Received: 30 June 2021 | Accepted: 31 January 2022
DOI: 10.1111/add.15843

RESEARCH REPORT

ADDICTION SSA

Problematic gaming risk among European adolescents: a cross-national evaluation of individual and socio-economic factors

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Abstract

Background and Aims: Previous research has identified numerous risk and protective factors of adolescent problematic gaming (PG) at the individual and social levels; however, the influence of socio-economic indicators on PG is less known. This study aimed to measure the contribution of individual and socio-economic factors involved in PG risk among adolescents from 30 European countries.

Design: Multi-level logistic regression analysis of survey data from the 2019 European School Survey Project on Alcohol and Other Drugs (ESPAD) cross-sectional study using self-administered anonymous questionnaires.

Setting: Thirty European countries.

Participants: A representative cohort of 15–16-year-old students (n = 88 998 students; males = 49.2%).

Measurements: The primary outcome measure was adolescents' (low and high) risk of PG. Individual key predictors included self-report assessments of socio-demographic characteristics, time spent gaming and family variables (parental regulation and monitoring, family support). Main country-level predictors comprised Gini coefficient for economic inequalities and benefits for families and children (% gross domestic product), retrieved from international public data sets and national thematic reports. The data analysis plan involved multi-level logistic regression.

Findings: Participants who reported stronger parental regulation [odds ratio (OR) = 0.81, 95% confidence interval (CI) = 0.79–0.83] and higher family support (OR = 0.93, 95% CI = 0.91–0.95) reported lower risk of PG. At the country-level, economic inequalities (OR = 1.05, 95% CI = 1.03–1.07) were positively associated with the risk of PG, while benefits for families and children (OR = 0.78, 95% CI = 0.70–0.89) were negatively correlated with the risk of PG.

Conclusions: Supportive family environments, lower country-level economic inequalities and higher government expenditures on benefits for families and children appear to be associated with a lower risk of problematic gaming among European adolescents.

KEYWORDS
Adolescence, ESPAD, multi-level analysis, problematic gaming, representative sampling, risk factors

INTRODUCTION

Video gaming is a highly popular leisure activity world-wide [1], particularly among adolescents, that can have benefits in cognitive, emotional and interpersonal domains [2]. Nevertheless, some individuals report negative consequences of excessive gaming, including anxiety and depression [3], lower academic achievement and sleep disturbance [4, 5] and problems with peers and aggressive behaviours [6]. Although problematic gaming in its most severe form has been recognized as 'gaming disorder' (GD) in the ICD-11 [7] there is continuing debate about the condition [8], as well as practical concerns including optimal assessment [9]. Studies have demonstrated that adolescents vary in their endorsement of gaming disorder-related indicators; however, there is a need for research that considers the different individual and interpersonal problems and risk factors at the subclinical level [7]. With this objective, the present study aims to investigate adolescent 'problematic gaming' (PG) [10], rather than gaming disorder *per se*, consistent with previous research [11] that conceptualizes PG along a spectrum.

Research concerning the risk and protective factors of adolescent PG has primarily examined the independent contribution of individual correlates, such as impulsivity, emotion dysregulation and psychopathology [12, 13], as well as the social environment [14]. With regard to the family domain, some researchers have drawn attention to the importance of parental practices in relation to PG [15, 16]; however, results have been inconsistent [17]. For instance, a study by Su *et al*. [18] reported that higher parental monitoring, described as parents' practices and knowledge concerning their children's activities and whereabouts [19], was associated with fewer GD symptoms, whereas Smith *et al*. [20] did not observe significant effects. Accumulated evidence has been more consistent in highlighting the protective role of positive family influences, including support and communication among family members [21].

However, from a public health perspective, research and prevention programmes addressing PG and other internet-related conditions only at proximal levels (i.e. individual, family) might be limited, and a more comprehensive approach is needed to capture the complexity of problematic behaviours [22, 23]. Lee and colleagues [24] recently proposed an epidemiological model for the prevention of internet use disorders (IUDs) highlighting the influence of individual factors as well as broader contextual factors (e.g. economic indicators, accessibility, public policies) on the development of IUDs. With regard to country-level factors, previous studies have documented the relevant impact of socio-economic indicators on adolescent health by showing that lower national wealth and higher economic inequalities are associated with a wide range of psychological and somatic symptoms [25, 26]. To date, little research is available on PG [27, 28]. To the best of our knowledge, only one study [27] has considered economic factors in explaining cross-national variations in perceived problems with gaming, reporting an increased risk of PG among adolescents using substances and living in less prosperous countries. Drawing from previous evidence on other problematic behaviours, it is plausible to hypothesize that PG might represent an additional negative consequence of status anxiety and weakened social capital deriving from socio-economic inequality. Moreover, among socio-economic factors, a recent multi-level analysis of health policies across Europe [29] identified the important role of benefits for families and children (e.g. child payments and allowances, parental leave payments) in decreasing adolescent mental health problems associated with poorer economic conditions. While previous research on adolescent problematic gambling [30] and alcohol use [31] included family benefits in the cross-national comparisons of these behaviours, no studies are available on PG.

To address these gaps, the present study adopted a multi-level approach to simultaneously estimate the contribution of: (i) individual factors (socio-demographic, self-reported measures of gaming time and of family characteristics) and (ii) country-level indicators (economic inequalities and benefits for families and children) in explaining cross-national variations in adolescents' risk of PG. We hypothesized that adolescents perceiving more parental regulation and parental monitoring would be at lower risk of PG. Furthermore, we expected that the perception of higher family support would be associated with lower risk of PG. At the country-level, higher economic inequalities were hypothesized to account for higher risk of PG, while greater national expenditures on benefits for families and children (hereafter referred to as family benefits) would reduce the risk of PG. Finally, considering that adequate availability of social and economic resources might improve the quality of family environment [32], the study also explored cross-level interactions between individual family variables and country-level family benefits. Specifically, we hypothesized that higher family benefits would moderate the association between family environment and the risk of PG. Finally, we included gaming time at the individual level (as control variable), previously found to be positively associated with PG [12].

METHODS

Design

Data for the present study were drawn from the 2019 European School Survey Project on Alcohol and Other Drugs (ESPAD), a cross-sectional survey carried out in 35 European countries targeting a population of adolescent students [33]. With prior parental consent, students voluntarily completed anonymous questionnaires during school hours. To collect comparable data, a shared standard methodology was employed. The study methodology involved national samples of randomly selected classes/schools in which the cohort of students aged 15–16 years completed the standardized

ESPAD questionnaire. In most countries, a stratified random sampling was performed, with the class being the final sampling unit. In Iceland, Malta and Montenegro a total population sample was used. All samples included in the analysis are nationally representative, apart from Cyprus (only government-controlled areas) and Germany (only the federal state of Bavaria). On average, 82% of the sampled schools (range = 21–100) and 84% of the sampled classes (range = 21–100) took part in the survey. Student representativeness ranged from 86 to 100%, with an average of 96%. Where necessary (11 countries), due to the non-proportional allocation of the sample to stratification variables and the possible differences in response rate, sampling weights were calculated by country principal investigators (e.g. to account for gender, geographical distribution, type and size of school). Further details about geographical coverage, sampling procedure in each country, representativeness and characteristics of the samples, as well as participation rates, can be retrieved in Tables 3 and 6–8 of the ESPAD 2019 Methodology Report [34]. Sampling design within each country is reported in Supporting information, Table S1.

Data set

Of the total sample (n = 90 299) from the original ESPAD database, 1301 cases (1.4%) were excluded from the current analyses because of missing values in the outcome variable (risk of PG). The final sample included 88 998 participants (n = 43 749 males, n = 45 249 females) from 30 European countries (Supporting information, Table S2). Country-level data for Gini coefficient were primarily retrieved from the last available data in Eurostat [35], complemented with information from the World Bank [36]. Data for family benefits were also obtained from Eurostat [37] and from national thematic reports on social protection provided by the European Social Policy Network [38, 39]. Of the initial ESPAD data set comprising 35 countries, five countries were excluded due to the unavailability of data either for gaming (France) or for any of the country-level variables (Faroes, Georgia, Monaco and Ukraine).

Measures

Dependent variable

To assess students' risk of PG, the perceived problem scale (PPS) was used [11]. This non-clinical and self-report screening tool consists of three items evaluating respondent's perception of problems in relation to: the amount of time spent gaming ('I think I spend way too much time playing computer games'), negative feelings because of restricted access ('I get in a bad mood when I cannot spend time on computer games') and parents' opinion over the time spent gaming ('My parents tell me I spend way too much time on computer gaming'). Both on- and offline activities were considered, as items refer to gaming on different electronic devices (e.g. computers, smartphones). Students were asked to rate their level of agreement with these statements using a five-point scale: 'strongly agree', 'partly agree', 'neither agree nor disagree', 'partly disagree' and 'strongly disagree'. In this study, Cronbach's alpha was 0.75. Consistent with previous research [11, 27, 40], each item was dichotomized into 'strongly agree'/'partly agree' (coded 1) versus the remaining categories (coded 0). Thus, the final index ranged from 0 to 3: in accordance with the threshold set by Holstein and colleagues [11], we considered a score of 0–1 points indicative of low risk of PG, and a score of 2–3 points to represent high risk of PG.

Individual-level variables

A detailed list of the variables is presented in the Supporting information, Table S3.

Family variables were assessed by measures related to parental regulation [30], parental monitoring [19, 41] and family support [42, 43].

Additionally, four control variables were included: (i) participants' gender (coded 1 for males and 2 for females); (ii) average amount of time spent gaming on electronic devices, measured as the number of hours in the last 30 days, on a school-day and on a non-school day separately. We computed a Pearson correlation between the two items (r = 0.82, P < 0.01) and consequently we included only the number of hours on a school-day in the final analyses to avoid collinearity issues; (iii) family structure [30]; and (iv) the perception of family economic status [44].[1]

Country-level variables

Two country-level variables were included: (i) economic inequality, measured by Gini coefficient of equivalized disposable income and (ii) family benefits, consisting of government expenditures on targeted social protection policies. A detailed description of the country-level variables is provided in the Supporting information, Table S4.

Data analysis

To estimate the influence of (i) individual- and (ii) country-level variables on the risk of PG, we analysed the data by implementing a multi-level logistic regression analysis using HLM version 7 [45], with students at level 1 and countries at level 2. Design weights were applied into multi-level models. In model I (empty model) we did not include any explanatory variables. In model II (within-country model) we estimated the links between the individual variables and the high risk of PG for individual I in country J. In

[1]We also conducted parallel analyses by including parental education as an additional control variable. The model was run on a reduced sample (n = 79 115) due to the high frequency of the answer categories 'don't know' and 'does not apply' for mother and father education (11.7%), which cannot be computed in the parental education variable. Results were comparable to the presented model and are available in Supporting information, Table S5.

model III (between-country model), we estimated the influence of country variables on students' high risk of PG. Additionally, to investigate the factors associated with high risk of PG, we calculated odds ratios (ORs) and 95% confidence intervals (CIs) through two-level logistic regression models. The random-effect factor (country) was included in all models to allow for possible heterogeneity. For the purpose of this study, only adolescents with complete data in the variables of interest (*n* = 88 118) were included in the final analyses. The analyses were not pre-registered, and therefore results should be considered exploratory.

RESULTS

Preliminary analyses

Twenty per cent of respondents in the total sample met the criteria for high risk of PG, with a prevalence observed among males (30.8%) more than triple that reported by females (9.4%). With regard to country prevalence, Danish youth reported the lowest rate of PG (12.0%), whereas Romanian adolescents the highest (30.2%). Concerning gender differences by country, Portugal presented the highest difference (42.9% for males versus 7.3% for females) (Supporting information, Table S2). Descriptive statistics for the individual and country-level variables are summarized in Table 1.

Factors associated with high risk of PG

The estimates of the HLM models are shown in Table 2. We started the analyses by fitting an unconditional model (model I) and comparing the empty model at one level with the empty model at two levels. This comparison revealed a significant main effect of the countries.

The within-country model (model II) included the demographic and family variables, controlling for the average amount of time spent on gaming on a school day. Findings indicated that females were less likely to be at high risk of PG. Daily number of hours spent on gaming was positively associated with high risk of PG. Among family variables, adolescents who experienced stronger parental regulation and higher family support reported lower risk of PG, whereas parental monitoring showed no significant association with the risk of PG. Furthermore, results evidenced that living within a non-traditional family structure may constitute a potential risk factor for PG. Finally, students' perception of their family economic status was not associated with high risk of PG.

The between-country model (model III) includes country variables (30 European countries). Family benefits (% of GDP) were negatively associated with high risk of PG. Thus, adolescents who live in a country in which welfare family benefits are higher have a lower likelihood of reporting gaming-related problems. In addition, the Gini coefficient for economic inequality was found to be positively associated with the risk of PG.

To account for between-country variability, we added the cross-level interaction between family benefits and family variables (regulation, monitoring and support), but we did not find any significant interaction.[2]

DISCUSSION

The aim of the current study was to test the contribution of individual (self-reported) and country-level indicators in explaining the risk of PG in a representative sample of adolescents living in 30 European countries. Among individual factors, our findings confirmed that being male increased the risk of PG [12]. This could be possibly due to neurobiological mechanisms, such as craving-related activations to gaming cues [46] and gaming culture (design features and interpersonal dynamics) favouring male participation [47]. Additionally, a positive association emerged between time spent playing and high risk of PG, in accordance with extant research [4, 6].

In this study, family variables reported by students were conceptually divided into two types: demographic/structural characteristics and relational–emotional factors. In line with previous research [48], our study revealed that adolescents living within a non-traditional family structure (e.g. single parents, stepfamilies) were at higher risk of PG, as these families may experience more difficulties in providing adequate resources or fulfilling individuals' needs [49]. Moreover, in accordance with findings identified in a systematic review [50], subjective assessment of family economic status was not associated with high PG risk.

One of the most important results of this study concerned the active role of parents in reducing adolescents' risk of PG, in terms of parental regulation and family support. Living in a family where limits on children's activities (including gaming) are clear could prevent the risk of PG [51] as adolescents' attention may be directed towards other recreational pastimes; for instance, physical activity [52]. However, especially in adolescence, parental regulation should occur in a context where youths perceive autonomy-supporting parenting, rather than coerciveness, as empathic communication and negotiation favour compliance to rules [53]. Consequently, a warm family environment offering the possibility of receiving emotional support was found to reduce the risk of PG [50]. As adolescents may play videogames in the attempt to cope with everyday stressors [54], being supported by family members when facing the complex challenges of adolescence appears to be crucial. Finally, parental monitoring was not related to the risk of PG. In this study, parental monitoring refers to general (not gaming-specific) parental knowledge of the children's whereabouts and it may play a crucial role in the development of risky behaviours entailing illegal and anti-social activities such as gambling, substance use or delinquency [55]. However, it may exert a less salient influence in reducing problems with gaming, as this is a socially accepted activity [7] and is likely to occur at home. Thus, rather than

[2]We thank an anonymous reviewer who suggested to check the interaction effect between family socio-economic status and parental regulation/monitoring/support on PG risk. No significant interactions were identified.

TABLE 1 Descriptive statistics for the individual- and country-level variables by risk of problematic gaming (PG)

Level 1 individual													Level 2 country	
	Gaming hours on a school day Mean (SD)		Living with both parents (%)		Parental regulation Mean (SD)		Parental monitoring Mean (SD)		Family support Mean (SD)		Perception of high family economic status (%)		Gini coeff. (%)	Benefits families/children (% of GDP)
Country	Lpg	Hpg	Lpg	Hpg	Lpg	Hpg	Lpg	Hpg	Lpg	Hpg	Lpg	Hpg		
Austria	2.08 (1.48)	3.54 (1.76)	71.9	62.7	3.48 (1.16)	3.23 (1.27)	1.58 (0.97)	1.78 (1.07)	5.81 (1.61)	5.41 (1.87)	92.0	92.0	27.5	2.7
Bulgaria	2.68 (1.59)	2.92 (1.75)	71.1	62.4	3.02 (1.26)	2.61 (1.32)	1.68 (1.07)	1.84 (1.15)	5.22 (2.12)	4.72 (2.30)	94.9	93.4	40.8	1.8
Croatia	2.25 (1.37)	3.38 (1.67)	80.4	79.7	2.92 (1.14)	2.75 (1.15)	1.65 (0.99)	1.92 (1.12)	5.80 (1.69)	5.61 (1.99)	93.0	91.9	29.2	1.8
Cyprus	2.06 (1.36)	2.65 (1.58)	81.5	73.2	3.16 (1.16)	2.78 (1.17)	1.41 (0.79)	1.63 (1.00)	5.96 (1.49)	5.57 (1.98)	90.0	88.1	31.1	1.2
Czechia	2.31 (1.40)	3.98 (1.35)	60.8	56.5	3.22 (1.01)	3.08 (0.98)	1.92 (1.09)	2.04 (1.08)	5.46 (1.79)	5.23 (1.97)	93.5	93.1	24.0	1.6
Denmark	2.63 (1.46)	4.14 (1.26)	73.4	77.5	3.64 (0.94)	3.46 (1.00)	1.52 (0.79)	1.54 (0.81)	5.89 (1.47)	5.63 (1.68)	93.4	93.1	27.5	3.4
Estonia	2.72 (1.56)	4.21 (1.33)	61.7	65.3	3.66 (1.12)	3.39 (1.13)	1.86 (1.06)	1.93 (1.07)	5.66 (1.51)	5.70 (1.50)	91.7	91.2	30.5	2.1
Finland	2.72 (1.44)	4.19 (1.35)	70.6	74.4	2.63 (1.10)	2.52 (1.08)	1.65 (0.89)	1.71 (0.87)	5.69 (1.59)	5.57 (1.83)	90.7	89.7	26.2	2.9
Germany	2.23 (1.37)	3.91 (1.35)	77.4	74.3	3.58 (1.01)	3.68 (1.00)	1.46 (0.84)	1.68 (1.01)	5.69 (1.50)	5.68 (1.46)	94.5	87.9	29.7	3.3
Greece	1.88 (1.28)	3.18 (1.69)	83.7	80.3	3.14 (1.18)	3.05 (1.22)	1.47 (0.86)	1.71 (0.99)	6.05 (1.32)	5.96 (1.39)	92.2	92.4	31.0	1.4
Hungary	2.22 (1.38)	3.50 (1.50)	65.8	65.9	3.52 (1.07)	3.25 (1.16)	1.44 (0.85)	1.58 (0.97)	5.63 (1.65)	5.52 (1.71)	95.7	94.2	28.0	2.2
Iceland	2.55 (1.73)	3.71 (1.86)	71.7	66.9	2.58 (1.13)	2.46 (1.16)	1.56 (0.85)	1.62 (0.90)	5.92 (1.62)	5.52 (1.99)	90.3	93.8	23.2	2.4
Ireland	1.87 (1.33)	3.03 (1.65)	78.3	73.6	2.64 (1.20)	2.57 (1.14)	1.72 (1.03)	1.81 (1.07)	5.38 (1.72)	5.26 (1.78)	90.8	90.8	28.3	1.2
Italy	2.15 (1.28)	3.07 (1.54)	71.4	69.2	2.87 (1.18)	2.59 (1.24)	1.63 (0.95)	1.67 (0.99)	5.67 (1.58)	5.52 (1.75)	87.6	87.8	32.8	1.8
Kosovo	1.76 (1.23)	2.31 (1.62)	88.6	79.3	2.07 (1.12)	1.91 (1.15)	1.43 (0.96)	1.54 (1.04)	5.89 (1.79)	5.16 (2.27)	98.9	99.2	29.0	0.1
Latvia	2.25 (1.54)	3.54 (1.71)	55.5	55.2	3.38 (1.16)	3.21 (1.14)	1.81 (1.04)	2.06 (1.12)	5.55 (1.68)	5.51 (1.74)	91.8	90.2	35.2	1.6
Lithuania	2.51 (1.47)	3.38 (1.66)	64.6	63.6	3.08 (1.17)	2.86 (1.20)	1.67 (0.94)	1.82 (1.00)	5.97 (1.54)	5.89 (1.68)	95.1	94.5	35.4	1.2
Malta	2.31 (1.40)	3.39 (1.65)	70.5	68.0	2.79 (1.11)	2.62 (1.10)	1.51 (0.88)	1.64 (0.91)	5.64 (1.62)	5.71 (1.61)	88.5	88.3	28.0	0.9
Montenegro	2.18 (1.41)	3.09 (1.72)	86.0	82.0	2.40 (1.20)	2.14 (1.19)	1.38 (0.82)	1.50 (0.91)	6.31 (1.34)	6.02 (1.78)	87.9	87.1	34.1	1.9
Netherlands	2.23 (1.38)	3.26 (1.62)	72.2	67.4	2.42 (1.12)	2.18 (1.07)	1.64 (0.87)	1.69 (0.86)	6.01 (1.33)	5.50 (1.60)	85.3	79.7	26.8	1.2
North Macedonia	2.01 (1.25)	2.87 (1.68)	83.4	74.0	2.70 (1.23)	2.39 (1.29)	1.57 (1.02)	1.59 (0.99)	5.77 (1.90)	5.32 (2.27)	91.2	92.7	30.7	0.9
Norway	2.46 (1.55)	3.78 (1.63)	75.8	72.6	2.35 (1.08)	2.39 (1.15)	1.60 (0.82)	1.72 (0.95)	5.75 (1.57)	5.49 (1.85)	93.3	91.6	25.4	3.2
Poland	2.67 (1.56)	3.75 (1.66)	74.0	72.8	3.43 (1.13)	3.19 (1.16)	1.85 (1.08)	2.09 (1.19)	5.15 (1.83)	4.79 (2.01)	91.8	91.7	28.5	2.6
Portugal	2.03 (1.31)	3.50 (1.57)	69.8	71.2	2.80 (1.17)	2.66 (1.14)	1.65 (0.94)	1.74 (0.97)	5.72 (1.54)	5.83 (1.46)	94.5	93.2	31.9	1.2
Romania	2.24 (1.48)	2.88 (1.68)	60.6	59.2	3.55 (1.22)	3.30 (1.33)	1.67 (1.09)	1.81 (1.17)	6.19 (1.39)	6.11 (1.54)	94.2	94.0	34.8	1.1
Serbia	2.07 (1.24)	3.07 (1.63)	78.7	78.8	3.21 (1.20)	2.95 (1.28)	1.48 (0.95)	1.70 (1.12)	6.22 (1.38)	6.05 (1.61)	85.3	84.8	33.3	1.2
Slovakia	1.93 (1.36)	3.18 (1.76)	71.1	67.2	3.26 (1.08)	3.02 (1.07)	1.83 (1.08)	2.00 (1.18)	5.15 (1.74)	5.04 (1.75)	94.3	94.0	22.8	1.6

(Continues)

TABLE 1 (Continued)

	Level 1 individual												Level 2 country	
	Gaming hours on a school day		Living with both parents (%)		Parental regulation		Parental monitoring		Family support		Perception of high family economic status (%)			Benefits families/children
	Mean (SD)				Mean (SD)		Mean (SD)		Mean (SD)				Gini coeff. (%)	(% of GDP)
Country	Lpg	Hpg	Lpg	Hpg	Lpg	Hpg	Lpg	Hpg	Lpg	Hpg	Lpg	Hpg		
Slovenia	1.95 (1.17)	3.30 (1.46)	80.8	77.2	3.21 (1.13)	2.96 (1.12)	1.56 (0.93)	1.80 (1.10)	5.74 (1.41)	5.59 (1.52)	85.4	87.3	23.9	1.8
Spain	1.98 (1.20)	3.18 (1.52)	74.0	71.4	2.62 (1.17)	2.53 (1.15)	1.67 (0.97)	1.81 (1.06)	5.75 (1.51)	5.45 (1.71)	92.2	91.3	33.0	1.2
Sweden	2.60 (1.43)	3.35 (1.60)	77.1	74.1	3.07 (1.14)	2.83 (1.21)	1.62 (0.88)	1.81 (1.00)	5.68 (1.54)	5.52 (1.80)	95.4	95.5	27.6	2.9
n	70 909	17 659	70 532	17 491	70 496	17 476	70 386	17 419	70 389	17 440	69 812	17 317	30	30
Total	2.25 (1.43)	3.32 (1.67)	73.7	71.2	2.99 (1.21)	2.79 (1.25)	1.61 (0.95)	1.75 (1.04)	5.77 (1.61)	5.61 (1.80)	91.7	91.2	29.67 (4.13)	1.81 (0.81)

Lpg = low risk of PG = 71 242; Hpg = high risk of PG = 17 756. Values are percentage frequency (%) or mean and standard deviation (SD).

focusing upon generic adolescents' whereabouts, future studies on PG should further examine parental knowledge of targeted gaming-related aspects, such as their children's playing motives (e.g. escapism) or favourite games genres (e.g. role-playing), which were previously found to be positively associated with increased levels of PG in adolescence [4, 12, 54].

The protective role of family benefits at the country-level confirmed the relevance of family-related factors in relation to adolescent risk of PG. Governmental investments in households may positively impact upon adolescent development both by directly increasing the availability of resources, in terms of goods, services and opportunities, and by indirectly improving family wellbeing [56, 57]. Indeed, in the family stress model framework [58], family functioning could be worsened by financial stress which can deplete the psychological and relational resources of care-givers, ultimately leading to more adjustment problems in adolescents. Given that PG has been previously associated with lower quality of family functioning [21, 50], the findings of the present study provided the first evidence that government expenditures on social protection policies, such as cash transfers, to support families in child-rearing, may reduce PG risk. As Bronfenbrenner & Morris [59] argued, proximal factors and macro-level determinants, such as social welfare systems and national wealth, can both exert pervasive influences on youth wellbeing. Contrary to our hypotheses, however, we did not find any cross-level interaction between family benefits and parental variables in the 30 European countries. This may be due to the fact that the effect has been previously tested for all countries in aggregate [57]. It is possible that more substantial effects would have been obtained if countries were grouped using welfare state typologies [60, 61], such as social democratic, conservative, liberal, southern and eastern [62], for which different returns from additional incomes on parental variables could be seen. Future multi-level research should investigate variations in PG by also considering the use of these welfare state typologies. Another explanation could be that family benefits may have a more direct impact on other parental mechanisms and characteristics associated to PG, which are not included in the present study. For instance, considering that economic hardship has been found to increase parental psychological distress and parental conflict [32], it may be interesting to examine the influence of additional incomes deriving from family benefits on these two variables, previously identified as risk factors for PG [21].

A further result of the current study showed a positive association between country-level inequalities and adolescents' likelihood of high risk of PG. This is in line with extensive literature on the detrimental effects of living in an unequal country on multiple components of wellbeing [25, 26]. It is possible that PG might be related to the preoccupation about the status deriving from a highly salient social hierarchy [63]. Adolescents living in such societies might be motivated to spend more time in virtual environments through videogames, where competition rules are different from the rules applying to real-world dynamics. However, it is worth noting that the effect was modest in magnitude. Future studies should explore the potential effect of the social hierarchy characterizing proximal environments, for example by investigating the role of relative deprivation at the school level.

TABLE 2 Correlates of the risk of problematic gaming (0 = low risk of PG, 1 = high risk of PG)

	Model I (unconditional model)			Model II			Model III		
Variables	**Coeff. (SE)**	***P*-value**	**OR (95% CI)**	**Coeff. (SE)**	***P*-value**	**OR (95% CI)**	**Coeff. (SE)**	***P*-value**	**OR (95% CI)**
Fixed effect									
Intercept	−1.39 (0.06)	< 0.001		−0.90 (0.09)	< 0.001		−0.93 (0.07)	< 0.001	
Individual level									
Gender (1 = male, 2 = female)				−1.06 (0.07)	< 0.001	0.34 (0.30–0.39)	−1.08 (0.07)	< 0.001	0.34 (0.29–0.39)
Gaming hours on a school day				0.34 (0.02)	< 0.001	1.41 (1.35–1.48)	0.35 (0.02)	< 0.001	1.42 (1.36–1.49)
Parental regulation				−0.20 (0.01)	< 0.001	0.81 (0.80–0.83)	−0.21 (0.01)	< 0.001	0.81 (0.79–0.83)
Parental monitoring				0.03 (0.01)	0.088	1.03 (0.99–1.06)	0.03 (0.01)	0.088	1.03 (0.99–1.06)
Family support				−0.07 (0.01)	< 0.001	0.93 (0.91–0.95)	−0.07 (0.01)	< 0.001	0.93 (0.91–0.95)
Perception of high family economic status				0.03 (0.04)	0.490	1.03 (0.95–1.10)	0.02 (0.03)	0.495	1.03 (0.95–1.10)
Living with both parents (0 = no, 1 = yes)				0.08 (0.03)	0.003	1.09 (1.03–1.15)	0.09 (0.03)	0.003	1.09 (1.03–1.15)
Country level (*n* = 30)									
Gini coefficient							0.05 (0.01)	< 0.001	1.05 (1.03–1.07)
Benefit families/children (% of GDP)							−0.24 (0.06)	< 0.001	0.78 (0.70–0.89)
Random effect									
Variance components	0.10 (0.31)	$\chi^2_{(29)} = 1549.62, P < 0.001$		0.16 (0.40)	$\chi^2_{(29)} = 2002.85, P < 0.001$		0.05 (0.24)	$\chi^2_{(27)} = 625.65, P < 0.001$	

The final model was as follows: PG = $\beta_{0j} + \beta_{1j} \times$ (gender) + $\beta_{2j} \times$ (gaming hours) + $\beta_{3j} \times$ (parental regulation) + $\beta_{4j} \times$ (parental monitoring) ++ $\beta_{5j} \times$ (family support) + $\beta_{6j} \times$ (family economic status) + $\beta_{7j} \times$ (family structure), $\beta_{0j} = \gamma_{00} + \gamma_{01} \times$ (Gini) + $\gamma_{02} \times$ (family/children benefits) + $\gamma_{03} \times$ (families with internet) + $u_{0j.}$ SE = standard error; OR = odds ratio; CI = confidence interval; GDP = gross domestic product. Individual random-effects tests examine hypotheses about whether the variance for each random intercept or slope (and their covariances) are significantly different from zero [45].

Limitations

This study is not without limitations. Although the ESPAD survey used the same methodology throughout participating countries, there are some limitations common to cross-sectional surveys that could possibly weaken the validity of the estimates. (1) Although students' participation rate was generally high, class participation rates were relatively low in Denmark and the Netherlands. (2) Data were self-reported and therefore possibly subjected to well-known biases. (3) The risk of PG was assessed with a three-item tool which, although proving appropriate for non-clinical surveys [11], may have limited accuracy in identifying problematic gamers [40]. This could potentially yield higher prevalence rates due to false positives [9]. As proposed by Carras & Kardefelt-Winther [64], given the complex phenomenology of PG and the current lack of a common measure, multi-national studies should investigate both gaming-related problems and the levels of addiction-related symptoms to define clearer boundaries for the condition. From an epidemiological perspective, it could also be relevant that future studies distinguish between the absence and low presence of PG risk. Furthermore, our findings on parental practices (regulation and monitoring) should be interpreted with caution, as the formulation of the items used for the assessment did not explicitly refer to gaming behaviours. Ultimately, while our comprehensive research focused upon several individual- and country-level factors, the influence of other variables, including game characteristics (e.g. genres, always-on-line gameplay, monetization), settings (e.g. peer, school) and country-level indicators (e.g. digital literacy) on the risk of PG may also be analysed. (4) Finally, the results may be considered representative only for 15–16-year-old students in regular schools and therefore they may be not extendable to adolescents not involved in education pathways.

CONCLUSIONS

This multi-level study presented several strengths, including the representativeness of the samples and the high number of countries. The findings highlighted the value of simultaneously considering family characteristics and country-level determinants in gaming research to inform decisions on resources including preventive interventions. Beyond supportive family environments, results indicated that lower country economic inequalities and more generous government expenditures in family benefits can protect adolescents from experiencing gaming-related problems. Future efforts for PG prevention should target both families to enhance parents' awareness of the role of family dynamics on offsprings' behaviours, and national governments, to promote social protection policies supporting positive youth development, thus reducing the risk of PG.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the members of the ESPAD Group who collected the nationaldata (http://www.espad.org/report/acknowledgements) and the funding bodies who supported the international coordination of ESPAD: the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) and the Institute of Clinical Physiology, CNR, Pisa, Italy who also compiled the common ESPAD trend database (1995–2019). Special thanks are due to the schoolchildren, teachers and national funding bodies who made this project possible.

DECLARATION OF INTERESTS

None.

AUTHOR CONTRIBUTIONS

Emanuela Colasante: Data curation; formal analysis; methodology; resources; supervision; validation. **Erika Pivetta:** Conceptualization; data curation; formal analysis; investigation; visualization. **Natale Canale:** Conceptualization; formal analysis; investigation; supervision; validation. **Alessio Vieno:** Conceptualization; formal analysis; investigation; software; supervision; validation. **Claudia Marino:** Formal analysis; investigation; validation. **Michela Lenzi:** Formal analysis; investigation; validation. **Elisa Benedetti:** Data curation; formal analysis; methodology; project administration; resources. **Daniel King:** Investigation; supervision; validation. **Sabrina Molinaro:** Funding acquisition; methodology; project administration; resources; supervision; validation.

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How to cite this article: Colasante E, Pivetta E, Canale N, Vieno A, Marino C, Lenzi M, et al. Problematic gaming risk among European adolescents: a cross-national evaluation of individual and socio-economic factors. Addiction. 2022;1–10. https://doi.org/10.1111/add.15843