; Matar Boumosleh & Jaalouk, 2017), (ii) gambling disorder (Fazeli et al.,

2020), and PSMU (Arrivillaga, Rey, & Extremera, 2021). Furthermore, there is a positive association between social anxiety and (i) problematic gaming, (ii) PSMU, and (iii) problematic gambling (Baltaci, 2019; Marino et al., 2020; Wong et al., 2013). Moreover, many studies have emphasized the role of ADHD in addictive behaviors, showing that individuals with ADHD may develop problematic gaming, PSMU or problematic gambling (Cabelguen et al., 2021; Groen et al., 2013; Han et al., 2021; Settanni et al., 2018). In sum, there is a high interaction between psychopathological and psychosocial factors in the acquisition, development and maintenance of problematic gaming, problematic gambling, and PSMU, and that further elaboration with regard to different patterns of comorbidity between them is needed. Therefore, due to the lack of studies regarding different co-occurrence profiles of problematic gaming, PSMU, and problematic gambling and factors contributing to these profiles, the present study was carried out.

1.5. Aim of the present study

Although there are previous studies that have examined the patterns of co-occurrence between behavioral addictions with person-centered analytical approaches, they did not specifically focus on the co-occurrence between PSMU, problematic gambling, and gaming. The present study attempted to get more accurate view of the psychosocial, psychopathological, and personality factors contributing to the co-occurrence of these three behavioral addictions in a country from a non-Western culture (i.e., Iran). As aforementioned, these factors might constitute a distinct risk for PSMU, problematic gambling, and problematic gaming. Moreover, the prevalence rates of the co-occurrence of these behaviors are quite high. Therefore, there is a need to identify which factors might contribute to the patterns of co-occurrence. The present study aimed to (i) identify subgroups of adolescents with distinct co-occurrence patterns of PSMU, problematic gambling, and problematic gaming, and (ii) examine psychopathological factors

(internalizing symptoms, ADHD, social anxiety), personality factors (self-esteem and sensation-seeking) and psychosocial factors (social support and loneliness) contributing to the different co-occurrence profiles. The findings of the present study contribute to enhancing the existing knowledge on the co-occurrence between these addictive behaviors by examining them in a new cultural context (i.e., Iran).

2. Methods

2.1. Participants

The study was conducted between 22 September 2021 and 20 October 2021 and it recruited a sample of 2390 Iranian adolescents (835 males and 1555 females) from Tehran, Iran, aged between 13 and 18 years ($M = 16.01$ years, $SD = 1.38$). In term of education level, 145 were seventh grade, 202 were eighth grade, 645 were first secondary grade, 752 were second secondary grade, 252 were third secondary grade, 233 were fourth secondary grade, and 161 were first year undergraduates. In terms of number of hours spent using the internet on a typical day, 132 used it less than 2 hours (5.5%), 589 used it 2 to 4 hours (24.6%), 750 used it 4 to 6 hours (31.4%), 509 used it 6 to 8 hours (21.3%), and 410 used it more than 8 hours (17.2%). In terms of the number of hours spent using social media on a typical day, 203 used it less than 2 hours (8.5%), 615 used it 2 to 4 hours (25.7%), 692 used it 4 to 6 hours (29%), 399 used it 6 to 8 hours (16.7%), and 481 used it more than 8 hours (20.1%). Finally, the number of hours spent gambling on a typical day, 2236 gambled less than 2 hours (93.5%), 115 gambled 2 to 4 hours (4.8%), 20 gambled 4 to 6 hours (0.8%), 13 gambled 6 to 8 hours (0.5%), and six gambled more than 8 hours (0.2%).

2.2. Measures

2.2.1. Socio-demographics

The survey asked for general demographic information including age, gender, and school grade.

2.2.2. *Depression, Anxiety, and Stress Scale-21 (DASS-21)*

The 21-item DASS-21 (Lovibond & Lovibond, 1995; Persian version: Asghari et al., 2008; Samani & Jokar, 2009) comprising three self-report subscales was used to assess anxiety, depression, and stress (seven items each). Items (e.g., “*I felt that life was meaningless*”) are rated on a four-point scale from 0 (*did not apply to me at all*) to 3 (*applied to me very much, or most of the time*). A higher score indicates higher anxiety, depression or stress. In the present study a total scale score on the DASS-21 was calculated to provide an overall internalizing psychopathological symptom level. This is in line with previous findings which have reported a unidimensional latent structure for the scale (Lee et al., 2019). The Cronbach alpha of the total DASS-21 in the present study was 0.94.

2.2.3. *Multidimensional Scale of Perceived Social Support (MSSPS)*

The 12-item MSSPS (Zemit et al., 1988; Persian version: Salimi et al., 2009) was used to assess perceived social support by family, friends, and significant others in personal life. Items (e.g., “*My family really tries to help me*”) are rated on a seven-point scale from 1 (*very strongly disagree*) to 7 (*very strongly agree*). The scale score is calculated by adding all the items together and dividing by 12. A higher score indicates greater perceived support from others. The Cronbach alpha of the total MSSPS in the present study was 0.91.

2.2.4. *Social Anxiety Scale for Adolescents (SAS-A) Short-Form (Nelemans et al., 2019)*

The 12-item Short-Form SAS-A (Nelemans et al., 2019; Original version: La Greca & Lopez, 1998) was used to assess social anxiety. The SAS-A comprises three subscales with four items in each subscale: (i) Social Avoidance and Distress-General, (ii) Fear of Negative Evaluation

and (iii) Social Avoidance and Distress-New. Items (e.g., “*I worry about what others think of me*”) are rated on a five-point scale from 1 (*not at all*) to 5 (*all the time*). A higher score indicates higher levels of social anxiety. Due to the lack of Persian version of SAS-A, and following international guidelines (Beaton et al., 2000), bilingual authors and psychologists translated the items into Persian, then two other psychologists, back-translated items into the original language. After comparing with the original version of the scale, the result was satisfactory and did not need to be revised. The Persian SAS-A was then piloted with 113 participants (mean age = 15.4 years \pm 1.97 years, males=54%), and after receiving feedback and reviewing the comments concerning fluency and clarity of the translated version, the final version was ready. The present study used the total scale score only. The Cronbach alpha of the total SAS-A in the present study was as 0.92.

2.2.5. *The Brief Sensation Seeking Scale (BSSS)*

The eight-item BSSS (Hoyle et al., 2002) – derived from the Zuckerman et al.’s Sensation Seeking Scale (1964) – was used to assess sensation seeking behaviors. The scale comprises four subscales (experience seeking, boredom susceptibility, thrill and adventure seeking, and disinhibition) with two items each. Items (e.g., “*I would like to explore strange places*”) are rated on a five-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly disagree*). A higher score indicates greater sensation seeking. Due to the lack of Persian version of the BSSS, the Persian version was developed following the same process outlined above. The present study used the total scale score only. The Cronbach alpha of the total BSSS in the present study was 0.76.

2.2.6. *Short Form of the UCLA Loneliness Scale*

The three-item short form of UCLA Loneliness Scale (Hughes et al., 2004) was used to assess loneliness. Items (e.g., “*I feel isolated from other*”) are rated on a three-point scale ranging from 1 (*hardly ever*) to 3 (often). A higher score indicates a greater level of loneliness. Due to the

lack of Persian version of UCLA Loneliness Scale, the Persian version was developed following the same process outlined above. The present study used the total scale score only. The Cronbach alpha of the UCLA Loneliness Scale in the present study was 0.79.

2.2.7. Rosenberg Self-Esteem Scale (RSES)

The 10-item RSES (Rosenberg, 1965; Persian version: Joshanloo & Ghaedi, 2008) was used to assess self-esteem (five positively and five negatively worded questions). Items (e.g., “*I take a positive attitude toward myself*”) are rated on a four-point scale ranging from 0 (*strongly disagree*) to 3 (*strongly agree*). A higher score indicates greater global self-esteem. In the present study to shorten the survey, just the five positively worded items of the original scale were used. The Cronbach alpha of the RSES in the present study was 0.91.

2.2.8. Strengths and Difficulties Questionnaire (SDQ)

The 25-item SDQ (Muris, Meesters, & van den Berg., 2003; Persian version: Ghanizadeh et al., 2007) was used to assess problems related to psychiatric disorders among children and 11 to 17 years old. The questionnaire consists of 25 questions and the degree of agreement with each is based on Items (e.g., “*I am restless, I cannot stay still for long*”) are rated on a three-point scale ranging from 0 (*never*) to 2 (*often*). A higher score indicates greater psychopathology. In the present study only one subscale of the SDQ was used, the five-item Hyperactivity-Inattention (H-I) subscale which assesses ADHD symptoms. The Cronbach’s alpha of the H-I subscale in the present study was 0.63.

2.2.9. Internet Gaming Disorder Test (IGDT-10)

The Ten-Item IGDT-10 (Király et al., 2015; Persian version: Király et al., 2019) was used to assess the symptoms of IGD. Items (e.g., “*Have you risk or lost a significant relationship because of gaming?*”) are rated on a three-point scale from 0 (*never*) to 1 (*often*). The “often”

responses indicate the presence of gaming disorder criteria. For Items 9 and 10, an answer of ‘often’ to both items only scores one point, so the total score ranges between 1 and 9. The presence of at least five criteria (rated ‘often’) indicates risk of gaming disorder. The Cronbach alpha of the IGDT-10 in the present study was 0.90.

2.2.10. Problem Gambling Severity Index (PGSI)

The nine-item PGSI (Ferris & Wynne, 2001; Persian version: Griffiths & Nazari, 2021) was used to assess problem gambling. Items (e.g., “*Have you borrowed money or sold anything to get money to gamble?*”) are rated on a four-point scale from 0 (*never*) to 3 (*almost always*). The total score is used for specifying the level of gambling risk: non-problem gambling (0), low-risk gambling (1-2), moderate-risk gambling (3-7), and problem gambling (8 or more). The Cronbach’s alpha of the PGSI in the present study was 0.91.

2.2.11. The Bergen Social Media Addiction Scale (BSMAS)

The six-item BSMAS (Andreassen et al., 2016; Persian version: (Lin et al., 2017) was used to assess problematic social media use. Items (e.g., “*In the last 12 months, I have Spent a lot of time thinking about the social media platforms or planned use of them*”) are rated on a five-point scale from 1 (*very rarely*) to 5 (*very often*). The overall score of the participants in this scale is between 6 and 30, and a score above 19 indicates a high risk of social media addiction (Bányai et al., 2017). The Cronbach alpha of the BSMAS in the present study was 0.76.

2.3. Procedure

A total sample of 2390 Iranian adolescents (residing in the city of Tehran) were recruited via convenience sampling. The inclusion criteria were being (i) a minimum age of 13 years and a maximum age of 18 years, and (ii) fluent in Persian. Participants were recruited using advertisements on social networks related to gaming, gambling, and social media. After the

participants voluntarily and anonymously responded to participate in the study, parental consent was also requested. The first page was for the child's parent(s) or guardian to be fully informed regarding the questions and purpose of the study. If the child's parent(s) or guardian agreed, then participants were asked to complete the survey at home without anyone else around them. The study was approved by the Ethics Committee of Kharazmi University of Tehran, and adhered to the Helsinki Declaration.

2.4. Statistical analyses

First, as a preliminary step, confirmatory factor analyses (CFAs) were performed to test the model fit of the one-factor structures of the PGSI, IGDT-10 and BSMAS. The Weighted Least Squares Means and Variances (WLSMV) adjusted estimation method was used as the items of these scales were handled as ordered categorical variables. Multiple statistical indices were considered to assess the level of model fit. In the cases of the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI), values ≥ 0.900 and ≥ 0.950 indicated adequate and optimal levels of model, respectively. For the Root Mean Square Error of Approximation (RMSEA) values ≤ 0.080 and ≤ 0.050 suggested adequate and optimal levels of model fit, respectively.

Next, latent profile analysis (LPA) was conducted to identify distinct subgroups with different levels of problematic gambling, problematic social media use, and problematic gaming. Indicator variables of the LPA were the standardized factor scores of the one-factor models of the PGSI, the IGDT-10 and the BSMAS. Therefore, the variables' mean and standard deviation were 0 and 1, respectively. Models with increasing numbers of latent classes were examined in consecutive steps. For example, first, the 1-class model was specified and then the 2-class model was fitted to the data. Multiple statistical indices were considered to compare the latent class models with each other. Lower levels of the Akaike Information Criterion (AIC), the Bayesian

Information Criterion (BIC) and the Sample Size Adjusted Bayesian Information Criterion (SSA-BIC) indicated more optimal model fit for a given latent class model compared with another one. The best fitting latent class model was selection primarily based on the result of the Lo-Mendel-Rubin adjusted likelihood ratio Test (LMRT). Significant results ($p < 0.05$) of the LMRT for a given latent class model (with n number of latent classes) indicated more optimal classification solution compared with a more parsimonious latent class model (with $n-1$ number of latent classes). Finally, higher levels on the Entropy index denoted higher classification accuracy.

The identified latent classes were interpreted based on two sources. First, means on the standardized factor scores of the PGSI, IGD-10 and BSMAS were considered. However, the factor scores *per se* did not provide indication whether individuals within a latent class show risk for problematic gambling, problematic social media use and/or gaming disorder. Therefore, the latent classes were also described and compared by the within-class proportions of the risk for problematic gambling, problematic social media use, and gaming disorder. Odds ratios (ORs) with 95% confidence intervals (CI) were calculated to compare the latent classes.

Finally, based on the best fitting model, the retained latent classes were compared in terms of psychological and psychosocial variables. First, the Bolck-Croon-Hagenaars (BCH) method was used to compare the latent classes separately on the variables assessing internalizing psychopathological symptoms, loneliness, social anxiety symptoms, ADHD symptoms, sensation seeking, social support, and self-esteem (Asparouhov & Muthen, 2014). Next, multinomial logistic regression was performed by using the R3Step method (Asparouhov & Muthen, 2013). The following predictor variables were included in the regression model: age, gender, internalizing psychopathological symptoms, loneliness, social anxiety symptoms, ADHD symptoms, sensation

seeking, social support, and self-esteem. The Mplus 8.0 statistical software was used for the analyses (Muthén & Muthén, 2017).

3. Results

3.1. Preliminary analyses

With respect to the cut-off points of the BSMAS and IGDT-10, 1039 participants showed a risk for PSMU (43.47%), and 143 participants showed a risk for problematic gaming (5.98%). Also, according to a risk-categories for the PGSI, there were 2143 participants with non-problematic gambling (89.6%), 41 participants with low problematic gambling (1.7%), 117 participants with moderate gambling problem (4.8%), and 58 participants with severe gambling problem (2.4%).

The one-factor model of the PGSI presented optimal levels of model fit ($\chi^2[27]=190.34$; $p<0.001$; RMSEA [90% CI]=0.050 [0.044-0.057]; CFI=0.994; TLI=0.992). All items had very strong, positive and significant relationships with the latent factor ($\lambda=0.92-0.97$; all p -values <0.001). Therefore, very high internal consistency was found for the scale ($\omega=0.95$).

In the case of the IGDT-10, moderate (i.e., RMSEA) and optimal (i.e., CFI, TLI) levels of model fit were demonstrated for the one-factor model ($\chi^2[35]=486.19$; $p<0.001$; RMSEA [90% CI]=0.073 [0.068-0.079]; CFI=0.980; TLI=0.974). All factor loadings were strong, positive and significant ($\lambda=0.75-0.89$; all p -values <0.001). The latent factor of problematic gaming presented very high internal consistency ($\omega=0.95$).

Finally, the one-factor model of the BSMAS was characterized by mixed levels of model fit. The CFI and the TLI indicated optimal and adequate levels of model fit, respectively. However, the RMSEA suggested insufficient model fit ($\chi^2[9]=281.94$; $p<0.001$; RMSEA [90% CI]=0.113 [0.102-0.124]; CFI=0.956; TLI=0.926). Overall, the model fit of the one-factor model was

considered acceptable as the RMSEA can suggest below-adequate model fit for models with low degrees of freedom (Kenny et al., 2015). All items of the BSMAS had moderate-strong, positive and significant associations with the latent factor ($\lambda=0.43-0.72$; all $p<0.001$) in addition to the high internal consistency of the problematic social media use factor ($\omega=0.80$).

3.2.Latent profile analysis (LPA)

Model fit indices of the latent class models are shown in Table 1. Models with 1 to 5 latent classes were tested. The 5-class model presented the most optimal levels of model fit based on the AIC, BIC and SSA-BIC. However, the non-significant result of the LMRT for this solution indicated that the 5-class model did not significantly contribute to a better classification solution compared with the 4-class model. Therefore, the more parsimonious 4-class model was retained for further analyses.

Figure 1 presents the profile characteristics of the latent classes. Members of the first latent class ('non-problematic behavior'; $N=1766$; 73.89%) presented moderately low levels of problematic gambling, problematic social media use, and gaming disorder. The second latent class ('problematic gambling', $N=183$; 7.66%) was characterized by very high levels of problematic gambling and average levels of problematic social media use and gaming disorder. The third latent class ('problematic social media use with gaming disorder'; $N=407$; 17.03%) comprised individuals with moderately low levels of problematic gambling, moderately high levels of problematic social media use and very high levels of gaming disorder. Finally, members of the fourth latent class ('disordered gambling with problematic social media use'; $N=34$; 1.42%) showed very high levels of problematic gambling and moderately high levels of problematic social media use and gaming disorder. The average latent class probabilities for the most likely latent class memberships were 0.94, 1.00, 0.84 and 1.00, respectively.

3.3. Cross-validation of the latent classes

The retained latent classes were also described and compared in terms of the risk for problematic gambling, problematic social media use, and gaming disorder. Table 2 shows within-class proportions for the presence of these problematic behaviors. In the ‘non-problematic behavior’ and the ‘problematic social media use with gaming disorder’ classes, all participants were non-problematic gamblers based on the PGSI. The majority of the members of the ‘problematic gambling’ class were at the moderate gambling problems category, whereas all individuals of the ‘disordered gambling with problematic social media use and gaming disorder’ class showed severe gambling problems as assessed using the PGSI. Statistical comparison of the latent classes was not possible due to zero cell counts.

In the case of problematic social media use, the ‘problematic social media use with gaming disorder’ and the ‘disordered gambling with problematic social media’ classes presented the highest prevalence rates for the risk of problematic social media use as assessed using the BSMAS. Lower within-class proportions for problematic social media use were demonstrated for the ‘non-problematic behavior’ and the ‘problematic gambling’ classes. A non-significant difference was found between the latter two classes in the risk for problematic social media use. Compared to the ‘non-problematic behavior’ class, significantly higher proportions of the ‘problematic social media use with gaming disorder’ and the ‘disordered gambling with problematic social media use’ classes presented risk for problematic social media use.

None of the individuals in the ‘non-problematic behavior’ class showed risk for gaming disorder, whereas only low proportions of the ‘problematic gambling’ and ‘disordered gambling with problematic social media use’ classes were characterized by the presence of risk for gaming disorder as assessed using the IGDT-10. That is, the moderately high levels on the standardized

factor score of the IGDT was associated with low levels for the risk of gambling disorder in the ‘disordered gambling with problematic social media use’ class. The ‘problematic social media use with gaming disorder’ class showed the highest proportion of individuals with a risk for gaming disorder as assessed using the IGDT-10. A non-significant difference was found between the ‘problematic gambling’ and the ‘disordered gambling with problematic social media use’ classes. Compared to the ‘problematic gambling’ class, significantly higher proportion of the ‘problematic social media use with gaming disorder’ class presented risk for gambling disorder.

3.4. Comparison of the latent classes in terms of psychological and psychosocial variables

Comparisons between the latent classes in terms of psychological and psychosocial variables are shown in Table 3. Significant overall differences were found in all variables between the latent classes. The classes of ‘problematic social media use with gaming disorder’ and ‘disordered gambling with problematic social media use’ had significantly higher levels of internalizing psychopathological symptoms, loneliness, and social anxiety symptoms compared to the ‘non-problematic behavior’ and ‘problematic gambling’ classes. Members of the ‘non-problematic behavior’ class had the significantly lowest levels of ADHD symptoms, whereas individuals in the ‘problematic social media use with gaming disorder’ and the ‘disordered gambling with problematic social media use’ classes presented significantly the highest rates of ADHD symptoms. The ‘problematic social media use with gaming disorder’ class was characterized by significantly higher levels of sensation seeking compared to the ‘non-problematic behavior’ class and the ‘disordered gambling with problematic social media use’ class. Significant differences were found between the latent classes in each post-hoc test for social support and self-esteem. The levels of social support increased in the following order of the latent classes: ‘disordered gambling with problematic social media use’, ‘problematic social media use with

gaming disorder', 'non-problematic behavior' and 'problematic gambling'. The levels of self-esteem increased in the following order of the latent classes: 'disordered gambling with problematic social media use', 'problematic social media use with gaming disorder', 'problematic gambling' and 'non-problematic behavior'.

Results of the multinomial logistic regression model are presented in Table 4. The reference category was the 'non-problematic behavior' class. Lower age and self-esteem as well as higher rates of ADHD symptoms and social support were significantly associated with higher odds for being a member of the 'problematic gambling' class, compared to the 'non-problematic behavior' class. The significant effects of loneliness and social anxiety symptoms were considered as statistical artefacts because the differences between the groups were not significant in the pairwise comparisons (Table 3). Male gender, higher levels of internalizing symptoms, and social anxiety symptoms were significantly and positively associated with the membership of the 'problematic social media use with gaming disorder' class, compared to the 'non-problematic behavior' class. Finally, lower levels of age, social support, and self-esteem and higher levels of internalizing psychopathological symptoms significantly predicted higher odds for the 'disordered gambling with problematic social media use' class membership, compared to the 'non-problematic behavior' class.

4. Discussion

The present study compared the psychological risk factor profiles of subgroups with distinct patterns of co-occurrence in problematic gambling, PSMU, and gaming disorder among Iranian adolescents. The analysis discriminated four latent classes: (i) the 'non-problematic behavior' class, (ii) the 'problematic gambling' class, (iii) the 'problematic social media use with gaming disorder' class, and (iv) the 'disordered gambling with problematic social media use' class.

Consequently, two classes showed co-occurrence of two potentially addictive behaviors: in Classes 3 and 4, high PSMU co-occurred with gaming disorder and problematic gambling, respectively. To the best of the authors' knowledge, previous studies using person-oriented analytical approaches have not previously reported these patterns of co-occurrence. However, it is important to note that the present findings are not directly comparable with previous studies because they did not investigate the co-occurrence of PSMU, problematic gambling, and gaming disorder specifically and focused on the co-occurrence of a larger set of addictive behaviors (e.g., Atroszko et al., 2021; Charzyńska et al., 2021; Deleuze et al., 2015; Konkoly-Thege et al., 2016). However, there are review studies which have reported the co-occurrence of these addictive behaviors (e.g., Burleigh et al, 2019; Delfabbro & King, 2020).

According to the results, there were high levels of co-occurrence between PSMU and gaming disorder, and between PSMU and problematic gambling, but not between gaming disorder and problematic gambling. One possible explanation for these findings is that social media platforms are more highly available and use of them is more socially acceptable in comparison to gambling and gaming (Villanti et al., 2017). Another explanation is related with the nature of these behaviors. Gambling and gaming are more intensive behaviors and they are more time consuming and more engaging compared to social media use. Therefore, their co-occurrence with each other is likely to be less common because of how much time they consume, whereas social media use is less intensive and the platforms might be used by problematic gamblers and problematic gamers to create online communities. Gambling and gaming opportunities are presented on social media platforms in the form of advertisements or announcements as well as offering direct opportunities to play with games (Gainsbury et al., 2015) which means that social media might act as a supplementary component of problematic gambling or problematic gaming behavior. More

specifically, the possible explanation for the co-occurrence of these behaviors is that social networking sites are also platforms in which individuals can also engage in activities such as gaming and gambling (Griffiths, 2012, 2015). In the same way that the internet is a medium in which many different activities can be carried out, social networking sites like platforms like *Facebook* are also websites in which many different activities can be engaged in including gaming (e.g., *Farmville*), playing gambling games with virtual money (e.g., *Slotzmania*, *Texas Hold-em Poker*), and gambling with real money (e.g., *Bingo Friendly*) (Griffiths et al., 2014).

In a systematic literature review, Gioia et al. (2022) reported that individuals having social anxiety difficulties are more vulnerable to become addicted to gaming or developing problematic gaming compared to individuals who did not. Therefore, their use of social media is possibly for communicating with their gaming peers and gaming purposes, while the ‘problematic gambling’ class might use social media or gamble just to alleviate their adverse emotions. It is also possible that gambling acts as a socializing platform for these adolescents and is a form of communication with their friends (Sirola et al., 2018). Also, the construct of PSMU severity in the present study might represent a general (non-specific) symptomatic severity level for social media use (in a similar way like problematic internet use). This general assessment approach might increase the possibility to identify co-occurrence profiles with high PSMU, compared to a social media platform-specific approach (e.g., specifically assessing problematic *Instagram* or *TikTok* use). Another explanation for the co-occurrences between high PSMU and high problem gambling or gaming is that the prevalence of risk for PSMU was considerably higher than the prevalence of risk for problematic gaming and gambling. Overall, there was a higher chance to identify classes which simultaneously show high levels of PSMU and problem gaming or gambling. In line with

this, the absence of a co-occurrence profile of high problem gaming and gambling can be accounted for the relatively few adolescents with high problem levels on these behaviors.

According to the multivariate analysis, lower age, lower self-esteem, higher ADHD symptoms and higher social support were significantly associated with higher odds for being a member of the ‘problematic gambling’ class, compared to the ‘non-problematic behavior’ class. Some previous studies have reported similar results in problematic gambling regarding lower age (Sacco et al., 2011; Savvidou et al., 2017), ADHD (Mestre-Bach et al., 2021), self-esteem (Kaare et al., 2009; Park et al., 2019; Rogier & Velotti, 2020), and social support (Bilt et al., 2004; Oksanen et al., 2019). In terms of severity of gambling and social support, the findings of the present study are in line with some previous studies as the pairwise comparisons of the disordered gamblers (who also showed high PSMU; Class 4) reported significantly lower social support compared to problem gamblers (Class 2) (Sleczka et al., 2016; Weinstock & Petry, 2008). One possible explanation might be that by increasing the severity of the gambling over time, adolescents who were involved in severe gambling might have lost actual social support. The DSM-5 criteria for gambling disorders also indicate that these individuals might lie about their gambling behaviors and jeopardize relationships due to gambling (APA, 2013). Therefore, the concurrent problematic social media use by the disordered gambling class might be an attempt to fill this social support gap through online interactions. Another explanation might be the different coping styles used by gamblers at different severity levels. As mentioned by Sleczka et al. (2016), it was only among adolescents with higher preventive coping that perceived social support was negatively associated with problem gambling. Consequently, adolescents with more severe gambling and a proactive coping style might use gambling to alleviate their stress or other negative emotions: note that the ‘disordered gambling with PSMU’ class (Class 4) reported significantly higher internalized

symptoms compared to the ‘non-problematic behavior’ class (Class 1)’ class and the ‘problematic gambling’ class (Class 2)’. However, among adolescents with higher preventive coping, social support might act as a source to alleviate adverse emotions and stress. Although, as the present study did not assess coping styles, these speculations should be examined empirically.

A rather surprising finding that no previous study has mentioned before among adolescent samples is that the problematic gamblers (Class 2) were characterized by higher social support compared to those showing non-problematic levels of gambling, gaming, and social media use (Class 1). One possible explanation might be the higher problematic social media use risk co-occurring with problem gambling might reflect higher frequency of social media use in this class as well. Drouin et al. (2018) reported higher perceived social support among college students who used social media more frequently. Therefore, future studies might consider controlling for other covariate effects that might explain the positive association between social support and problematic gambling. Meanwhile Class 2 reported the highest degree of social support compared to other classes, and Class 4 reported the lowest. Prior studies have reported that perceived social support is inversely associated with gaming disorder (Zhang et al., 2019; Teng et al., 2020).

On the other hand, it is possible that adolescents who are gamers in Iran mostly prefer videogames that do not require online interaction due to the internet lag. Therefore, by spending so much time gaming they lose their objective real sources of social support and report lower perceived social support. However, adolescents who show both disordered gaming and PSMU might shift from their offline social sources to their online gaming community because of their social anxiety (note that the highest degree of social anxiety symptoms were reported by the ‘gaming disorder with PSMU’ class (3) which significantly differed from the problem gambling

(2) class; moreover, in the multinomial regression, social anxiety symptoms only significantly increased the odds of being a member of the ‘gaming disorder’ class).

Low self-esteem is considered as a negative evaluation of self and many studies have reported that low self-esteem is related to excessive use of social networking sites (e.g., Aydm & San, 2011; Sechi et al., 2021; Yao et al., 2014) and internet gaming (e.g., Beard et al., 2017; Scerri et al., 2019) and gambling (Kaare et al., 2009). Furthermore, the lowest self-esteem scores were in the ‘disordered gambling with problematic social media use’ class. In this class, gambling can be described as a self-defeating behavior because adolescents involved in severe gambling behavior continue to gamble despite negative consequences including losing a lot of money, increased family conflicts, and poor school performance (Kaare et al., 2009). Moreover, there is evidence that gambling severity is positively associated with self-stigma, which might affect the adolescent gamblers’ self-esteem (Hing & Russel, 2017), although more studies utilizing longitudinal or experimental designs are needed to clarify the causal relationship between gambling severity, self-stigma, and self-esteem. Furthermore, many studies have reported the role of low self-esteem in the PSMU (Anderssen et al., 2017; Kircaburun et al., 2018). As discussed by Kircaburun et al. (2018), individuals with low self-esteem, might use social media excessively to avoid face-to-face relationship difficulties and to compensate their need for real social relationships.

Another finding of the present study was that male gender, higher levels of internalizing symptoms, and social anxiety symptoms were significantly and positively associated with the membership of the ‘problematic social media use with gaming disorder’ class, compared to the ‘non-problematic behavior’ class. Internalizing psychopathological symptoms, specifically depression and social anxiety, have been reported to have positive association with PSMU in adolescence (Walker et al., 2020) as well as with gaming disorder (Männikkö et al., 2017),

unspecified internet-use disorders, and other behavioral addictions (Starcevic & Khazaal, 2017). In fact, individuals in the ‘problematic social media use with gaming disorder’ group (Class 3) might be using social media and gaming to reduce psychological discomfort. Indeed, higher degrees of psychopathological symptoms increase the risk of engaging in more than one addictive behavior (Cerniglia et al., 2019). Also, some studies have shown that higher levels of internalizing psychopathological symptoms, especially depression and anxiety, are associated specifically with the co-occurrence of gaming disorder and PSMU (Burleigh et al, 2019; Reer, Festl, & Quandt, 2021). Therefore, it can be said that individuals in the ‘non-problematic behavior’ and ‘problematic gambling’ classes use less maladaptive coping strategies because according to pairwise comparisons, these two classes reported significantly lower internalizing symptoms compared to Class 3 who reported higher levels of (i) internalizing psychopathological symptoms, (ii) loneliness, and (iii) social anxiety (Cerniglia et al., 2016). Also, high social anxiety can lead to a preference of social media and gaming to reduce perceived social risks over real situations (Caplan, 2006). In fact, individuals in the ‘problematic social media use with gaming disorder’ class might be using social media and gaming to reduce psychological discomfort and because of higher level of psychopathological symptoms they engage in more than one addictive behavior (Cerniglia et al., 2019). In other words, individuals in the ‘non-problematic behavior’ and the ‘problematic gambling’ classes might use less maladaptive coping strategies because they had lower psychopathological symptoms, less loneliness and lower social anxiety. These explanations should be considered cautiously because the present study did not examine the motivational background of each addictive behavior.

The ‘problematic social media use with gaming disorder’ class (Class 3) was characterized by significantly higher levels of sensation seeking compared to the ‘non-problematic behavior’

class (Class 1). This finding is in line with some studies (e.g., Estevez et al., 2015; Gervasi et al., 2017; Khanbabaei et al., 2022; Mehroof & Griffiths, 2010), but in contrast with some others (Del Pino-Gutiérrez et al., 2017; Fortune & Goodie, 2010). Prior studies have reported that disordered online gamers have higher sensations seeking than healthy and non-disordered gamers. For example, as mentioned by Mehroof and Griffiths (2010), videogames have a wide variety of rewards, therefore individuals who have higher novelty seeking and reward sensitivity are more likely to be involved in gaming and develop disordered gaming. As suggested by Sheldon (2012), individuals high in sensation seeking are novelty seekers who like experiencing different kinds of content and be connected to many individuals. Higher sensation seekers may become involved in both problematic gaming and PSMU, because this way they widen their experiencing possibilities and have more chances to be connected with individuals like themselves.

Finally, lower age, lower self-esteem, and lower social support as well as higher rates of internalizing psychopathological symptoms, were significantly associated with higher odds of being a member of the ‘disordered gambling with problematic social media’ class, compared to the ‘non-problematic behavior’ class. One possible explanation for the lower age among the Class 4 disordered gamblers is that previous research has reported an inverse relationship between impulsiveness and age among gamblers (Savvidou et al., 2017).

The present study has some limitations that should be noted. First, due to convenience sampling the sample is not representative of the Iranian adolescent population. Second, although the study aim was to investigate these behaviors in a non-Western culture, there are other non-Western countries where such research could be carried out. Third, the cross-sectional design meant that causal relationships between the variables could not be determined. Fourth, the use of self-report measures for data collection might have introduced various response biases (e.g.,

memory recall, social desirability), therefore the present study's findings should be interpreted with some caution. Fifth, the present study utilized a large number of scales in the survey, and this might have caused survey fatigue among some of the participants. Despite these limitations, the present study identified important risk factors in the co-occurrence of problematic gambling, PSMU, and gaming disorder among adolescents. Subsequent studies should also be carried out with other age cohorts as well as in other countries to confirm the results reported here.

The present study found that lower self-esteem, lower social support, higher sensation seeking, higher social anxiety, and internalizing symptoms may predict co-occurrence of PSMU, problematic gambling, and problematic gaming among adolescents. Probably different psychological variables in adolescence lead to co-occurrence of different addictive behaviors. The present study's findings have important practical implications for psychological and mental healthcare practitioners in developing prevention and intervention programs for gaming disorder, problematic gambling and problematic social media use, and their co-occurrence. Such programs would need to focus on improving interpersonal relationships, enhancing self-esteem, and stress management.

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Table 1: Model fit of the latent class models

Model	AIC	BIC	SSA-BIC	Entropy	LMRT	<i>p</i>
1-Class model	20359.58	20394.25	20375.19	-	-	-
2-Class model	13804.37	13862.17	13830.39	1.00	6358.85	<0.001
3-Class model	10828.16	10909.07	10864.59	1.00	2909.41	<0.001
4-Class model	10447.64	10551.66	10494.47	0.88	378.78	<0.001
5-Class model	8360.19	8487.33	8417.43	0.90	382.59	0.060

Notes: AIC: Akaike Information Criterion. BIC: Bayesian Information Criterion. SSA-BIC: Sample Size Adjusted Bayesian Information Criterion. LMRT: Lo-Mendell-Rubin Adjusted Likelihood Ratio Test.

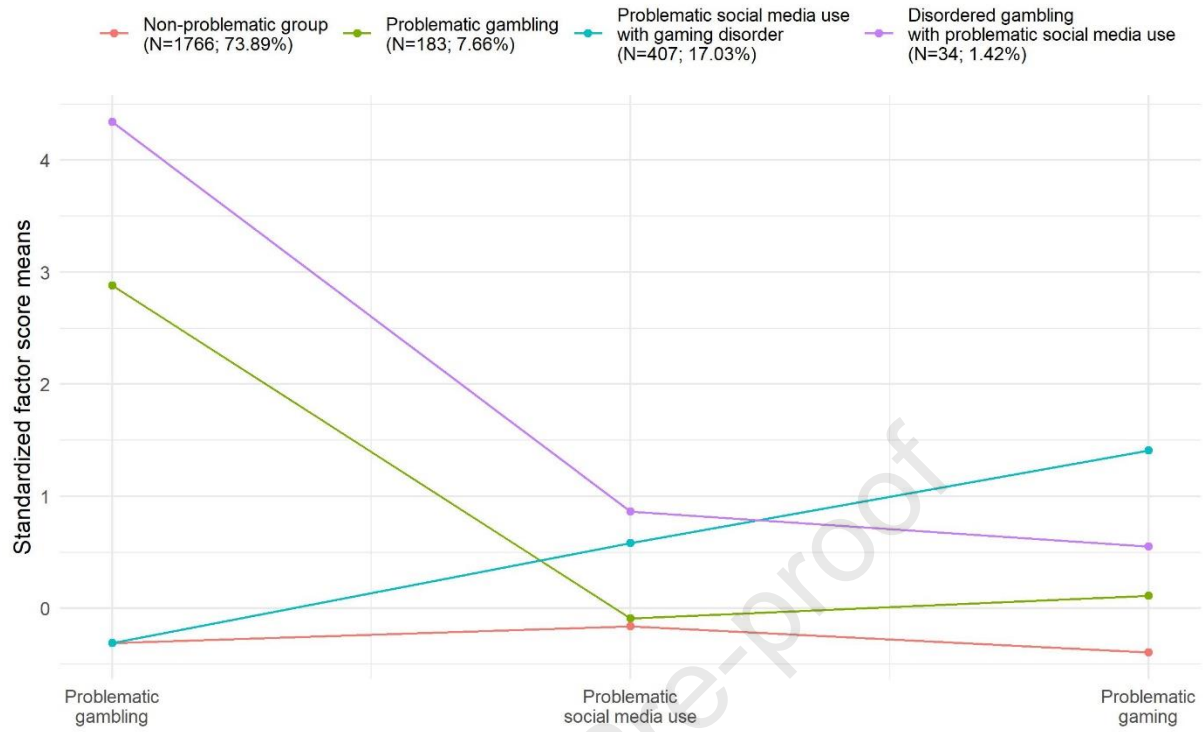


Figure 1: Profile characteristics of the latent classes

Table 2: Cross-validation of the latent classes: within-class proportions of problematic behaviors

	NPB (N=1766; 73.89%)	PG (N=183; 7.66%)	PSMU with GD (N=407; 17.03%)	DG with PSMU (N=34; 1.42%)
Risk categories of the Problem Gambling Severity Index (PGSI)¹ – N (within-class %)				
Non-problematic gamblers	1766 (100%)	0 (0%)	407 (100%)	0 (0%)
Low gambling problems	0 (0%)	41 (22.40%)	0 (0%)	0 (0%)
Moderate gambling problems	0 (0%)	118 (64.48%)	0 (0%)	0 (0%)
Severe gambling problems	0 (0%)	24 (13.11%)	0 (0%)	34 (100%)
OR [95% CI]	-.2	-.2	-.2	-.2
Risk categories of the Bergen Social Media Addiction Scale (BSMAS)³ – N (within-class %)				
No risk for problematic social media use	1130 (63.99%)	105 (57.38%)	108 (26.54%)	8 (23.53%)
Risk for problematic social media use	636 (36.01%)	78 (42.62%)	299 (73.46%)	26 (76.47%)
OR [95% CI]	Ref.	1.32 [0.97-1.80]	4.92 [3.87-6.26]***	5.77 [2.60-12.83]***
Risk categories of the 10-item Internet Gaming Disorder Test (IGDT-10)⁴ – N (within-class %)				
No risk for gaming disorder	1766 (100%)	179 (97.81%)	269 (66.09%)	31 (91.18%)
Risk for gaming disorder	0 (0%)	4 (2.19%)	138 (33.91%)	3 (8.82%)
OR [95% CI]	-.5	Ref.	22.96 [8.35-63.15]***	4.33 [0.92-20.30]

Notes: NPB=Non-problematic behavior, PG=Problematic gambling, PSMU with GD=Problematic social media use with gaming disorder, DG with PSMU=Disordered gambling with problematic social media. ¹Risk categories were defined based on the total score of the PGSI (Ferris & Wynne, 2001): (i) Non-problematic gamblers: 0 pts; (ii) Low gambling problems: 1-2 pts; (iii) Moderate gambling problems: 3-7 pts; (iv) Severe gambling problems: 8 or more pts. ²The latent were not compared statistically due to 0 cell counts in each class. ³Risk categories were defined based on the total score of the BSMAS (Bányai et al., 2017): (i) No risk for problematic social media use: 6-18 pts; (ii) Risk for problematic social media use: 19 or more pts. ⁴Risk categories were defined based on the number of gaming disorder criteria with often presence (Király et al., 2017, 2019): (i) No risk for gaming disorder: 0-4 criteria, (ii) Risk for gaming disorder: 5 or more criteria. ⁵The latent class was not included in the comparisons due to a zero cell count. OR [95% CI]: odds ratio with 95% confidence interval. Level of significance: *** $p < 0.001$. Ref.: reference category (with the lowest within-class proportion for the problematic category).

Table 3: Pairwise comparisons of the latent classes

	NPB (N=1766; 73.89%) M (S.E.)	PG (N=183; 7.66%) M (S.E.)	PSMU with GD (N=407; 17.03%) M (S.E.)	DG with PSMU (N=34; 1.42%) M (S.E.)	Overall Wald- test χ^2
Internalizing					
psychopathological symptoms	41.15 (0.34) ^a	42.25 (1.14) ^a	57.87 (0.84) ^b	60.71 (2.27) ^b	357.89***
Loneliness	5.80 (0.05) ^a	6.09 (0.15) ^a	7.30 (0.11) ^b	7.32 (0.30) ^b	157.66***
Social anxiety symptoms	31.53 (0.28) ^a	31.05 (0.85) ^a	41.10 (0.66) ^b	40.62 (1.51) ^b	183.68***
ADHD symptoms	8.45 (0.05) ^a	8.99 (0.16) ^b	10.12 (0.12) ^c	10.15 (0.27) ^c	172.20***
Sensation seeking	23.14 (0.17) ^a	23.38 (0.54) ^{a,b}	24.69 (0.43) ^b	21.59 (1.09) ^a	12.63**
Social support	56.79 (0.41) ^c	60.84 (1.35) ^d	47.69 (0.98) ^b	37.38 (2.41) ^a	135.66***
Self-esteem	16.05 (0.09) ^d	15.12 (0.28) ^c	13.46 (0.24) ^b	10.21 (0.69) ^a	152.48***

Notes: NPB=Non-problematic behavior; PG=Problematic gambling; PSMU with GD=Problematic social media use with gaming disorder; DG with PSMU=Disordered gambling with problematic social media. Values in each latent class-related columns are means (M) and standard errors (S.E.). Post-hoc tests: values which share the same superscript (a, b, c) are not significantly different at $p < 0.050$ level. Level of significance for the overall Wald-test: ** $p < 0.010$; *** $p < 0.001$.

Table 4: Multinomial logistic regression: predictive effects on latent class memberships

	PG (N=183; 7.66%)	PSMU with GD (N=407; 17.03%)	DG with PSMU (N=34; 1.42%)
	OR [95% CI]	OR [95% CI]	OR [95% CI]
Age	0.72 [0.65; 0.80]***	0.95 [0.85; 1.07]	0.76 [0.58; 0.99]*
Male gender (vs. female gender)	1.30 [0.92; 1.82]	2.11 [1.50; 2.97]***	1.85 [0.88; 3.90]
Internalizing psychopathological symptoms	0.99 [0.97; 1.00]	1.07 [1.05; 1.10]***	1.05 [1.02; 1.09]**
Loneliness	1.18 [1.07; 1.29]*** ¹	1.07 [0.95; 1.20]	0.91 [0.70; 1.18]
Social anxiety symptoms	0.97 [0.96; 0.99]** ¹	1.04 [1.02; 1.06]***	1.01 [0.97; 1.05]
ADHD symptoms	1.15 [1.06; 1.26]**	1.09 [0.99; 1.20]	1.07 [0.90; 1.28]
Sensation seeking	0.99 [0.96; 1.01]	1.03 [1.00; 1.05]	0.98 [0.93; 1.04]
Social support	1.03 [1.02; 1.05]***	0.99 [0.98; 1.01]	0.97 [0.95; 0.98]***
Self-esteem	0.87 [0.81; 0.92]***	1.03 [0.97; 1.10]	0.79 [0.72; 0.88]***

Notes: PG=Problematic gambling; PSMU with GD=Problematic social media use with gaming disorder; DG with PSMU=Disordered gambling with problematic social media. Reference category: Non-problematic behavior (N=1766; 73.89%). OR [95% CI]: odds ratio with 95% confidence interval. Level of significance: * $p < 0.050$; ** $p < 0.010$; *** $p < 0.001$. ¹The significant relationship was considered as a statistical artefact as the difference between the groups was not significant in the pairwise comparisons (see Table 3).

We have now reduced the characters to a minimum but some Highlights still are more than 85 characters. In our opinion, if we reduce more than these characters, we cannot convey the meaning. We are very grateful if you accept current form of the Highlights.

Highlights:

- Latent profile analysis produced four classes of co-occurrence patterns of problematic gaming, problematic social media use, and problematic gambling
- Adolescent problem gamblers reported higher social support and lower self-esteem
- Adolescents with co-occurring problems for social media use and gaming had higher internalizing symptoms, higher sensation seeking and higher social anxiety
- Adolescents with co-occurring problems of disordered gambling with problematic social media use had higher internalizing symptoms, lower social support and lower self-esteem