



Prevalence of problematic Internet use and problematic gaming in Spanish adolescents

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ABSTRACT

Epidemiological studies on problematic Internet use and problematic gaming conducted so far have mainly been carried out with unrepresentative and self-selected convenience samples, resulting in unreliable prevalence rates. This study estimates the prevalence of problematic Internet use and problematic gaming in a large sample of Spanish adolescents ($N = 41,507$) and identifies risk and protective factors for these risky behaviours. Data were collected online using the Adolescent Problem Internet Use Scale and the Adolescent Gaming Addiction Scale. Using a cut-off approach with measurement instruments inspired by the DSM-5 framework, we found a prevalence of 33% for problematic Internet use and 3.1% for problematic gaming. With a more conservative approach inspired by the ICD-11 framework, prevalence rates decreased to 2.98% for problematic Internet use and 1.8% for problematic gaming. Female gender, higher parents' education, elevated Internet connection time, reporting being online after midnight and using the mobile phone in class predicted problematic Internet use; whereas male gender, "living situation" where families do not have a traditional structure or stable environment, elevated Internet connection time and reporting using the mobile phone in class predicted problematic gaming. A cut-off approach involving scales that recycle substance use criteria (as in the DSM-5) over-pathologize Internet use and gaming behaviours. In contrast, the ICD-11 approach seems to provide more realistic and reliable prevalence rates.

1. Introduction

The globalization of the Internet and advances in the field of technology over the last two decades, in addition to the undeniable benefits they have brought, have been the driving force behind one of the biggest behavioural changes in society, especially affecting children and adolescents (Díaz-Aguado et al., 2018; Vigna-Taglianti et al., 2017). These populations have been increasingly involved in – and spend a lot of time on – online activities, which amongst other things, affects the construction of their identity (Raiziene et al., 2022; van der Merwe, 2017), contributes to fulfilling basic needs (Chen, 2019; Partala, 2011) and yet

also raises concerns about potentially risky or hazardous online behaviours (Fontana et al., 2022; Kaess et al., 2021). In 2015, the World Health Organization published a report about the need to consider the public health implications of excessive use of the Internet, computers, smartphones and similar electronic devices (World Health Organization, 2019). Simultaneously, online video games became one of the most popular leisure activities worldwide. Recently, the COVID-19 pandemic further increased reliance on online platforms and apps for professional, social and leisure purposes, raising concerns about a potential increase in problematic patterns of Internet use (Király et al., 2020).

Problematic Internet use is an umbrella construct that refers to a

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wide range of online behaviours (shopping, pornography viewing, social networking, cyberbullying, “cyberchondria”) that can become uncontrolled and engender negative consequences (social, occupational, familial, educational), and associated with functional impairment in a subgroup of vulnerable users (Fineberg et al., 2018, 2022; World Health Organization, 2019). Notably, however, the construct of problematic Internet use is still debated. Several authors have argued that the Internet has to be viewed as a medium through which specific potentially problematic online activities occur and that the addiction framework is not necessarily the most suited to explaining problematic Internet use (Kardefelt-Winther, 2014; Ryding and Kaye, 2018; Starcevic and Billieux, 2017). Despite these conceptual controversies, scientific evidence shows that problematic patterns of involvement in online activities can be linked with psychological and physical adverse consequences and can thus be considered a relevant public health issue (World Health Organization, 2019).

This excessive or inappropriate use of the Internet is not recognized as a psychiatric condition per se, as only gaming disorder has been included in the latest version of the *International Classification of Diseases* (ICD-11) in its section on “disorder due to addictive behaviours” (Reed et al., 2022). Gaming disorder is primarily characterized by the manifestation of a persistent and dysregulated pattern of involvement associated with negative consequences (social, occupational, familial, educational) and functional impairment (Reed et al., 2022; Stein et al., 2018).

Video game involvement, including e-sports participation, has been growing exponentially, especially amongst young people (King and Potenza, 2019). Similarly, adolescents are increasingly confronted with gambling opportunities, especially regarding sport betting, putting them at risk of developing hazardous gambling behaviours (Barrera-Algarín and Vázquez-Fernández, 2021). A growing convergence between (video) gaming and gambling has been observed in recent years, further exposing children and adolescents to gambling opportunities (e.g. loot boxes) while they are playing video games (Kim and King, 2020). It is essential to produce reliable data on the prevalence of problematic Internet use and problematic gaming in representative adolescent samples. Indeed, previous epidemiological studies were mainly conducted in self-selected non-representative convenience samples (Rumpf et al., 2019; van Rooij et al., 2018), which resulted in unreliable prevalence rates of between 4% and 22.8% for problematic Internet use (Bickham, 2021; Díaz-Aguado et al., 2018) and between 0.7% and 15.6% for problematic gaming (Buiza-Aguado et al., 2018; Colasante et al., 2022; Gómez et al., 2020). In Spain, the country in which the current study takes place, previous studies also showed inconsistent results, with prevalence rates ranging from 16.3% to 38.8% (Gómez et al., 2017; Rial et al., 2018; Rodríguez et al., 2020) for problematic Internet use and from 3.3% to 7.1% specifically for problematic gaming (Brime et al., 2021; Mora-Salgueiro et al., 2022).

This huge variability in prevalence rates may be due to the overall poor quality of epidemiological studies in this field (Rumpf et al., 2019) related to the constant evolution of the technology itself, the screening instruments used, the target population and the lack of consensus about the establishment of cut-off points or the criteria used to define a “disorder” (King et al., 2013, 2020; Slack et al., 2022; Stevens et al., 2021). These aspects have contributed to the current situation in which prevalence rates are often inflated, contributing to moral panic and casting doubt on their public health relevance (Ryding and Kaye, 2018).

Previous prevalence studies in this field also largely relied on a “confirmatory approach”, which consists in recycling the criteria for substance use disorder to define online addictive behaviours (Billieux et al., 2015, 2022; Kardefelt-Winther, 2015), resulting in over-pathologization of normal behaviours and contributing to the inflated prevalence rates. Over-pathologization occurs because some criteria borrowed from substance use disorder (e.g. tolerance, mood regulation) – and included as diagnostic criteria in the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association,

2013), fifth edition (DSM-5) – are not necessarily indicative of pathology in gaming or Internet use (Castro-Calvo et al., 2021; Charlton, 2002; Charlton and Danforth, 2007). In contrast, the ICD-11 framework posits that a behavioural addiction is present when a dysfunctional pattern of involvement (in the activity) is characterized by loss of control, excessive priority given to the activity and continued use despite negative consequences, implying significant impairment in important domains of life (Brand et al., 2020; Reed et al., 2022). In fact, studies that applied stringent criteria and considered functional impairment as a mandatory feature (as defined in the ICD-11) reported more reliable prevalence rates (e.g. 1%–2%); see Stevens et al. (2021).

Against this background, and cognizant of the limitations of previous epidemiological research in this field, in the present study, we investigated the prevalence of problematic Internet use and online gaming in a large representative sample of Spanish adolescents. Here we capitalized on a double approach to determine prevalence rates. First, we followed the classic approach used in the last decade by using cut-off-based measurement instruments inspired by the DSM-5 framework and the recycling of substance use disorder criteria. Second, to avoid over-diagnosis and over-pathologization, we also applied the more conservative and recent ICD-11 framework, in which three criteria are necessary (i.e. loss of control, excessive priority, continued use despite consequences) and some potentially non-valid substance use disorder criteria not retained (e.g. tolerance, preoccupation, mood regulation) (Castro-Calvo et al., 2021; Reed et al., 2022). In addition, we also aim is to identify risk and protective factors for problematic Internet use and problematic gaming. Indeed, based on previous studies, we can expect that a number of factors to be associated with these problematic behaviours, including sociodemographic, familial, and environmental factors (e.g., Ji et al., 2022; Kuss et al., 2014, 2020; Nielsen et al., 2020).

2. Methods

2.1. Participants and procedure

A survey was conducted amongst Spanish adolescents who were between 11 and 18 years old. The target population consisted of all schoolchildren residing in the national territory who were in compulsory secondary education in Spain. We relied on two-stage sampling that combined clusters and quotas (Cooksey and McDonald, 2019; Rada and Martín, 2014). Clusters were used to select the largest groups within the country, identified as the educational centres of each autonomous community, and quotas (city, province, sex, age and ownership of the centre) to establish the smallest groups, that is, to select the second-level units, the students (Fig. 1). The sampling procedure was the same as that used in the Survey on Drug Use in Secondary Education in Spain (ESTUDES, 2021) (Spanish Observatory on Drugs and Addictions, & Government Delegation for the Spanish National Drugs Plan, 2022) and in the Report of the European School Survey Project on Alcohol and Other Drugs (ESPAD, 2019) (EMCDDA, 2020).¹

Information letters for parents explained the purpose, form and date of data collection. The letters also requested consent from families for the inclusion of their children in the study. The questionnaire was administered by using the school's own natural groups or “classes” between February and April 2021. All schoolchildren were duly informed of the purpose of the study, its confidential and voluntary nature, and the anonymity of their responses. The study was approved by the Bioethics Committee of the University of Santiago de Compostela under registry USC-35/2021/08/07. The final sample consisted of 41'507 adolescents, 48.7% females and 50.3% males, aged between 11 and 18

¹ In order to take into account the discrepancy between the total number of students in each autonomous community and the samples actually collected in the current study, we also computed weighted prevalence rate which are available from the Open Science Framework (OSF): <https://osf.io/ujh3y/>.

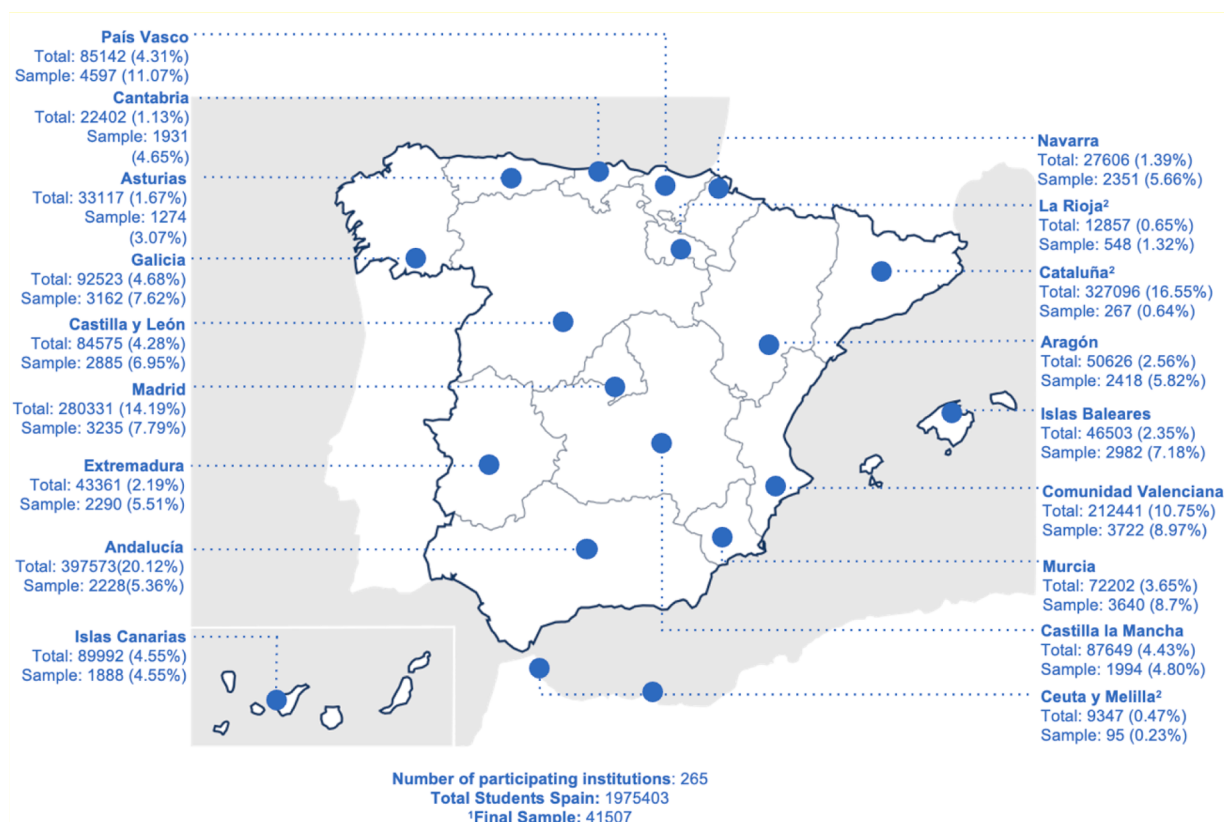


Fig. 1. Distribution of participants by autonomous community

1. The sample was adjusted to correct the imbalances generated by the fieldwork on the original sample.

2. In the case of Cataluña, La Rioja, and Ceuta and Melilla, the corresponding weighting was not performed, because it was not possible to reach the necessary sample size.

Total = number of students per autonomous community and percentage of participation per each community; Sample = final number of students per community and percentage of the total sample.

years ($M = 13.81$; $SD = 1.32$) (Table 1). The study was not pre-registered, but all data and materials used are available from the following Open Science framework (OSF) link: <https://osf.io/8dha5/>.

In this study, we used a two-step procedure corresponding to the research objectives to determine the prevalence rates. A first prevalence rate was determined from the traditional cut-off values validated for each instrument used. This approach is aligned with the DSM-5 framework and considers each criterion for substance use disorder to be equivalent for reaching a cut-off value for problematic Internet use or problematic gaming. A second more conservative prevalence rate was determined from the recent diagnostic guidelines provided in the ICD-11. To determine this second prevalence rate, we selected items from the Game Addiction Scale for Adolescents (GASA) and Problematic Internet Use Scale in adolescents (PIUS-a) that match the ICD-11 clinical guidelines proposed for gaming disorder (ICD-11 code: 6C51) and other specified disorders for addictive behaviours (ICD-11 code: 6C5Y) (see Table 2 for details). For this second approach, the scores were recoded dichotomously so that they corresponded with dichotomic (yes/no) diagnostic criteria (for a similar approach, see (Király et al., 2019)).

2.2. Instruments

An online survey was developed that included psychometrically validated measurement instruments. This survey was implemented on a platform of the University of Santiago de Compostela, hosted in the Galicia Supercomputing Centre, with the technical and legal supervision of the General Council of Professional Colleges of Computer Engineering of Spain. To minimize the possible problem of accuracy of the online survey methods, two complementary strategies have been used. On the

one hand, a double piloting process of the questionnaire was carried out. The questionnaire was tested by individual interview (face-to-face) with a sample of 50 students of the same age target under study and, subsequently, in its online version with a sample of 432 students from two schools, one in a large city and the other in a rural town. On the other hand, a careful data cleaning process was carried out, following the indications of Rial et al. (2001), not only analysing the presence of missing data, but also incoherent response patterns and numerous repeated answers involving the same response option. The SPSS v.25 EXAMINE procedure was used for this purpose. From an initial sample of 50'957 adolescents, 9450 adolescents were excluded based on this procedure, resulting in a final sample of 41'507 adolescents.

2.2.1. Demographic variables

The demographic variables collected consisted of gender, age, sexual orientation, school year, country of birth, number of siblings, parent education, living situation and partner.

2.2.2. Problematic Internet use scale in adolescents (PIUS-a) (Rial et al., 2015)

This scale is designed to assess problematic Internet use, with items having been selected to cover the DSM-5 constructs of gambling disorder and Internet gaming disorder, as well as the opinion of a panel of experts based on a Delphi consensus (for more details, see Rial et al., 2015). Classic features of substance use disorder such as tolerance, withdrawal or mood regulation are assessed with 11 items arranged on a Likert-type scale with five alternatives. The total score ranges from 0 to 44 and a cut-off point of 16 has been established (Rial et al., 2015). For the calculation of prevalence according to the ICD-11 approach, the PIUS-a

Table 1
Characteristics of study participants.

Variable	Total (n = 41,507)
Gender, n (%)	
Female	20,219 (48.7%)
Male	20,907 (50.4%)
Other	381 (0.9%)
Age (%), years	
11	87 (0.2%)
12	7885 (18.9%)
13	9950 (24.0%)
14	10,518(25.3%)
15	9318(22.4%)
16	3036 (7.3%)
17	134 (0.3%)
18	609(1.5%)
Age, mean $\pm$ SD	13.81 $\pm$ 1.32
Scholar Year, n (%)	
1st compulsory secondary education	10,376 (25%)
2nd compulsory secondary education	10,820 (26.1%)
3rd compulsory secondary education	10,828 (26.1%)
4th compulsory secondary education	9483 (22.8%)
Repeat course	6732 (16.2%)
Parent Education, n (%)	
Mother	
No education	452 (1.1%)
Primary	4896 (11.8%)
Secondary	12,933 (31.2%)
University	16,425 (39.6%)
No response	6801 (16.4%)
Father	
No education	464 (1.1%)
Primary	6355 (15.3%)
Secondary	13,818 (33.3%)
University	12,846 (30.9%)
No response	8024 (19.3%)
Born in Spain, n (%)	
Mother	
Yes	34,308 (82.7%)
No	6903 (16.6%)
No response	296 (0.7%)
Father	
Yes	34,527 (83%)
No	6476 (15.6%)
No response	504 (1.2%)
Adolescent	
Yes	38,654 (93.1%)
No	2680 (6.1%)
No response	173 (0.4%)
Living situation, n (%)	
With both parents	30,433 (73.3%)
With parents and grandparents	989 (2.4%)
Shared custody	3622 (8.7%)
With grandparents	214 (0.5%)
With mother	2434 (5.9%)
With mother and partner	1886 (4.5%)
With father	2434 (5.9%)
With father and partner	269 (0.6%)
Other	1259 (3.1%)
Siblings, n (%)	
Only child	6717 (16.2%)
1	23,905 (57.6%)
2	7595 (18.3%)
3 or more	3288 (9.4%)
Partner, n (%)	
Single	35,645 (85.9%)
Couple	5855 (14.1%)
No response	7 (0.0%)
Sexual Orientation, n (%)	
Totally heterosexual	29,586 (71.3%)
Fundamentally heterosexual	4797 (11.6%)
Totally homosexual	388 (0.9%)
Fundamentally homosexual	421 (1%)
Bisexual	3215 (7.7%)
Asexual	319 (0.8%)
No response	2781 (6.7%)

Table 2
Distribution of items according to ICD-11 criteria.

	ICD-CRITERIA Negative consequences	Increasing priority	Impaired control
PIUS- a	8. I've sometimes got into trouble because of the Internet	3. I've sometimes even managed to neglect certain tasks or perform below par (in exams, sport, etc.) because I put connecting to Internet first	7. I've stopped going to places or doing things that interested me before so as to connect to the Internet
GASA	6. Did you have fights with others (e.g., family, friends) over your time spent on games?	7. Have you neglected other important activities (e.g., school, work, sports) to play games?	4. Have others (limitations) unsuccessfully tried to reduce your game use?

responses for “never”, “almost never” and “sometimes” were recoded as zero, indicating that the criterion was not met, and the response options of “very often” and “always” were assigned a value of 1, implying the criterion was met. The scale has high reliability, with a Cronbach's alpha of 0.88 in this sample.

2.2.3. Game addiction scale for adolescents (GASA-Short version) (Lemmens et al., 2009; Lloret et al., 2018)

This scale assesses gaming addiction in a framework that essentially recycles substance use disorder criteria (e.g., tolerance, withdrawal, etc.). It is composed of seven items preceded by the statement “During the last six months, how often . . .” and is scored with a 5-point Likert scale, ranging from 1 (never) to 5 (very often). All responses over 3 (sometimes) are given a score of 1, with a cut-off point of ≥ 4 , which allows the creation of three categories: normal use (0–3), problematic use (4–6) and possible gaming disorder (7). To determine prevalence rates according to the ICD-11, we followed the same approach as for the PIUS-a, assigning a value of zero (the criterion is not met) for the response options “never”, “almost never” and “sometimes” and a value of 1 (the criterion is met) for the alternatives “often” and “very often”. The scale shows high internal consistency ($\alpha = 0.87$).

2.3. Data analytic strategy

Data analysis was performed in two steps. First, a descriptive analysis of the data and a frequency analysis were performed to summarize the socio-demographic data of the sample and the prevalence data. Prevalence rates were then computed according to the procedure described earlier. Second, a series of binary logistic regression analyses were computed to identify potential risk and protective factors associated with the targeted problematic behaviours. The independent variables were categorized (age, sex, parents' education, living situation, Internet use frequency and use of mobile phone) to estimate the statistical probability that these variables predict the prevalence of problematic Internet use and problematic gaming, based on the odds ratio with 95% confidence intervals. Bonferroni correction (Hochberg, 1988; Knudby and Ellsworth, 1936) was used to adjust the Type 1 error (α) by the total of the test (α/n) (Mohieddin and Naser, 2019; VanderWeele and Mathur, 2019). Statistical analyses were performed by using SPSS 25 (IBM Corp, 2017) and R programming language (R Core Team, 2021) through the graphical user interface, RStudio (R Studio Team, 2021).

3. Results

3.1. Socio-demographic characteristics of the sample

Table 1 shows a detailed description of the sample, which presents a homogeneous and balanced gender distribution (females 48.7%, males 50.4%), with 71.3% of the participants identifying themselves as heterosexual. The 13- to 16-year age group is the most represented in the sample. The most common family unit is that of mother and father (73.3%), in which mothers have a higher level of education, with 39.6% having a university education compared with 30.9% of fathers. More than 80% of the children assessed had at least one sibling, with only 16.2% being an only child. Almost all participants (96.3%) reported using an electronic device to stay connected to the Internet, 90.9% regularly used social networks and 67.7% frequently played video games.

3.2. Prevalence data

After we calculated the new prevalence rates according to the ICD-11 criteria, the results were lower than those obtained with the cut-off generally used for the scales (see Table 3 for details). Using a traditional cut-off value, we obtained a global prevalence of 33% for problematic Internet use and 3.1% for problematic gaming. When we applied the conservative approach adopted in the ICD-11, the prevalence rates decreased to 2.98% for problematic Internet use and 1.8% for problematic gaming. Detailed prevalence rates by gender and age ranges are reported in Table 3 and Fig. 2 (data shown only for the problematic use cases).

3.3. Identification of risk and protective factors

A logistic regression model was created by using the p-value of the Bonferroni correction ($p = 0.005$) in order to identify the relationship between each behaviour and the used Vis (gender, age, parents' education, living situation, Internet connection frequency, bringing a mobile phone to class and using a mobile phone during lessons). The dependant variable used in the regression was the prevalence rate for problematic Internet use (ICD-11 approach) and problematic gaming

(ICD-11 approach). As shown in Table 4, statistically significant predictors for the problematic Internet use model were female gender (odds ratio [OR] = 1.524, 95% confidence interval [CI] = 1.362, 1.706), higher parents' education (OR = 1.129, 95% CI = 1.052, 1.211), elevated Internet connection time (week: OR = 1.252, 95% CI = 1.170, 1.340, weekend: OR = 1.325, 95% CI = 1.223, 1.436), reporting being online after midnight (OR = 1.593, 95% CI = 1.490, 1.706)) and reporting using the mobile phone in class (OR = 1.390, 95% CI = 1.390, 1.318).

As shown in Table 5, statistically significant predictors for problematic gaming were male gender (OR = 0.344, 95% CI = 0.272, 0.431), "living situation" for those families that do not have a "traditional structure" or a stable environment (OR = 0.801, 95% CI = 0.671, 0.963), elevated Internet connection time (week: OR = 1.266, 95% CI = 1.133, 1.415, weekend: OR = 1.334, 95% CI = 1.170, 1.528), being online after midnight (OR = 1.352, 95% CI = 1.216, 1.508) and reporting using the mobile phone in class (OR = 1.441, 95% CI = 1.317, 1.575).

4. Discussion

In this study, we sought to establish the possible prevalence of problematic Internet use and problematic gaming in a sample of Spanish adolescents, using two different methods: a cut-off-based approach inspired by the DSM-5 framework (in which all symptoms are considered equivalent to reach a defined cut-off value) versus an approach based on the recent ICD-11 framework (in which specific symptoms are required to endorse a condition). We also tested whether specific socio-demographic variables and technology usage patterns are associated with the presence of problematic Internet use and problematic gaming. These analyses revealed that different risk factors can be identified for problematic Internet use versus problematic gaming. This study represents one of the few epidemiological studies conducted in a large and representative sample of adolescents in this field.

Epidemiological studies of problematic Internet and gaming use have presented with several limitations beyond the difficulties inherent in identifying problematic usage patterns of technologies that are constantly evolving (Fineberg et al., 2022) (e.g. poor sampling methods, lack of gold standard, pathologizing measurement instrument), making them unreliable and promoting unrealistic prevalence rates (Ballou and Zendle, 2022; Billieux et al., 2015; King et al., 2020; van Rooij et al., 2018). In the present study, we tried to overcome these limitations by (1) using a nationally representative sample of Spanish adolescents and (2) comparing a cut-off approach inspired by the DSM-5 framework for substance use disorder with a more conservative approach inspired by the recent ICD-11 framework, in which three specific criteria need to be present to endorse the condition (i.e., loss of control, excessive priority given to the activity and continued use despite negative consequences). Similarly, compared with what was reported in a few other recent studies (Borges et al., 2021; Maldonado-Murciano et al., 2022; Pontes et al., 2022), the ICD-11 framework produced lower and more realistic prevalence rates. This finding is also consistent with a recent meta-analysis showing that when stringent criteria are used, the prevalence of problematic gaming is estimated to be around 1% to 2% of the general population (Stevens et al., 2021). Crucially, the excessively elevated prevalence rates found in previous studies on problematic Internet use (Díaz-Aguado et al., 2018; Gómez et al., 2017; Lopez-Fernandez et al., 2019; Pontes and Macur, 2021) cannot be solely attributed to poor sampling, as the present study showed that 33% of the sample reached the cut-off for problematic Internet use. In contrast, when classic substance use disorder criteria were not considered and the more conservative framework from the ICD-11 was used, the prevalence rate obtained became more realistic (2.98% of probable problematic users).

Although the measurement instrument used in the current study to screen for problematic gaming seems less prone to over-pathologization than that used for problematic Internet use, applying the ICD-11

Table 3
Prevalence data for each of the approaches (classic vs ICD).

		Problematic use		GASA	
		PIUS-a		Classic	ICD-11
Gender		Classic	ICD-11	Classic	ICD-11
Male	% within row	29.80%	3.10%	4.90%	2.40%
	% of total	15.02%	1.11%	2.50%	1.43%
Female	% within row	36.10%	5.00%	1.10%	0.90%
	% of total	17.58%	1.82%	0.50%	0.35%
Other	% within row	47.00%	11.00%	7.10%	5.00%
	% of total	0.43%	0.05%	0.10%	0.05%
Age					
11	% within row	25.30%	2.30%	3.40%	1.40%
	% of total	0.10%	0.00%	0.00%	0.00%
12	% within row	23.20%	2.40%	2.40%	1.30%
	% of total	4.38%	0.34%	0.50%	0.25%
13	% within row	30.90%	3.80%	3.20%	1.90%
	% of total	7.41%	0.66%	0.80%	0.46%
14	% within row	35.90%	4.50%	3.00%	2.00%
	% of total	9.09%	0.87%	0.8%	0.49%
15	% within row	38.30%	4.80%	3.10%	1.80%
	% of total	8.60%	0.79%	0.70%	0.39%
16	% within row	38.20%	5.40%	3.70%	2.30%
	% of total	2.79%	0.24%	0.30%	0.15%
17	% within row	41.80%	9.70%	8.20%	10.90%
	% of total	0.13%	0.02%	0.00%	0.03%
18	% within row	38.30%	5.60%	3.80%	2.40%
	% of total	0.56%	0.05%	0.10%	0.03%
Total		33.03%	2.98%	3.1%	1.84%

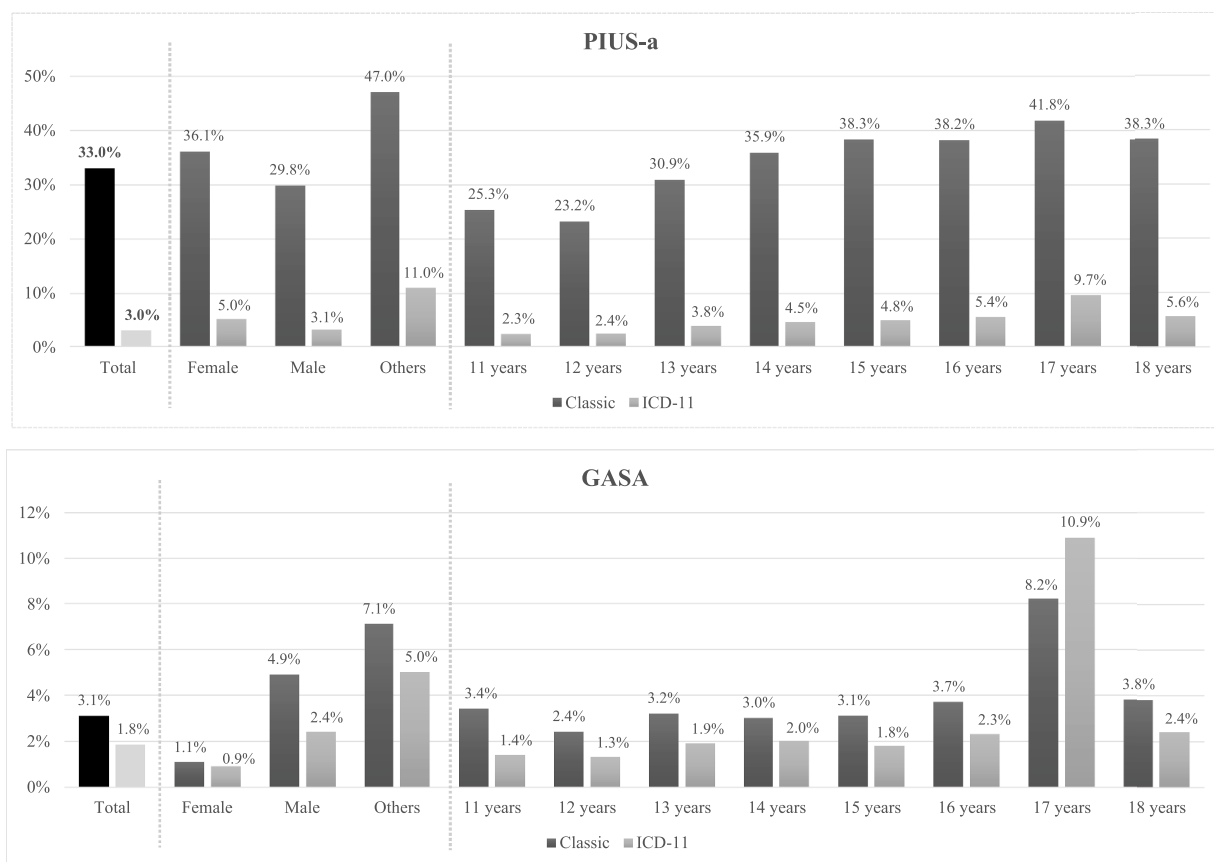


Fig. 2. Prevalence data by gender and age for problematic use cases (PIUS-a and GASA).

Table 4

Results of binary logistic regression analysis for the prediction of problematic Internet use.

Variables	B	Standard error	Z	Exp (B)	95%CI	Wald statistic	df	P	Bonferroni adjusted value
Gender	0.421	0.057	7.335	1.524	[1.362–1.706]	53.796	1	0.000	0.005**
Age	−0.052	0.024	−2.162	0.948	[0.903–0.994]	4.676	1	0.031	0.005
Parents' education	0.121	0.035	3.405	1.129	[1.052–1.211]	11.594	1	0.001	0.005*
Living situation	−0.061	0.057	−1.073	0.940	[0.841–1.053]	1.152	1	0.283	0.005
Internet connection frequency	−0.288	0.096	−3.008	0.749	[0.625–0.913]	9.051	1	0.003	0.005*
Connection time (week)	0.225	0.034	6.519	1.252	[1.170–1.340]	42.494	1	0.000	0.005**
Connection time (weekend)	0.281	0.040	6.886	1.325	[1.223–1.436]	47.415	1	0.000	0.005**
Connecting after midnight	0.466	0.034	13.547	1.593	[1.490–1.706]	183.527	1	0.000	0.005**
Bringing a mobile phone to class	0.014	0.029	0.493	1.014	[0.958–1.074]	0.243	1	0.622	0.005
Using a mobile phone during lessons	0.329	0.026	12.319	1.390	[1.390–1.318]	151.756	1	0.000	0.005**
Intercept	−4.682	0.452	−10.338	0.009	[0.003–0.022]	106.864	1	0.000	

* ≥ 0.001 .

** < 0.001 .

Table 5

Results of binary logistic regression analysis for the prediction of problematic gaming.

Variable	B	Standard error	Z	Exp (B)	95% CI	Wald statistic	df	P	Bonferroni adjusted value
Gender	−1.065	0.117	−9.075	0.344	[0.272–0.431]	82.353	1	0.000	0.005**
Age	−0.097	0.040	−2.405	0.907	[0.837–0.981]	5.782	1	0.016	0.005
Parents' education	0.029	0.060	0.495	1.030	[0.914–1.159]	0.245	1	0.620	0.005
Living situation	−0.221	0.092	−2.399	0.801	[0.671–0.963]	5.757	1	0.016	0.005
Internet connection frequency	−0.401	0.127	−3.154	0.669	[0.529–0.875]	9.949	1	0.002	0.005*
Connection time (week)	0.236	0.056	4.170	1.266	[1.133–1.415]	17.388	1	0.000	0.005**
Connection time (weekend)	0.288	0.068	4.244	1.334	[1.170–1.528]	18.013	1	0.000	0.005**
Connecting after midnight	0.302	0.054	5.513	1.352	[1.216–1.508]	30.393	1	0.000	0.005**
Bringing a mobile phone to class	−0.080	0.045	−1.771	0.922	[0.845–1.009]	3.136	1	0.077	0.005
Using a mobile phone during lessons	0.365	0.045	8.033	1.441	[1.317–1.575]	64.530	1	0.000	0.005**
Intercept	−3.269	0.686	−4.764	0.038	[0.009–0.143]	22.691	1	0.000	

framework significantly reduced the prevalence rates obtained (from 3.1% to 1.8%). All in all, this result is consistent with recent studies showing that the ICD-11 approach is less likely to pathologize intensive but healthy gaming patterns (Reed et al., 2022; Yen et al., 2022). The number of studies that use tools based on the ICD-11 framework is increasing; nevertheless, more work is needed to test the diagnostic accuracy and clinical relevance of such tools (Fineberg et al., 2022).

In line with previous research, female gender (Machimbarrena et al., 2022; Procházka et al., 2021), a higher number of hours of Internet connection (Bickham, 2021; Macur and Pontes, 2021) and high parental educational level (Kabasakal, 2015; Wu et al., 2016) were risk factors for problematic Internet use. Past literature shows that females are more prone than males to developing specific forms of problematic Internet use (e.g., problematic use of social media) (Baloglu et al., 2020), but that time alone cannot be considered a predictor of problematic use (Slack et al., 2022). Time spent online has been heavily criticized as a proxy or predictor of problematic involvement, and other contextual factors have to be considered in relation to time spent online (e.g., period of the year) to avoid confounding problematic involvement with intensive but healthy involvement in online activities (Pontes et al., 2022; Yen et al., 2022). Finally, regarding parental education, previous research has been inconsistent (Li et al., 2014; Yu et al., 2018) and does not systematically report a relationship between parental education level and problematic Internet use (Malak et al., 2017). The study by Koo et al. (2021) is an exception in showing that children of parents with a higher level of education tend to display less problematic Internet use. These authors suggest that highly educated families seem to be more aware of the potential risks associated with Internet use and thus are more equipped to guide their children towards healthier use.

Our results align with previous research showing that male gender (Ferreira et al., 2020; King and Potenza, 2019; Mora-Salgueiro et al., 2022; Stevens et al., 2021), a non-traditional family structure (Colasante et al., 2022; Juthamane and Gunawan, 2021), going online after midnight (Marouane Moustakbal and Maataoui, 2022), and mobile phone use during school hours (Choe and Yu, 2022; Sahu et al., 2019), constitute risk factors for problematic gaming. Previous research systematically showed that male gender constitutes a predictor of problematic gaming (Lopez-Fernandez et al., 2019). This has also been related to the fact that games have for a long time been created by males for a male audience (Colasante et al., 2022; Lopez-Fernandez et al., 2019), which, according to some authors, has contributed to directing females towards other online activities such as social network sites (Fam, 2018; Uçur and Dönmez, 2021; Victorin et al., 2020). Family/-parental structure has tended to be overlooked in previous research on problematic gaming; however, it seems that those families reporting less cohesion and more conflicts are less involved in supervising gaming behaviours of their children, which favours problematic usage patterns (Nielsen et al., 2020). Finally, our findings support that interference in sleep and school constitutes a relevant trigger warning to identify potentially problematic users.

4.1. Limitations

The present study has a number of limitations. First, the scales we used were not specifically designed to assess ICD-11 criteria. However, other studies have followed the same approach as the one used here to compare, e.g., DSM-5 and ICD-11 conceptualizations of gaming disorder (Jo et al., 2019). Second, problematic Internet use is an umbrella construct encompassing several different activities (Baggio et al., 2018; Starcevic and Aboujaoude, 2017), and therefore future studies should also consider specific activities (e.g. social media) to establish reliable and specific prevalence rates. In particular, it is likely that there is an overlap in the prevalence of problematic Internet use and problematic gaming, and that a proportion of adolescents identified with problematic Internet use are in fact presenting problematic gaming (Machimbarrena et al., 2022). This is one of the reasons why some authors

claimed that problematic Internet use is not necessarily a valid construct and that the focus should instead be made on the actual activities performed online (Starcevic and Aboujaoude, 2017; Starcevic and Billieux, 2017). Third, the two scales we used are not entirely comparable in terms of the items included and specific features assessed, which may explain the discrepancies in prevalence rates. In particular, the scale used to assess problematic Internet use is likely to comprise a substantial amount of “over-pathologizing items”, i.e. items assessing normal usage patterns (King et al., 2020). Fourth, the study is based on self-reports, implying that adolescents may have underestimated or overestimated the behaviours they carry out and their possible implications. However, as different authors have pointed out, self-report measures have proven to be reliable and even better than other methods when it comes to assessing levels of substance use and addictive disorders (Babor et al., 1989; Winters et al., 1990).

4.2. Conclusion

This study shows that the cut-off approach in which scales recycle substance use criteria (as in the DSM-5 framework) over-pathologize Internet use and gaming behaviours. In contrast, the ICD-11 approach seems to provide more realistic and reliable prevalence rates. In addition, risk factors problematic Internet use versus problematic gaming are not the same. Problematic Internet use and problematic gaming are two issues that have been the subject of much controversy, especially problematic Internet use, which is not yet recognised as a disorder. Indeed, the heterogeneity in its conceptualisation and assessment has made many researchers wary, and they do not hesitate to consider it a real minefield (Ryding and Kaye, 2018). This manuscript aimed at a better assessment of the problem, relying on criteria that help to provide epidemiological data that are closer to the clinical reality. Therefore, our findings hold important implications for future epidemiological studies and preventive actions.

Author contributions

VVB was involved in designing the study protocol in the context of a collaborative project between UNICEF Spain, the University of Santiago de Compostela and the Spanish General Council of Informatics Engineering (CCII). ANL and JB conceived the present study and developed its theoretical framework with the support of VVB. ANL and JB wrote the paper. ARB and IGG led and carried out the project design and data collection. ANL performed the statistical analysis under the supervision of JB. ANL was responsible for uploading the data and protocol in the Open Science Framework (OSF). All authors discussed the results and contributed to editing the final manuscript.

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Declaration of Competing Interest

The authors report no conflicts of interest with respect to the content of this manuscript.

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