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Mental health and behavioral problems associated with video game playing among Brazilian adolescents

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ABSTRACT

Background: The problematic use of video games is linked to mental health and behavioral problems among adolescents. World reported averages for problematic use range from 1.3% to 19.3%. This is the first study to investigate these problems among Brazilian adolescents.

Objectives: This study aimed to describe the prevalence of the non-problematic and problematic use of video games among Brazilian adolescents, and to assess mental health and behavioral problems associated with both types of use.

Methods: This study used the baseline data of a cluster randomized controlled trial that evaluated the effectiveness of the school-based program #Tamojunto2.0. The sample included 3,939 eighth-grade students who answered an anonymous self-report questionnaire. Video game use was investigated through a question, and problematic use was assessed using a scale. Weighted logistic regressions were used to investigate the associated factors.

Results: The results show that 85.85% of the children reported playing video games in the past year, 28.17% fulfilled our criteria for problematic use. Non-problematic video game use is associated with being male, younger ages, and bullying perpetration. Problematic video game use is associated with being male, tobacco and alcohol use, bullying perpetrators, and bullying victims, with abnormal levels of hyperactivity/inattention, social behavior problems, conduct problems, peer relationship problems, and emotional symptoms.

Conclusion: Brazilian adolescents' self-reported use of video games is compatible with the world average, but the percentage of those who showed problematic use is higher than the world average. This study demonstrates the need for investigating how to prevent and intervene in this situation.

KEYWORDS

Internet gaming disorder; adolescents; video games; epidemiology

Introduction

Video games are a common form of entertainment, with a diverse audience ranging from children to adults. It is constantly growing and gaining increased relevance as a prominent industry, which is reshaping how people interact with the world.¹ International literature has investigated different aspects involving video game playing and its effects on adolescents.²

There is currently a debate as to whether video game use is either beneficial or detrimental to its players and under which conditions.³ Different studies have shown that some of the possible gains in playing video games are improvements

in visual-spatial and social abilities, as well as the learning of specific skills.³ It has been shown that action video games can improve different skills, such as contrast sensitivity function,⁴ speed of processing⁵ and spatial resolution of vision.⁶ But, as video games vary widely in content and mechanisms, the effects of playing may also vary greatly, that is, educational games could teach educational content; games designed to teach health content might teach those concepts but the violent games may teach the violent content.⁷

Taking this into account, the possible negative outcomes of playing video games may be the enhancement of violent behaviors, diminishment

of pro-social behaviors, lower academic performance, enhancement of attentional problems, and addiction.^{3,8}

The prevalence of adolescent video game playing varies according to country; for example, 98.5% in Norway,⁹ 65.4% in Hungary,¹⁰ 92.5% in Finland,¹¹ and 88% in the United States of America (USA).¹² One hypothesis as to why the prevalence varies so much has to do with how the sample of each study was recruited and how this behavior was investigated in their respective questionnaires.

The problematic use of video games has been receiving increased attention from important health organizations. The American Psychiatric Association (APA) and the World Health Organization (WHO) included disorders related to pathological video game usage within the latest versions of their respective diagnostic manuals.^{13,14} The Diagnostic and Statistical Manual, fifth edition (DSM-5)¹³ states that Internet Gaming Disorder may be described as a “persistent and recurrent use of the Internet to engage in games, often with other players, leading to clinically significant impairment or distress”.

Different names have been used in the literature to describe this pathological use, including concepts like behavioral addiction or an addictive disorder; in this study the term problematic use was utilized as suggested by¹⁵ since it reflects the current nature of the understanding of the construct, and also includes different ranges of the condition.

When looking at the problematic use of this media format, prevalence has not been established,¹³ but it does seem to vary greatly.² found that the prevalence of this problematic use varies from 1.3% to 19.9% among adolescents worldwide. When looking at nationally representative samples of adolescents, the prevalence of problematic video game playing was 2.7% in Norway,⁹ 1.7% in Germany,¹⁶ 4.6% in Hungary,¹⁰ 9.1% in Finland,¹¹ 1.6% in seven other European, 3.6% according to a different European study,¹⁷ and 8.5% in the USA.¹² Such striking differences in prevalence may be due to variations in the methods used in each of these studies. For example, sampling may either be self-recruited or not representative of the target population.¹⁸ Differences may also occur depending on the instrument used

to screen the population and the cutoff point utilized between normal and problematic use.²

Moreover, studies have been consistent in showing that the problematic use of video games is associated with an array of behavioral and mental health conditions, such as aggression,^{12, 19–21} smoking and other drug use,²² impulse control problems,^{12, 16,17, 23} anxiety,^{11, 16, 18, 24} depression,^{11, 18, 24–26} lowered self-esteem,²⁵ earlier onset use of alcohol, tobacco, and cannabis,²⁷ being bullied and/or bullying others,²⁸ low social competence,^{29,30} and skipping school classes.²⁶ In terms of populations found to be more at risk of problematically playing video games,² research usually points to males and younger users.

There are many aspects of gaming that contribute to its problematic onset and maintenance as a problematic behavior. As a complex psychological condition, it involves neurobiological, personality and motivational aspects. Structural characteristics of games may play an important role on the onset and maintenance of problematic gaming.³¹ This points out to the complexity of the field and the need to access it from a multidisciplinary viewpoint.

As the Brazilian video game market is thriving, currently it has the largest revenue in Latin America and is 12th globally,³² and the growth potential is even more promising for the future, as infrastructure in the country has been improving.³³ Further research is required about the problematic and non-problematic use of video games in populations that have not yet been investigated. Also, there is a particular lack of studies situated within Latin American countries and of low- and middle-income countries in general.² This need for further studies on pathological video gaming is stressed, for example, by the APA, which describes this disorder in its “Conditions for Further Study” section.

The hypotheses tested were that video game non-problematic use would be frequent and below the world average, as the population investigated has lower income than the population commonly investigated and video games tend to be expensive. Another hypothesis was that problematic use would be higher than world average, as low income populations are associated with higher risk for mental health problems in general.³⁴

Therefore, the aim of the present study was to describe the prevalence of the non-problematic versus the problematic use of video games among Brazilian adolescents, and to assess whether sociodemographic factors, alcohol and tobacco use, bullying, victimization and perpetration, and mental health conditions are associated with both types of video game use.

Methods

This study was registered in the Brazilian Ministry of Health's Registry of Clinical Trials (Registro Brasileiro de Ensaios Clínicos—REBEC) under number RBR-8cnkqw. The study protocol was approved on August 8th, 2018 by the Universidade Federal de São Paulo research ethics committee (protocol 2.806.30).

Study design

This study was a cross-sectional survey, nested in a cluster randomized controlled trial (RCT) to evaluate drug prevention program in schools, based on the European program “Unplugged”³⁵ (<https://www.eudap.net/>) which has already been culturally adapted in Brazil and is known as #Tamojunto 2.0. The 50 minutes long classes used interactive methods to provide information about drugs, social and interpersonal skills and personal skills. The RCT³⁶ showed that the program reduced alcohol initiation, among 8th grade students in Brazil. The present research examined the baseline data gathered prior to the application of the intervention of the program and analyzed its focus on video game use.

Sampling

The sample consisted of eighth grade students (average age = 13.20 ± 0.84) from public schools in the cities of São Paulo, Eusebio, and Fortaleza. PASS 15.0 software was used to calculate sample sizes of the two groups in a cluster RCT.³⁷ The sample size was estimated to reach a power of 82% in identifying a difference between groups of 2.5%, with an initial prevalence of 10%, a significance level of 5% and an intraclass correlation of 0.005. More information about the randomization process are in^{36, 38} According to³⁶ 5,371

students were present during the baseline data collection. However, of the total number of students who participated in the RCT, 3,939 were subjects of the present study, as 1,432 of the total sample did not answer the questions in the questionnaire that evaluated the variables investigated here.

Consent to participate in the study was obtained from the schools' directors before randomization and, from students and parents, after randomization.

Instruments and variables

The data were collected through an anonymous questionnaire completed by the participants and administered by researchers in the classroom, without the presence of the teacher. The questionnaire was developed and tested by the European Union Drug Abuse Prevention (EU-DAP) program and has been used in previous studies on the effectiveness of the Unplugged program.³⁹ A version that had been translated into and adapted for use by Portuguese language speakers was used in Brazil,⁴⁰ with some questions replaced by items from two questionnaires that have been widely used in various studies of Brazilian students: a WHO questionnaire used in the VI Brazilian Survey of Drug Use among Students⁴¹ and the questionnaire of the National Survey of Student Health (Pesquisa Nacional de Saúde do Escolar – PENSE) used by the Brazilian Ministry of Health.⁴² In addition, questions on eating disorder symptoms,⁴³ bullying,⁴⁴ mental health symptoms,⁴⁵ and video game use¹³ were added. Further details regarding the study instrument are presented by⁴⁶ that also show the questionnaire validation.

In the present study, there were two outcome variables assessed: the non-problematic and problematic use of video games in the past year. Data relating to video game use was gathered through a dichotomous (yes or no) question, with video game abuse being assessed using a nine-item dichotomous (yes or no) scale, based on the DSM-5.¹³ The nine criteria described in the manual were converted into “yes” or “no” questions, with the language being simplified in order to make the items more understandable and relatable to teenagers. To be considered an abusive

user, the adolescent had to have answered “yes” to five or more of the nine questions, which is the same criteria presented in the DSM-5¹³ for diagnosing Internet Gaming Disorder.

The explanatory variables were analyzed:

Adolescent drug use: The use (yes or no) of alcohol and tobacco over the past year was assessed with two questions;

Bullying victimization and perpetration: these variables were measured using two dimensions of bullying victimization (ranging from 0 to 7, where a higher score represents greater bullying victimization) and perpetration (ranging from 0 to 8, where a higher score represents greater bullying perpetration). Data relating to bullying victimization and perpetration were collected through the Olweus Bully/Victim Questionnaire.⁴⁴ This instrument consists of a two-dimensional scale that investigates episodes of bullying in school— one to assess bullying victimization with seven dichotomous questions (yes or no). The other scale, to assess bullying perpetration, consists of eight dichotomous questions (yes or no). In this questionnaire, students indicated if they had experienced repeatedly, in the last 30 days, specific types of bullying, including verbal, physical, and relational bullying.⁴⁴ With regards to the reliability and validity of the bullying perpetration and victimization scales, previous studies from different countries have reported good internal consistency, with a Cronbach’s alpha ranging from 0.80 to 0.90.⁴⁷

The *sociodemographic data* collected included participants’ gender, age, and socioeconomic status. Students’ socioeconomic status was assessed using the scale of the Brazilian Association of Research Companies (Associação Brasileira de Empresas de Pesquisa - ABEP),⁴⁸ which takes into account the head of the household’s education and the goods and services used. Scores ranged from 0 to 100 being arranged in categories from A to E, with socioeconomic classes being ranked from A (highest) to E (lowest).

Mental health status was evaluated using the Strengths and Difficulties Questionnaire (SDQ).⁴⁵

⁴⁹ This scale evaluates children’s and adolescents’ mental health by asking them to answer 25 questions about events occurring in the last six months. The 25 items are divided into five scales

with five items each, generating scores for Conduct Problems, Inattention/Hyperactivity, Emotional Symptoms, Peer Problems, and Prosocial Behaviors. Its psychometric properties are adequate for the Brazilian population.⁴⁵ Results were classified as normal, borderline, or abnormal in each of the scales. In this research, borderline respondents were classified as normal.

Statistical analysis

Analyses were performed using weighted data to correct the unequal probabilities of the sample selection. Sample weights considered each participants’ school as the primary sampling unit, with stratification by city, the total number of students expected in each class, those present on the day of the survey, and the total universe expected in each city according to the national registry (Instituto Nacional de Estudos e Pesquisa Educacionais Anísio Teixeira [INEP]). We considered each school as a cluster.

Stata 16 program was used, with survey (svy) commands, for descriptive statistics on the weighted percentages (wgt%). To determine the relationship between the outcome and explanatory variables (adolescents’ alcohol and tobacco use, bullying victimization and perpetration, ABEP score, gender, age, and psychological attributes), a Pearson’s correlation test was used for each one.

The same program was used to run both the univariate and multivariate logistic regressions,⁵⁰ with exploratory variables affecting the outcome measure. An initial univariate logistic regression, including the explanatory variables with a p-value of ≤ 0.20 , was considered. A backward procedure was used to remove the explanatory variables with $p \geq 0.05$, aiming to obtain a final model for each response variable. Inferential point estimates are given in odds ratios (ORs) with their respective 95% confidence intervals (CIs) and p-values. The level of significance was set at 5%.

Results

Table 1 presents the sociodemographic characteristics of the students that answered the question regarding whether they played video games ($n = 3,939$). There was a balance found between

Table 1. Distribution of the sample according to sociodemographic variables, alcohol and tobacco use, bullying, clinical level mental health problems (SDQ), and non-problematic and problematic video game use (N=3939).

	N	wgt%	wgt95%CI
Sex			
Boys	1910	49.40	[48.14; 50.66]
Girls	1984	50.60	[49.34; 51.86]
Age (years)			
12 – 14	3848	92.24	[91.22; 93.15]
15 – 17	310	7.76	[6.85; 8.78]
Average Age	13.20 ± 0.84		
ABEP score^a			
	24.89 ± 9.30		
A (45-100)	146	4.22	[3.64; 4.88]
B (29-44)	975	27.31	[25.04; 29.70]
C (17-28)	2122	53.97	[52.36; 55.57]
D/E (1-16)	657	14.51	[12.92; 16.26]
Adolescent Past-Year Drug Use			
Alcohol	1336	35.77	[34.49; 37.07]
Tobacco	259	6.40	[5.79; 7.06]
Bullying^b			
Victim (from 1 yes)	1691	44.41	[43.06; 45.76]
Practitioner (from 1 yes)	1052	28.10	[26.86; 29.38]
Psychological Attributes^c			
Hyperactivity/Inattention	638	17.12	[16.00; 18.29]
Prosocial Behavior	492	13.18	[12.49; 13.91]
Conduct Problems	760	20.46	[19.33; 21.63]
Peer Relationship Problems	492	12.95	[12.11; 13.83]
Emotional Symptoms	752	19.42	[18.54; 20.33]
Videogame Past-Year Use	3396	85.85	[85.05; 86.63]
Problematic Video Game Use	1077	28.17	[27.09; 29.28]

^aSocioeconomic status according to ABEP.

^bOlweus Bully/Victim Questionnaire.

^cStrengths and Difficulties Questionnaire (SDQ).

male (49.40%) and female (50.60%) students, with the majority of students being aged between 12 and 14 years old (92.24%) and belonging to the middle socioeconomic class (53.97%). Moreover, the results show that the drug most used by these students in the last year was alcohol (30.94%), with 44.41% of the students being victims of bullying, and the psychological attribute with a higher percentage of cases being a problem. In total, 85.85% of the children reported playing video games in the previous year, with 28.17% of the total sample fulfilling the DSM-5¹³ criteria for problematic use.

Table 2 shows the distribution of the study data, with the percentage and standard error, of video games non-problematic and problematic users according to the sociodemographic variables (sex, age, and socioeconomic status),

alcohol and tobacco use, bullying, and mental health symptoms. The data shows that both non-problematic and problematic video game use are more prevalent among males (95.54% and 36.68%, respectively), and, with regard to social classes, problematic use is more frequent among the upper class (44.42% versus 29.81%, 26.49% and 26.36%). Bullying perpetration was slightly more frequent among video game users (88.93% vs. 84.81%), with this difference being higher among problematic video game users (42.63 vs. 22.45%). Regarding bullying victimization, problematic video game users reported a higher frequency (36.23% vs. 21.53%). Tobacco and alcohol use, and all mental health symptoms, were significantly more frequent among those who used video games problematically.

Table 3 presents the results of the univariate and multivariate logistic regressions for non-problematic video game use. In the final model, video game use was associated with being male (aOR = 7.08, CI = 6.00 to 8.35), participants' age (aOR = 0.79, CI = 0.74 to 0.84), and bullying perpetration (aOR = 1.48, CI = 1.28 to 1.71). Sex is the variable with the greatest association with playing video games; males are 608% more likely to play than females, while the self-report of bullying perpetration is associated with a reported 48% higher prevalence of video game use.

Table 4 presents the results of the univariate and multivariate logistic regressions for problematic video game use. The strongest association with problematic video game use was found with sex: males are 3.43x more likely to report this problem, followed by adolescents with conduct problems and those with emotional symptoms – the latter are 2.03x and 1.95x more likely to report it, respectively.

Discussion

The present study used baseline data from a RCT from a representative sample of eighth grade students from three cities in Brazil to investigate the relationship between this population and their non-problematic and problematic video game use. The literature on this topic mostly comes from high-income countries, meaning that this study is important as it broadens the understanding of

Table 2. Distribution of non-problematic and problematic video game users according to sociodemographic variables, alcohol and tobacco use, bullying, and abnormal level mental health problems (SDQ).

	Non-problematic video game use (N=3939)										Problematic video game use (N=3778)									
	No					Yes					No					Yes				
	N	%	SE	N	%	SE	N	%	SE	p-value	N	%	SE	N	%	SE	p-value			
Sex																				
Male	89	4.46	0.330	1821	95.54	0.330	1147	63.32	0.793	<0.001	670	36.68	0.793	670	36.68	0.793	<0.001			
Female	446	23.45	0.717	1538	76.55	0.717	1521	80.01	0.628		397	19.99	0.628	397	19.99	0.628				
Age																				
12 a 14	479	12.30	0.420	3059	86.16	0.420	2440	72.11	0.560	<0.001	958	27.89	0.560	958	27.89	0.560	0.080			
15 a 17	54	18.93	1.362	256	81.07	1.362	201	69.30	1.569		95	30.70	1.569	95	30.70	1.569				
SES																				
A	17	12.30	2.387	129	87.70	2.387	81	55.58	3.035	<0.001	62	44.42	3.035	62	44.42	3.035	<0.001			
B	103	10.62	0.583	872	89.38	0.583	657	70.19	1.341		281	29.81	1.341	281	29.81	1.341				
C	301	15.22	0.534	1821	84.78	0.534	1479	73.51	0.815		558	26.49	0.815	558	26.49	0.815				
D/E	119	17.78	0.859	538	82.22	0.859	458	73.64	1.001		166	26.36	1.001	166	26.36	1.001				
Tobacco use																				
No	503	14.20	0.410	3135	85.80	0.410	2533	72.81	0.419	0.832	959	27.19	0.419	959	27.19	0.419	<0.001			
Yes	37	14.56	1.640	222	85.44	1.640	139	56.14	1.819		111	43.86	1.819	111	43.86	1.819				
Alcohol use																				
No	357	14.14	0.487	2217	85.86	0.487	1859	75.51	0.605	0.855	610	24.49	0.605	610	24.49	0.605	<0.001			
Yes	184	14.29	0.701	1152	85.71	0.701	822	65.33	0.842		458	34.67	0.842	458	34.67	0.842				
Bullying Perpetration																				
No	412	15.19	0.463	2379	84.81	0.463	2070	77.55	0.495	<0.001	615	22.45	0.495	615	22.45	0.495	<0.001			
Yes	113	11.07	0.604	939	88.93	0.604	581	57.37	1.136		439	42.63	1.136	439	42.63	1.136				
Bullying Victimization																				
No	298	14.09	0.529	1878	85.91	0.529	1620	78.47	0.596	0.932	459	21.53	0.596	459	21.53	0.596	<0.001			
Yes	233	14.15	0.525	1458	85.85	0.525	1045	63.77	0.766		599	36.23	0.766	599	36.23	0.766				
Hyperactivity/ Inattention																				
Absent	414	13.93	0.432	2681	86.07	0.432	2211	73.46	0.580	0.231	808	26.54	0.580	808	26.54	0.580	<0.001			
Present	97	15.11	0.920	541	84.89	0.920	387	62.55	1.245		240	37.45	1.245	240	37.45	1.245				
Prosocial Behavior																				
Normal	443	13.98	0.404	2745	86.02	0.404	2261	73.28	0.622	0.461	842	26.72	0.622	842	26.72	0.622	<0.001			
Problematic	69	14.82	1.109	423	85.18	1.109	301	62.59	1.706		178	37.41	1.706	178	37.41	1.706				
Conduct Problems																				
Absent	422	14.47	0.507	2561	85.53	0.507	2217	76.39	0.638	0.171	694	23.61	0.638	694	23.61	0.638	<0.001			
Present	93	13.07	0.749	667	86.93	0.749	383	52.53	1.060		358	47.47	1.060	358	47.47	1.060				
Peer Relationship Problems																				
Absent	443	14.22	0.449	2797	85.78	0.449	2329	73.92	0.546	0.600	837	26.08	0.546	837	26.08	0.546	<0.001			
Present	68	13.57	1.073	424	86.43	1.073	268	55.69	1.746		210	44.31	1.746	210	44.31	1.746				
Emotional Symptoms																				
Absent	388	13.37	0.450	2599	86.63	0.450	2159	74.21	0.629	<0.001	756	25.79	0.629	756	25.79	0.629	<0.001			
Present	125	17.42	0.819	627	82.58	0.819	439	60.30	1.002		295	39.70	1.002	295	39.70	1.002				

SE = Standard error.

Table 3. Logistic regression estimates for non-problematic video game use during the year prior to the according to sociodemographic variables, alcohol and tobacco use, bullying, and abnormal level mental health problems (SDQ) (crude and adjusted odds ratios).

	Non-problematic video game use (N=3939)					
	Univariate regression			Multivariate regression		
	cOR	95%IC	p-value	aOR	95%IC	p-value
Male	6.57	[5.58; 7.72]	<0.001	7.08	[6.00; 8.35]	<0.001
Age	0.90	[0.85; 0.96]	0.001	0.79	[0.74; 0.84]	<0.001
SES^a						
C	1.20	[1.03; 1.40]	0.019	–	–	–
B	1.82	[1.53; 2.15]	<0.001	–	–	–
A	1.54	[0.97; 2.43]	0.063	–	–	–
Tobacco use	2.09	[0.73; 1.27]	0.832	–	–	–
Alcohol use	0.99	[0.86; 1.13]	0.855	–	–	–
Bullying Perpetration	1.44	[1.26; 1.64]	<0.001	1.48	[1.28; 1.71]	<0.001
Bullying Victimization	1.00	[0.89; 1.11]	0.932	–	–	–
Hyperactivity/ Inattention	0.91	[0.78; 1.06]	0.231	–	–	–
Prosocial Behavior	0.93	[0.77; 1.12]	0.461	–	–	–
Conduct Problems	1.13	[0.95; 1.33]	0.171	–	–	–
Peer Relationship Problems	1.06	[0.86; 1.29]	0.600	–	–	–
Emotional Symptoms	0.73	[0.64; 0.83]	<0.001	–	–	–

^aReference group for socioeconomic status was the lowest level (D/E).

Table 4. Logistic regression estimates for problematic video game use during the year prior to the according to sociodemographic variables, alcohol and tobacco use, bullying, and abnormal level mental health problems (SDQ) (crude and adjusted odds ratios).

	Problematic video game use (N=3778)					
	Univariate regression			Multivariate regression		
	cOR	95%IC	p-value	aOR	95%IC	p-value
Male	2.32	[2.11; 2.55]	<0.001	3.43	[3.03; 3.89]	<0.001
Age	1.15	[1.11; 1.20]	<0.001	–	–	–
SES^a						
C	1.01	[0.88; 1.15]	0.919	–	–	–
B	1.19	[1.02; 1.37]	0.025	–	–	–
A	2.23	[1.69; 2.95]	<0.001	–	–	–
Tobacco use	2.09	[1.80; 2.42]	<0.001	1.20	[1.01; 1.44]	0.044
Alcohol use	1.64	[1.49; 1.79]	<0.001	1.29	[1.16; 1.43]	<0.001
Bullying Perpetration	2.57	[2.31; 2.84]	<0.001	1.71	[1.49; 1.96]	<0.001
Bullying Victimization	2.07	[1.90; 2.25]	<0.001	1.74	[1.56; 1.93]	<0.001
Hyperactivity/ Inattention	1.66	[1.47; 1.86]	<0.001	1.31	[1.15; 1.49]	<0.001
Prosocial Behavior	1.64	[1.40; 1.92]	<0.001	1.35	[1.11; 1.63]	0.002
Conduct Problems	2.92	[2.61; 3.27]	<0.001	2.03	[1.77; 2.31]	<0.001
Peer Relationship Problems	2.26	[1.94; 2.62]	<0.001	1.37	[1.15; 1.64]	0.001
Emotional Symptoms	1.89	[1.71; 2.09]	<0.001	1.95	[1.73; 2.20]	<0.001

^aReference group for socioeconomic status was the lowest level (D/E).

localized differences in video game use by examining adolescents in a low-income country. It was found that non-problematic video game playing is associated with being male, age, and bullying perpetration, while problematic video game playing is associated with being male, alcohol and tobacco use, bullying perpetration and victimization, as well as mental health problems. Brazilian data about sex differences are consistent with those of global studies, indicating that males are more at risk of both non-problematic and problematic playing than females.² The hypothesis as to why this global trend in these sex differences was repeated in the present population includes

the characteristics of the global video game industry, as there is a more frequent production of violent games⁸ which are usually more appealing and marketed to males than to females.⁵¹ Age differences in this sample were not significant, probably because the data were collected among eighth graders only, lowering the variability of ages among the adolescents.

Data here collected about the non-problematic use disconfirms the initial hypothesis, as Brazilian use (85.85%) was compatible to the world average (55% to 98.7%), and not below it.² Even though consoles and games costs are higher in Brazil, the local market is very strong on mobile games,

that are less expensive.³³ This explains Brazilian use not differing from the global average even though the local income is lower. The data about non-problematic use show that video gaming is highly prevalent among Brazilian teenagers; therefore, warrants further investigation.

The problematic use of video games was found to be highly prevalent (28.17%) in our study sample. This prevalence is more than three times higher than those in all of the samples investigated in other countries, that range from 1.3% to 19.9% worldwide.² There is a limitation to these comparisons as the studies vary in population and scales used, but the magnitude of the difference places Brazilian adolescents at high risk, as this condition is associated with many negative behaviors and mental health problems.² Some hypothesize that the seemingly higher prevalence of the problematic use of video games in Brazil when compared to other countries may have to do with difficulties in engaging in activities concurrent with video game playing, as longer time playing is a risk factor for problematic use.⁷ These difficulties – including poorer access to public services of leisure and sports and higher levels of violence – keep adolescents from going out to meet with friends and engage in offline activities.

The relationship between the problematic use of video games with both mental health symptoms and drug use that has been discussed in previous literature^{11,12, 16, 18, 22,23, 25,26, 30} was also found in this sample of Brazilian adolescents, as all drugs and mental health problems investigated here were more frequent among problematic users. These associations suggest that behavioral and mental health problems occur together, indicating that programs that aim to help adolescents overcome either one of these conditions should target both of them as a unit.

The present study found a significant difference in bullying perpetration for both non-problematic and problematic video game players, while bullying victimization was significantly higher among problematic video game players. How video game exposure relates to bullying is unclear in the existing literature, as some studies find a correlation between them and some do not.⁵² These differences may be explained by the method used to assess adolescent behaviors,

as well as the types of games played by the investigated sample, as different types of video games may lead to different effects on peoples' behaviors.⁷

This study has some limitations. This was a cross-sectional survey nested in a RCT; therefore, it was not possible to determine the temporal sequence of the analyzed variables, which means that we cannot infer causality in the associations found. Also, the comparisons presented here were made regarding studies that used different methods than the present one. Other studies also used different scales to assess the information around this topic; therefore, accurate literature comparisons may be limited. Another limitation is that the presented data did not analyze the type of games played by the adolescents or the amount of time spent playing daily, which is shown in the literature to be significant in determining problematic use.^{3, 7,8} Regarding the methods used, the main limitations of this study are that 26.6% of the data is missing. The analysis represents only complete cases. The authors opted to not perform multiple imputation since the patterns of missing were not missing completely at random or missing at random and, in this case, it is not possible to account for systematic differences. Another method limitation is the fact that the sample consisted of only public-school students (that represent 82% of the total students enrolled in elementary school⁵³) – private school students and adolescents that do not attend school were not considered.

Moreover, the present data was collected in March 2019, prior to the coronavirus pandemic that affected Brazil starting in the first school semester of 2020. As a result of social isolation measures adopted all over the world, video game use has spiked and has even been recommended by the general media.^{54–56} Therefore, new data should be gathered to understand how this unprecedented situation has changed the behaviors displayed in the present study.

As non-problematic and problematic digital media use is a recent field of study, especially in the Brazilian context, there are many suggestions for new research in order to understand how this population uses this type of media. This research found that richer adolescents are at higher risk of problematic use of video games, so future

research should also be conducted in private schools (which are usually attended by students with higher family incomes) to better assess this population. This research also found that many mental health problems are related to problematic video game use so future research could be conducted with clinically relevant instruments to better understand the relationship between mental health, pro-social behaviors, and video game use. Further studies should also be conducted to better understand why problematic use is so frequent in the population assessed here. As a high prevalence was found for problematic use, and its attendant problems, it is important that future studies focus on developing tools that may help screening adolescents in schools that are engaging in problematic playing, as part of a plan to help treat their associated conditions and develop a healthier gaming plan.

In conclusion, this study found that video game use is a highly common phenomenon in the population investigated here, and that problematic video game use has a particularly high prevalence in Brazil. Brazilian adolescents tend to spend time using videogames in a compatible way to the world average, but they seem more problematic than the world average. Problematic video game use is associated with all the behavioral and mental health problems studied here. This indicates that Brazilian adolescents – a population not previously investigated under these conditions – are at particular risk and that future research should be conducted to broaden the understanding of these problems, as well as provide information on how to prevent and solve them. The current study will hopefully contribute to the understanding of the effects of non-problematic and problematic video game playing among adolescents.

Authors' contributions


Luiza C. Brandão: Conceptualization; investigation; data curation; writing-original draft. Zila M. Sanchez: Conceptualization; funding acquisition; methodology; validation; writing-review & editing. Patrícia P. Galvão: Data curation; investigation; writing-review and editing. Márcia H.

S. Melo: Investigation; methodology; writing-review & editing.

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References

1. Webb K. The \$120 billion gaming industry is going through more change than it ever has before, and everyone is trying to cash in. *Business insider*; 2019. <https://www.businessinsider.com/video-game-industry-120-billion-future-innovation-2019-9>.
2. Mihara S, Higuchi S. Cross-sectional and longitudinal epidemiological studies of Internet gaming disorder: A systematic review of the literature. *Psychiatry Clin Neurosci*. 2017;71(7):425–44. doi:10.1111/pcn.12532.
3. Prot S, McDonald KA, Anderson CA, Gentile DA. Video games: good, bad, or other? *Pediatr Clin North Am*. 2012;59(3):647–58. doi:10.1016/j.pcl.2012.03.016.
4. Li R, Polat U, Makous W, Bavelier D. Enhancing the contrast sensitivity function through action video game training. *Nat Neurosci*. 2009;12(5):549–51. doi:10.1038/nn.2296.
5. Dye MWG, Green CS, Bavelier D. Increasing speed of processing with action video games. *Curr Dir Psychol Sci*. 2009;18(6):321–6. doi:10.1111/j.1467-8721.2009.01660.x.
6. Green CS, Bavelier D. Action-video-game experience alters the spatial resolution of vision. *Psychol Sci*. 2007;18(1):88–94. doi:10.1111/j.1467-9280.2007.01853.x.
7. Bavelier D, Green CS, Han DH, Renshaw PF, Merzenich MM, Gentile DA. Brains on video games. *Nat Rev Neurosci*. 2011;12(12):763–8. doi:10.1038/nrn3135.
8. Anderson CA, Bushman BJ. Effects of violent video games on aggressive behavior, aggressive cognition,

- aggressive affect, physiological arousal, and prosocial behavior: A meta-analytic review of the scientific literature. *Psychol Sci.* 2001;12(5):353–9. doi:10.1111/1467-9280.00366.
9. Johansson A, Götestam KG. Problems with computer games without monetary reward: Similarity to pathological gambling. *Psychol Rep.* 2004;95(2):641–50. doi:10.2466/pr0.95.2.641-650.
 10. Pápay O, Urbán R, Griffiths MD, Nagygyörgy K, Farkas J, Kökönyei G, Felvinczi K, Oláh A, Elekes Z, Demetrovics Z. Psychometric properties of the problematic online gaming questionnaire short-form and prevalence of problematic online gaming in a national sample of adolescents. *Cyberpsychol Behav Soc Netw.* 2013;16(5):340–8. doi:10.1089/cyber.2012.0484.
 11. Männikkö N, Billieux J, Kääriäinen M. Problematic digital gaming behavior and its relation to the psychological, social and physical health of Finnish adolescents and young adults. *J Behav Addict.* 2015;4(4):281–8. doi:10.1556/2006.4.2015.040.
 12. Gentile D. Pathological video-game use among youth ages 8 to 18: a national study. *Psychol Sci.* 2009;20(5):594–602. doi:10.1111/j.1467-9280.2009.02340.x.
 13. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed; Arlington, VA: American Psychiatric Association; 2013.
 14. World Health Organization. International statistical classification of diseases and related health problems. 11th ed; 2018. <https://icd.who.int/browse11/l-m/> <http://id.who.int/icd/entity/1448597234>.
 15. Fernandes B, Maia BR, Pontes HM. Internet addiction or problematic internet use? Which term should be used? *Psicologia USP.* 2019;30:e190020. doi:10.1590/0103-6564e190020.
 16. Rehbein F, Psych G, Kleimann M, Mediasci G, Mößle T. Prevalence and risk factors of video game dependency in adolescence: Results of a German nationwide survey. *Cyberpsychol Behav Soc Netw.* 2010;13(3):269–77. doi:10.1089/cyber.2009.0227.
 17. Strittmatter E, Kaess M, Parzer P, Fischer G, Carli V, Hoven CW, Wasserman C, Sarchiapone M, Durkee T, Apter A, et al. Pathological Internet use among adolescents: Comparing gamers and non-gamers. *Psychiatry Res.* 2015;228(1):128–35. doi:10.1016/j.psychres.2015.04.029.
 18. Reer F, Festl R, Quandt T. Investigating problematic social media and game use in a nationally representative sample of adolescents and younger adults. *Behav Inf Technol.* 2021;40(8):776–89. doi:10.1080/0144929X.2020.1724333.
 19. Festl R, Scharkow M, Quandt T. Problematic computer game use among adolescents, younger and older adults. *Addiction.* 2013;108(3):592–9. doi:10.1111/add.12016.
 20. Grüsser SM, Thalemann R, Griffiths MD. Excessive computer game playing: Evidence for addiction and aggression? *Cyberpsychol Behav.* 2007;10(2):290–2. doi:10.1089/cpb.2006.9956.
 21. Lemmens JS, Valkenburg PM, Peter J. Development and validation of a game addiction scale for adolescents. *Media Psychol.* 2009;12(1):77–95. doi:10.1080/15213260802669458.
 22. Desai RA, Krishnan-Sarin S, Cavallo D, Potenza MN. Video-gaming among high school students: Health correlates, gender differences, and problematic gaming. *Pediatrics.* 2010;126(6):e1414–e1424. doi:10.1542/peds.2009-2706.
 23. Choo H, Gentile D, Sim T, Li DD, Khoo A, Liau A. Pathological video-gaming among Singaporean youth. *Ann Acad Med.* 2010;39(11):822–9.
 24. Mentzoni RA, Brunborg GS, Molde H, Myrseth H, Skouvrøe KJM, Hetland J, Pallesen S. Problematic video game use: Estimated prevalence and associations with mental and physical health. *Cyberpsychol Behav Soc Netw.* 2011;14(10):591–6. doi:10.1089/cyber.2010.0260.
 25. Király O, Griffiths MD, Urbán R, Farkas J, Kökönyei G, Elekes Z, Tamás D, Demetrovics Z. Problematic Internet use and problematic online gaming are not the same: Findings from a large nationally representative adolescent sample. *Cyberpsychol Behav Soc Netw.* 2014;17(12):749–54. doi:10.1089/cyber.2014.0475.
 26. Rehbein F, Kliem S, Baier D, Mößle T, Petry NM. Prevalence of internet gaming disorder in German adolescents: Diagnostic contribution of the nine DSM-5 criteria in a state-wide representative sample. *Addiction.* 2015;110(5):842–51. doi:10.1111/add.12849.
 27. Coëffec A, Romo L, Cheze N, Riazuelo H, Plantey S, Kotbagi G, Kern L. Early substance consumption and problematic use of video games in adolescence. *Front Psychol.* 2015;6:501. doi:10.3389/fpsyg.2015.00501.
 28. Rasmussen M, Meilstrup CR, Bendtsen P, Pedersen TP, Nielsen L, Madsen KR, Holstein BE. Perceived problems with computer gaming and Internet use are associated with poorer social relations in adolescence. *Int J Public Health.* 2015;60(2):179–88. doi:10.1007/s00038-014-0633-z.
 29. Dreier M, Wölfling K, Duven E, Giralt S, Beutel ME, Müller KW. Free-to-play: About addicted Whales, at risk Dolphins and healthy Minnows. Monetization design and internet gaming disorder. *Addict Behav.* 2017;64:328–33. doi:10.1016/j.addbeh.2016.03.008.
 30. Müller KW, Janikian M, Dreier M, Wölfling K, Beutel ME, Tzavara C, Richardson C, Tsitsika A. Regular gaming behavior and internet gaming disorder in European adolescents: Results from a cross-national representative survey of prevalence, predictors, and psychopathological correlates. *Eur Child Adolesc Psychiatry.* 2015;24(5):565–74. doi:10.1007/s00787-014-0611-2.
 31. Király O, Nagygyörgy K, Griffiths MD, Demetrovics Z. Problematic online gaming. In: Rosenberg K, Feder L, editors. Behavioral addictions: Criteria, evidence and

- treatment. New York, NY: Elsevier, 2014. p. 61–97. doi:10.1016/B978-0-12-407724-9.00004-5.
32. Henrique A. 2021. Mercado de jogos no Brasil atingirá US\$2 bilhões em 2021. Olhar Digital. <https://olhardigital.com.br/2021/05/05/games-e-consoles/mercado-de-jogos-no-brasil-2021-pesquisa/>.
 33. Weustink J. Brazilian games market consumer insights: Brazil's mobile players are likelier to play competitive & midcore games. *Newzoo*; 2020. <https://newzoo.com/insights/articles/brazilian-games-market-consumer-insights-brazils-mobile-players-are-likelier-to-play-competitive-midcore-games/>.
 34. Reiss F. Socioeconomic inequalities and mental health problems in children and adolescents: A systematic review. *Soc Sci Med*. 2013;90:24–31. doi:10.1016/j.socscimed.2013.04.026.
 35. Kreeft PVD, Wiborg G, Galanti MR, Siliquini R, Bohrn K, Scatigna M, Lindahl A-M, Melero JC, Vassara M, Faggiano F. Unplugged': A new European school programme against substance abuse. *Drugs: Education, Prevention and Policy*. 2009;16(2):167–81. doi:10.1080/09687630701731189.
 36. Sanchez ZM, Valente JY, Galvão PP, Gubert FA, Melo MHS, Caetano SC, Mari JJ, Cogo-Moreira H. A cluster randomized controlled trial evaluating the effectiveness of the school-based drug prevention program #Tamojunto2.0. *Addiction*. 2021;116(6):1580–92. doi:10.1111/add.15358.
 37. Donner A, Klar N. Design and analysis of cluster randomization trials in Health Research. London, England: Arnold Publishers; 2000.
 38. Sanchez ZM, Valente JY, Pereira APD, Cogo-Moreira H, Melo MHS, Caetano SC, Mari JJ. Effectiveness evaluation of the school-based drug prevention program #Tamojunto2.0: Protocol of a cluster randomized controlled trial. *BMC Public Health*. 2019;19(1):1–10. doi:10.1186/s12889-019-7090-9.
 39. Faggiano F, Galanti MR, Bohrn K. EUDAP—European drug addiction prevention trial. *Policy*. 2008;16:167–81.
 40. Prado MC, de O, Schneider DR, Sañudo A, Pereira APD, Horr JF, Sanchez ZM. Transcultural adaptation of questionnaire to evaluate drug use among students: The use of the EU-Dap European questionnaire in Brazil. *Subst Use Misuse*. 2016;51(4):449–58. doi:10.3109/10826084.2015.1117108.
 41. Carlini ELA, Noto AR, Sanchez ZM, Carlini CMA, Locatelli DP, Abeid LR. VI Levantamento Nacional sobre o Consumo de Drogas Psicotrópicas entre Estudantes do Ensino Fundamental e Médio das Redes Pública e Privada de Ensino nas 27 Capitais Brasileiras – 2010/ E. A. Carlini (supervisão) [et al.]. São Paulo: CEBRID - Centro Brasileiro de Informações sobre Drogas; Psicotrópicas: UNIFESP - Universidade Federal de São Paulo; 2010. 503 p.
 42. IBGE, Instituto Brasileiro de Geografia e Estatística. *Pesquisa Nacional de Saúde do Escolar*; 2012.
 43. Morgan JF, Reid F, Lacey JH. The SCOFF questionnaire: Assessment of a new screening tool for eating disorders. *BMJ*. 1999;319(7223):1467–8. doi:10.1136/bmj.319.7223.1467.
 44. Solberg ME, Olweus D. Prevalence estimation of school bullying with the Olweus Bully/Victim Questionnaire. *Aggr Behav*. 2003;29(3):239–68. doi:10.1002/ab.10047.
 45. Fleitlich B, Cortázar PG, Goodman R. Questionário de capacidades e dificuldades (SDQ). *Infanto Rev. neuropsiquiatr. infanc. adolesc*. 2000;8(1):44–50.
 46. Galvão PP, de O, Valente JY, Millon JN, Melo MHS, Caetano SC, Cogo-Moreira H, Mari JJ, Sanchez ZM. Validation of a tool to evaluate drug prevention programs among students. *Front Psychol*. 2021;12:678091. doi:10.3389/fpsyg.2021.678091.
 47. Olweus D. School bullying: Development and some important challenges. *Annu Rev Clin Psychol*. 2013;9:751–80. doi:10.1146/annurev-clinpsy-050212-185516.
 48. ABEP Associação Brasileira de Empresas de Pesquisa. *Critério de Classificação Econômica Brasil*; 2016. <http://www.abep.org>.
 49. Goodman R. The strengths and difficulties questionnaire: A research note. *Child Psychol Psychiatr Allied Discipl*. 1997;38(5):581–6.
 50. Hosmer DW, Lemeshow S, Sturdivant RX. Applied logistic regression. Hoboken, NJ: John Wiley & Sons; 2013; vol. 398.
 51. Lemmens JS, Bushman BJ, Konijn EA. The appeal of violent video games to lower educated aggressive adolescent boys from two countries. *Cyberpsychol Behav*. 2006;9(5):638–41. doi:10.1089/cpb.2006.9.638.
 52. Ferguson CJ, Colwell J. A meaner, more callous digital world for youth? The relationship between violent digital games, motivation, bullying, and civic behavior among children. *Psychol Popular Media Cult*. 2018;7(3):202–15. doi:10.1037/ppm0000128.
 53. IBGE, Instituto Brasileiro de Geografia e Estatística. *Pesquisa Nacional por Amostra de Domicílios Contínua*; 2019.
 54. Gault M. I'm gaming my way through quarantine—and that's nothing to feel guilty about. *TIME*; 2020. <https://time.com/5824415/video-games-quarantine/>.
 55. Mamiit A. Steam breaks concurrent player record as gamers stay indoors due to coronavirus. *Digital Trends*; 2020. <https://www.digitaltrends.com/gaming/steam-new-concurrent-player-record-20-million/>.
 56. Owen P. 2020. 15 chill video games for your coronavirus quarantine. *The Wrap*. <https://www.thewrap.com/15-relaxing-chill-video-games-for-your-coronavirus-covid-19-quarantine/>.