AKADÉMIAI KIADÓ

Journal of Behavioral Addictions

13 (2024) 3, 742–750

DOI:
10.1556/2006.2024.00045

FULL-LENGTH REPORT

Internet gaming disorder and risky behaviours among Czech adolescents: A nationally representative study

JAROSLAVA SUCHÁ[1*], MARTIN DOLEJŠ[2], DANIEL DOSTÁL[2], HELENA PIPOVÁ[2] and HALLEY M. PONTES[3]

[1] Department of Addictology, First Faculty of Medicine, Charles University, Czech Republic

[2] Department of Psychology, Palacký University Olomouc, Czech Republic

[3] School of Psychological Sciences, Birkbeck, University of London, United Kingdom

Received: February 10, 2024 • Revised manuscript received: May 3, 2024; June 11, 2024; July 11, 2024 • Accepted: July 30, 2024
Published online: September 12, 2024

ABSTRACT

Background and aims: The aim of the present study was to estimate the complex association between Internet Gaming Disorder (IGD), substance use, and other risky behaviours in Czech adolescents whilst providing prevalence estimates of IGD and psychometric information regarding the Czech Internet Gaming Disorder Scale–Short-Form (IGDS9-SF). *Methods:* A representative sample of 3,950 Czech adolescents was recruited through stratified random sampling in the school setting. *Results:* Disordered gamers showed frequent use of specific substances such as pharmaceuticals, methylenedioxymethamphetamine, and lysergic acid diethylamide. In contrast, non-gamers had higher prevalence of alcohol, cigarettes, sedatives and tranquillisers, and marijuana use. A logistic regression, utilising IGDS9-SF raw scores and average daily gaming time, revealed a U-shaped relationship between gaming and both alcohol and cigarette use. Additionally, conduct problems such as bullying, and risky in-game behaviours were more prevalent among disordered gamers, with the exception of forging parents' signatures. The overall prevalence of IGD was 3.62% (95% CI = [3.1%, 4.3%]), with higher rates in males (5.89%; 95% CI = [4.9%, 7.0%]) than in females (1.45%; 95% CI = [1.0%, 2.1%]). *Discussion and conclusions:* The Czech IGDS9-SF used in the present study showed adequate psychometric properties. The association between gaming and substance use behaviours may be specific and multifaceted depending on the severity of the gaming-related problems. Furthermore, disordered gamers may become more vulnerable due to a higher incidence of conduct problems, bullying (victimisation), and in-game risky behaviours such as engagement with microtransactions mechanics (e.g., loot box) within video games.

KEYWORDS

internet gaming disorder, substance use, conduct problems, risky behaviour, adolescence classification

INTRODUCTION

Gaming is rapidly growing in popularity across all age groups, becoming one of the fastest-growing segments of the entertainment industry (Research and Markets, 2018). While healthy gaming has many benefits such as improving social problem-solving in children (Yılmaz & Griffiths, 2023) and enhancing wellbeing during the COVID-19 pandemic (Türkay, Lin, Johnson, & Formosa, 2022), mixed effects have also been reported in the literature including potential addictive outcomes (Pontes, Schivinski, Kannen, & Montag, 2022). In 2013, the American Psychiatric Association (APA) defined 'Internet Gaming Disorder' (IGD) as persistent and repeated video game use causing clinical impairment and distress, characterised by meeting five out of nine criteria over 12 months. Additionally, the

*Corresponding author.
E-mail: jaroslava.sucha01@gmail.com

World Health Organization (2023) recently recognised 'Gaming Disorder' (GD) in the ICD-11, highlighting addictive-like responses to dysregulated gaming behaviours.

A higher frequency of a particular problem behaviour increases the likelihood of other problem behaviours (Jessor, 1991). Recent literature associated IGD with various types of substance use (Di Carlo et al., 2023; Perales, Maldonado, López-Quirantes, & López-Torrecillas, 2021; Van Rooij et al., 2014) and risky behaviours (Müller et al., 2015; Savci, Ercengiz, Yildiz, Griffiths, & Aysan, 2022). Skařupova, Blinka, and Tápal (2018) found that excessive gamers commonly used stimulants, while sedatives were linked to disordered gaming. Time spent gaming has been found to be higher among users of stimulants, methylenedioxymethamphetamine (MDMA), sedatives, and amphetamines. Turel and Bechara (2019) noted that moderate gamers had lower substance use, whereas excessive gamers had higher usage of alcohol, marijuana, amphetamines, sedatives, tranquillisers, and MDMA.

The relationship between gaming and conduct problems has already been researched (Richard, Fletcher, Boutin, Derevensky, & Temcheff, 2020). Brunborg, Mentzoni, and Frøyland (2014) found a link between gaming and rule-breaking behaviours in Norwegian adolescents aged 13–17 years, classifying these behaviours into serious, aggressive, and hidden problems, all significantly related to IGD.

Conduct problems such as bullying and cyberbullying have been analysed in relation to gaming (Zhao, Li, Zhou, Nie, & Zhou, 2020). Yılmaz, Yel, and Griffiths (2018) found that excessive school-aged gamers exhibited risky behaviours such as bullying, rule violations, and increased irritability. Mihara and Higuchi (2017) reported an association between IGD with higher peer problems and bullying rates, both as perpetrators and victims. Uçur and Dönmez (2022) found that playing video games significantly increases the risk of cyberbullying and the risk of being a perpetrator of bullying is significantly high among players of violent video games.

The risk components implemented in digital games include loot boxes which are high-chance factor purchases. These elements may develop gambling behaviour in gamers, as engaging in these gambling-like activities is associated with both problem gaming and problem gambling (Raneri, Montag, Rozgonjuk, Satel, & Pontes, 2022).

The current study

Adolescence is a high-risk period for developing behavioural addictions due to the significant biological, psychological, social, and environmental changes that occur, making it suitable developmental stage for studying online risk behaviours such as IGD. This is due to adolescents' high propensity for experimentation and risk-taking, termed the syndrome of risk behaviour in adolescence (Jessor, 1991). The main aim of this study is to analyse various types of risk behaviour and their interrelationships in adolescents.

We draw upon Turel and Bechara's (2019) positive displacement hypothesis, which suggests that video games may reduce the opportunity and motivation for substance use. We hypothesize that non-disordered (healthy) gaming may fulfil adolescents' reward needs, preventing them from engaging in risky activities such as substance use. Therefore, we expect higher substance use in non-gamers and disordered gamers compared to non-disordered gamers.

This study aims to extend the existing literature on IGD by examining the relationship between gaming, multiple substance use, and risk behaviours in a nationally representative sample of Czech adolescents. Addressing the limitations of previous research, this study has three primary objectives. First, it aims to assess the relationship between gaming, psychoactive substance use, and risk behaviours, focusing on whether individuals at risk for substance use and risky behaviours over various timeframes (lifetime, last 12 months, last 30 days) are also at risk for IGD. Second, it seeks to determine the prevalence of IGD. Third, it intends to investigate the psychometric properties of the Czech Internet Gaming Disorder Scale–Short-Form (IGDS9-SF) (Pontes & Griffiths, 2015).

METHODS

Participants and procedures

This study collected data from students across all 14 regions of the Czech Republic in 48 primary and secondary schools using stratified cluster random sampling to ensure the recruitment of a nationally representative sample of Czech adolescents aged between 11 and 19 years. The stratification process considered school type, year of study, and region. From each region, a proportionate number of schools representing each type was randomly selected. Within these selected schools, classes were selected and the students in these classes were invited to participate in the survey. A total of 79 schools were contacted and cooperation was established with 48 schools (61%) mentioned above, with 31 schools (39%) refusing to participate in the research. Approximately 685 (14,8%) of students contacted either refused to participate in the research, did not provide consent from a parent or legal guardian or were absent on the day of testing, therefore they did not participate in the research.

Data was collected using a paper-and-pencil method by a trained researcher in 2018. Data collection was anonymous and voluntary and both the legal guardians and adolescents had to provide informed consent prior to the data collection. In total, 3,950 participants were recruited (n_{male} = 1,940, 49.11%) with an average age of 15.73 years (SD = 1.99 years). The distribution of age was not significantly different between the sexes (Kolmogorov-Smirnov D = 0.037, p = 0.134). Further characteristics of the research sample, including the distribution by age, school type, and level of education are shown in Table 1.

Measures

Internet gaming disorder scale – short-form (IGDS9-SF). The IGDS9-SF (Pontes & Griffiths, 2015) was used to assess IGD due to its robust psychometric properties (see

Table 1. Characteristics of the research sample and percentages of each group

Sex	*n*	%
Males	1,940	49.1
Females	2,010	50.9
Age		
11	76	1.9
12	199	5.0
13	357	9.0
14	433	11.0
15	560	14.2
16	802	20.3
17	698	17.7
18	554	14.0
19	271	6.9
School type		
Primary school	900	22.8
Lower grammar school	528	13.4
Higher grammar school	1,067	27.0
Secondary school with a leaving exam	936	23.7
Vocational secondary schools	519	13.1
Levels of education		
ISCED 2	1,428	36.2
ISCED 3	2,522	63.9

Abbreviations: ISCED = International Standard Classification of Education.

de Palo et al., 2019; Stavropoulos et al., 2018). The IGDS9-SF is based on the DSM-5 criteria for IGD and assesses the severity of IGD in the last 12 months through a set of nine items that load on a single-factor solution. In the present study, the items were dichotomised (yes/no), so that the recommended cut-off score of endorsing at least five symptoms could be more easily interpreted in the estimation of prevalence rates of IGD. Respondents obtaining a score of at least five points were classed as 'disordered gamers' while those scoring less than five were classified as 'non-disordered gamers'. Participants who declared they did not play video games at all were classified as 'non-gamers'.

The psychometric properties of the Czech IGDS9-SF were also analysed in terms of factor structure, reliability, and distribution of the raw scores. The previously reported unidimensional factor structure for the IGDS9-SF was analysed with Confirmatory Factor Analysis (CFA) to further provide evidence of the scale's construct validity using the Weighted Least Squares with the Mean and Variance Adjustment (WLSMV) method, which yielded an acceptable fit for the model ($\chi^2[27] = 84.667$, CFI = 0.976, RMSEA = 0.023 [0.018; 0.029]). The reliability estimate of McDonald's Omega for ordinal data was 0.664 (Green & Yang, 2009). If a maximum of one response per item was missing, regression imputation was performed. Approximately 31 participants (0.007%) were excluded from the analyses due to the application of list-wise deletion, which was necessitated by multiple items with missing data.

Sociodemographic data and risk behaviour. Basic sociodemographic data from participants were collected (e.g., sex, age, school type, and level of education) alongside data on other variables related to four sections of risk behaviour - *substance use*, *conduct problems*, *bullying*, and *in-game risky behaviours*. Items in the *substance use* section were selectively chosen from The Scale of Risk Behaviour in Adolescents (SRBA) (Dolejš & Skopal, 2016). The areas covered were: alcohol, cigarette and drunkenness in the past 30 days; lifetime prevalence of use of pharmaceuticals (all kinds) and marijuana. Furthermore, the entire section *conduct problems* and *bullying* was drawn from this method. *Conduct problems* were operationalised as behaviours violating rules such as the following: forgery of parents' signature (lifetime prevalence), truancy (lifetime prevalence), vandalism (whether they damaged someone else's property in their life just for fun), theft (has experience with stealing something such as money or anything else in their life), problems with the police (lifetime prevalence), and self-harm (lifetime experience). *Bullying* was analysed from the victim's perspective through two questions regarding experience with rough insults from classmates and related online experience (i.e., taunts and harm) in their last 30 days. All questions were answered with a yes/no response format. These items were supplemented with self-created questions on the use of sedatives and tranquillisers, MDMA, lysergic acid diethylamide (LSD), hallucinogens, methamphetamine, cocaine, and inhalants. The following answers that could have been given were: never used; yes, in the last 30 days; yes, in the last 12 months; yes, sometime in my life. For the purpose of this research, the responses were transformed to dichotomous and were scored as follows: yes (i.e., have lifetime experience) and no (i.e., no lifetime experience).

Finally, two questions from the Questionnaire of Digital Game Playing (Suchá, Dolejš, & Pipová, 2019) were added to focus on in-game risky behaviours, specifically insults from other gamers and purchase of loot boxes. Insults from other gamers were operationalised through the lifetime experience of insults (toxic behaviour) from other gamers. The purchase of loot boxes was operationalised through microtransactions focusing on the purchase of loot boxes. Both questions, assessing the lifetime prevalence, are answered on a yes/no scale.

In all cases of the above risk behaviours, the scores for the yes responses were coded as 1 point, and the no response was coded as 0 points. Since participation was voluntary, some items had a significant amount of missing data. In the group of 11-year-olds, 55% of respondents failed to answer an item, in the case of 14-year-olds it is 10% and in the case of 19-year-olds only 2.6%. In these cases, list-wise deletion was employed and no data imputation performed.

Statistical analysis

The psychometric properties of the nine IGDS9-SF items were analysed through CFA using the *lavaan* package for R (Rosseel, 2012). The WLSMV method was used alongside the following fit indices and their recommended thresholds: Root Mean Square Error of Approximation (RMSEA) (≤0.05), Comparative Fit Index (CFI) (≥0.95) and

Standardized Root Mean Residual (SRMR) (≤0.08), for further details on the thresholds, see Hooper, Coughlan, and Mullen (2008). The reliability of the IGDS9-SF was assessed using McDonald's Omega coefficient (Green & Yang, 2009). Moreover, the prevalence of risk behaviours was compared using Pearson's chi-squared test and numeric variables with the Kruskal-Wallis test. The relationship between gaming and cigarette or alcohol use was estimated with a logistic regression. The logistic regression was performed to further assess the nature of the relationship between gaming and selected substance use. Alcohol and cigarette use were analysed in separate models. Video gaming intensity was also operationalised in two ways: 1) through IGDS9-SF raw scores (i.e., the number of IGD criteria endorsed) and 2) through the average daily time spent gaming. Consequently, four regression models were computed with the following three covariates being included in the models: sex, age, and school type. The squared value of age was also included to model the non-linear increase in the prevalence of substance use behaviours in adolescence. No weighting procedures were used to increase the representativeness of the data. All analyses were performed in the R environment (R Core Team, 2019). The data supporting the findings of this study as well as detailed results are available in an open repository at Open Science Framework (OSF), https://osf.io/6jesc/.

Ethics

All procedures performed in studies involving human participants were under the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Both participants and their legal representatives signed written informed consent forms. All participants were informed about the study's purpose and assured that the data used for the analysis were anonymous and confidential.

RESULTS

Prevalence rates of IGD

An overall IGD prevalence rate of 3.62%, 95%-CI = [3.1%, 4.3%] was found in the sample. Notably, the prevalence was higher in males (5.89%, 95%-CI = [4.9%, 7.0%]) in comparison to females (1.45%, 95%-CI = [1.0%, 2.1%]), with the highest rates of IGD being found among 12-year-old males. Accordingly, disordered gamers were slightly younger (15.56 years on average) than non-disordered gamers (16.04 years on average) (see Table 2). Furthermore, the relationship between average daily time spent gaming and age was negative and statistically significant ($r = -0.11$, $p < 0.001$). Additionally, disordered gamers spent statistically significantly more time gaming (4.85 hours a day) than non-disordered gamers (2.34 hours a day), with the overall association between IGD severity and average daily time spent gaming being relatively high ($r = 0.53$, $p < 0.001$).

Online gaming and substance use

The overall 30-day prevalence of substance use in the sample was 64.5% [62.9%, 66.0%] for alcohol use and 27.0% [25.6%, 28.5%] for cigarette smoking. Furthermore, the lifetime prevalence of other substances ranged from 1.4% (methamphetamine) to 14.0% (sedatives and tranquillisers) with the exception of marijuana, which was reported at 33.3% [31.8%, 34.8%].

To test Turel and Becharas' (2019) hypothesis of positive displacement, a logistic regression was performed. The logistic regression explored the relationship between gaming and alcohol and cigarettes, using IGDS9-SF scores and average daily time spent gaming as two operational measures of gaming manifestation. Results from all four models supported the presence of a U-shaped relationship between gaming and the consumption of alcohol and cigarettes. The quadratic term was statistically significant when describing the use of cigarettes (average daily time spent gaming: $z = 3.27$, $p = 0.001$, IGD: $z = 2.03$, $p = 0.042$), as well as the use of alcohol (average daily time spent gaming: $z = 3.62$, $p < 0.001$, IGD: $z = 3.30$, $p < 0.001$, see Fig. 1). The school type, age, and age squared were also statistically significant ($p < 0.001$). In contrast, the effect of sex was not statistically significant in any model. In general, cigarette smoking and alcohol use were used more frequently by older adolescents attending vocational secondary schools.

The lowest rates of cigarette smoking, misuse of pharmaceuticals, sedatives and tranquillisers, marijuana, MDMA, and LSD were observed among non-disordered gamers. Conversely, disordered gamers engaged more often in substance use behaviours, particularly the misuse of pharmaceuticals, MDMA, and LSD, compared to non-disordered gamers and non-gamers. However, there were no statistically significant differences between the groups in the use of hallucinogens, methamphetamine, cocaine, inhalants, or experiences of drunkenness.

Gaming and other risky behaviours

Disordered gamers experienced statistically significantly more conduct problems (i.e., truancy, thefts, vandalism, trouble with the police, and self-harm) than non-gamers, and non-disordered gamers, with the exception of forgery of parents' signature, which was more prevalent among non-gamers. Finally, bullying victimisation in the last 30 days and in-game risky behaviours were also more commonly found among disordered gamers than non-gamers and non-disordered gamers.

DISCUSSION

The aim of the present study was to estimate the prevalence of IGD and the association between risky behaviours related to conduct problems and substance use in a nationally representative sample of Czech adolescents. The results obtained indicated an overall 3.62% [3.1%, 4.3%] prevalence

Table 2. Demographics and risky behaviour differences across non-gamers, non-disordered gamers and disordered gamers

Variable	Non-gamers	Non-disordered gamers	Disordered gamers	*p*-value
Frequency	28.3%	**68.1%**	3.7%	–
Gender (female)	**80.4%**	40.9%	20.4%	<0.001
Age	**16.79**	16.04	15.56	<0.001
Average daily time spent gaming	0.00	2.34	**4.85**	<0.001
Substance use				
Alcohol[2]	**72.1%**	61.2%	61.4%	<0.001
Drunkenness[2]	17.9%	15.6%	**20.5%**	0.121
Cigarettes[2]	**31.3%**	24.8%	28.3%	<0.001
Pharmaceuticals (all kinds)[1]	18.5%	13.5%	**20.5%**	<0.001
Sedatives and tranquillizers[1]	**17.1%**	12.4%	13.6%	0.002
Marijuana[1]	**38.7%**	30.6%	35.4%	<0.001
MDMA[1]	5.3%	3.8%	**9.1%**	0.010
LSD[1]	2.6%	1.7%	**8.3%**	<0.001
Hallucinogens[1]	2.6%	**20.0%**	2.7%	0.483
Methamphetamine[1]	**2.2%**	1.1%	0.9%	0.054
Cocaine[1]	1.7%	1.5%	**1.8%**	0.927
Inhalants[1]	2.6%	2.5%	**5.5%**	0.185
Conduct problems				
Parents' signature forgery[1]	**58.4%**	46.5%	54.3%	<0.001
Truancy[1]	38.0%	28.3%	**41.7%**	<0.001
Thefts[1]	28.7%	32.9%	**44.1%**	<0.001
Vandalism[1]	16.4%	19.6%	**33.1%**	<0.001
Trouble with the police[1]	13.6%	12.9%	**22.0%**	0.017
Self-harm[1]	30.2%	27.1%	**51.2%**	<0.001
Bullying				
Insults from classmates[2]	13.5%	19.5%	**35.4%**	<0.001
Online taunts and harm[2]	5.6%	7.9%	**22.8%**	<0.001
In-game risky behaviours				
Insults from other gamers[1]	8.1%	52.2%	**82.3%**	<0.001
Purchase of loot boxes[1]	2.2%	23.9%	**51.8%**	<0.001

Abbreviations: MDMA = Methylenedioxymethamphetamine; LSD = Lysergic acid diethylamide.
Note: In numeric variables, *p*-values were obtained using the Kruskal-Wallis test. For nominal variables, a Chi-squared test with simulated *p*-values was used. The values in the non-gamers, non-disordered gamers, and disordered gamers represent the relative frequencies or mean values for each group. The highest means or frequencies are in bold.
The time frame for all measures is the following: [1] = lifetime prevalence, [2] = last 30 days.

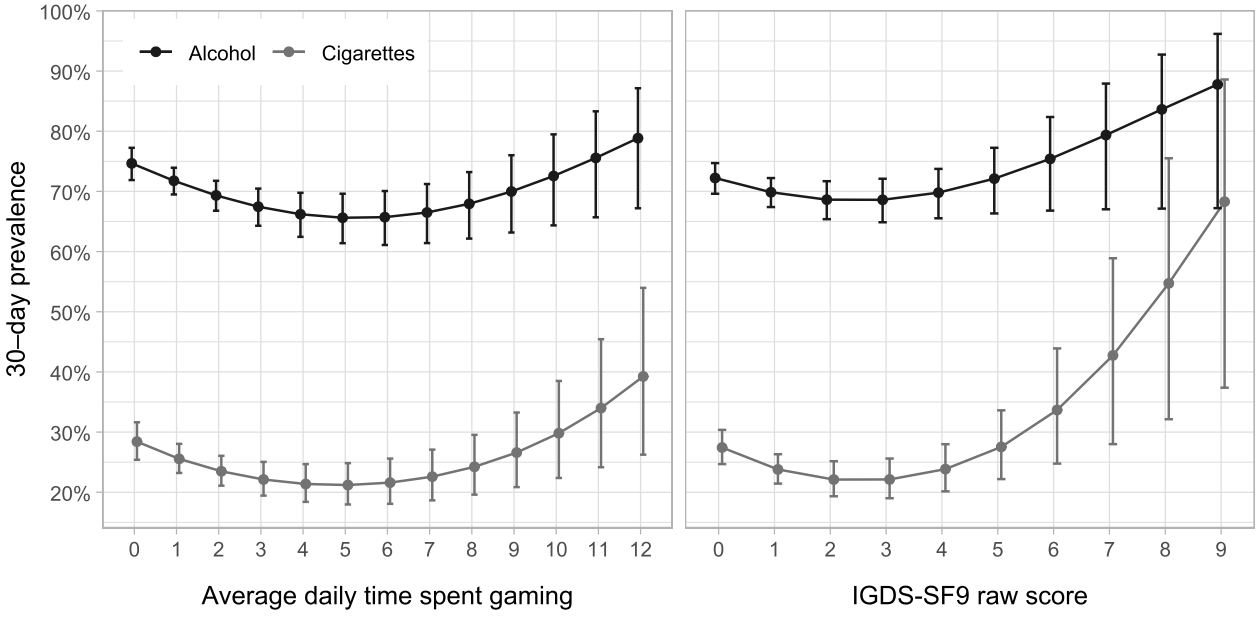

Fig. 1. Fitted values of cigarette and alcohol use 30-day prevalence in relation to gaming

of IGD among Czech adolescents. Specifically for males, the prevalence of IGD was 5.89% [4.9%, 7.0%] and for females it was 1.45% [1.0%, 2.1%]. This prevalence corresponds to the results of a large survey of Spanish adolescents (n = 41,507) aged 11–18 years (prevalence of IGD was 4.90% for boys and 1.10% for girls) (Nogueira-López, Rial-Boubeta, Guadix-García, Villanueva-Blasco, & Billieux, 2023). The overall prevalence rate was higher than the 1.6% reported among 11 to 17-year-old adolescents from seven European countries (Müller et al., 2015) and the 2.5% reported in Slovenian adolescents (12–16 years) (Pontes, Macur, & Griffiths, 2016). Despite this, the prevalence rate found here was lower than the one found in Germany (5.70%) among 12 to 25-year-olds (Wartberg, Kriston, & Thomasius, 2017), in Austria (5.7%) (Riedl et al., 2016), and in Korea (5.9%) (Yu & Cho, 2016).

Regarding the relationship between gaming and substance use, previous research by Turel and Bechara (2019) suggested a U-shaped association between gaming and substance use. The present study provides further support to this finding for both cigarette smoking and alcohol use among adolescents. This may imply that non-disordered gaming might have a buffering effect in relation to substance use. This is consistent with the findings presented suggesting that non-disordered gamers have the lowest rates of cigarette smoking, less experience with misuse of all kinds of pharmaceuticals, sedatives and tranquillisers, marijuana, MDMA, and LSD than non-gamers and disordered gamers. The findings obtained suggest that it is important to distinguish between non-disordered gamers and disordered gamers. However, the interplay between substance use and gaming is nuanced as non-gamers engaged more often in specific substance use behaviours (i.e., alcohol, cigarettes, sedatives and tranquillisers, marijuana) than gamers in general. If a statistically significant difference in substance use was found between groups, the lowest prevalence was always the group of non-disordered gamers. In summary, moderate gaming may have protective effects, while disordered gaming is associated with increased substance use.

Van Rooij et al. (2014) reported that male nicotine, alcohol, and cannabis users were nearly twice as likely to report disordered gaming compared to non-users. Furthermore, Gallimberti et al. (2016) also reported that adolescents who have previously experienced drunkenness were more likely to develop disordered gaming. However, the present research did not find support for this association. The findings obtained align with the study by Brunborg et al., (2014) which reported no association between IGD and the frequency of drunken episodes.

Coëffec et al., (2015) conducted a large-scale study examining substance use (i.e., alcohol, tobacco, marijuana) and gaming behaviours in a sample of 1,423 French adolescents aged between 11 and 17 years and reported that disordered gamers started using these substances at younger age when compared to non-problematic gamers. The authors also reported that gamers consumed alcohol more often than non-gamers, which is contrary to the findings of the present study.

Regarding the link between gaming and conduct problems, the results indicated that disordered gamers have higher frequency of conduct problems than non-gamers and non-disordered gamers (with the exception of forging parents' signatures). This finding aligns well with the suggestion that IGD severity is closely related to rule-breaking behaviours as reported by Müller et al. (2015) based on an extensive representative European study. This finding might be explained by the co-occurrence of age-related developmental disorders in adolescents experiencing behavioural addictions, such as Oppositional Defiant Disorder (ODD) and key individual differences factors such as hostility and aggression (Gunes et al., 2018). Another potential buffer effect of non-disordered gaming was found for truancy and parental signature forgery, where non-disordered gamers were found to have the lowest frequency of this behaviour. These findings indicate that the severity of gaming can influence the formation of global and school self-concepts of adolescents and the creation of their personal standards of behaviour (Čerešník, 2014).

Another important finding of the present study was that disordered gamers were more likely to be ridiculed, insulted, and harmed by their classmates than non-gamers and non-disordered gamers. These results mirror the findings of a systematic review by Mihara and Higuchi (2017) suggesting that IGD is associated with a greater incidence of problems with peers in relation to bullying. A potential reason for this finding might be due to the greater incidence of peer victimisation among disordered gamers (Teng, Griffiths, Nie, Xiang, & Guo, 2020). Similarly, Zsila et al. (2018) suggest that problematic Internet use predicts victimisation in both traditional bullying and cyberbullying. Concerning in-game risky behaviours, disordered gamers were more likely to purchase loot boxes, which may be related to their addictive potential, that is consistent with the emerging findings suggesting a link between IGD and risky engagement with loot box mechanics (Kim et al., 2023). Purchasing loot boxes in video games is also considered a risk factor for gambling-related problems (Wardle & Zendle, 2021). Based on the results of this research, the implication is to support the call for stakeholders to implement policy and regulatory practices aimed at reducing the potential for consumers to experience gambling-related harms, such as those associated with loot boxes in video games (Raneri et al., 2022). Previous evidence underscores the importance of harm reduction strategies for minimising these risks (Miovský, Černíková, Kalina, & Nováková, 2023).

Despite its many novel findings, the present study has several limitations. Although the current study was conducted using a large and representative sample of adolescents, one of the limitations is the small age groups (e.g., 11-year-olds, 19-year-olds), which included fewer respondents than other age groups. Another limitation of the study is the unevenness of responses to the items and hence the lack of completion of some items, especially among the youngest participants (11-year-olds) who often skipped answering the questions on risk behaviour. This may be due to unfamiliarity with several terms (e.g. names of drugs).

Nevertheless, the present sample is representative of the Czech population of adolescents studying in the upper classes of primary schools (grades 6, 7, 8, 9), lower grammar schools, higher grammar schools, secondary schools with a leaving examination, and vocational secondary schools and several implications can be derived from the present investigation.

This study identified the highest prevalence rates of IGD in 12-year-old male adolescents, highlighting the importance of early and targeted preventive efforts to address IGD. Disordered gamers also experienced higher incidences of bullying-related problems, indicating that prevention and intervention strategies should focus on enhancing peer relationships and social functioning. Furthermore, the observed association between gaming and self-harm underscores the need for practitioners to screen for self-harm risks in disordered gamers to improve their mental health and wellbeing.

Future studies should incorporate longitudinal designs and analyse additional factors of relevance to substance use and conduct problems (e.g. thefts) as well as risk factors and underlying mechanisms for observed associations among gamers. Finally, the results further revealed that healthy gaming might have a buffering effect on the conduct problems and substance use assessed in this study. The current results may help inform practitioners and guide prevention efforts to reduce disordered gaming in society.

Funding sources: This manuscript was supported by the Charles University institutional support programme Cooperatio, research area Health Sciences. This study was co-financed from the state budget by the Technology agency of the Czech Republic under the SIGMA Programme, proj. No. TQ12000040.

Authors' contribution: JS: conceptualization, methodology, formal analysis, writing-original draft, editing. MD: methodology, supervision. DD: methodology, statistical analysis, writing-original draft. HP: methodology, project administration, data collection. HMP: supervision and editing. All authors read and approved the finalized manuscript.

Conflict of interest: The authors declare that they have no conflict of interest.

Acknowledgements: Thank you to the participants and their parents/legal guardians for their willingness to participate.

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