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Who Is at Risk for Problematic Video Gaming? Risk Factors in Problematic Video Gaming in Clinically Referred Canadian Children and Adolescents

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Abstract: Both Internet and offline video gaming have become a normal aspect of child development, with estimates of children playing video games ranging from 90% to 97%. Research on problematic video gaming (PVG) has grown substantially in the last decade. Much of that research has focused on community samples, while research on clinically referred children and youth is lacking. The present study includes 5820 clinically referred children and youth across 44 mental health agencies, assessed using the interRAI Child and Youth Mental Health Assessment. Logistic regression analyses revealed that older age, male sex, extreme shyness, internalizing symptoms, externalizing symptoms, and poor relational strengths are all significant predictors of problematic video gaming (PVG). Further analyses suggested that, out of the internalizing symptoms, anhedonia was predictive of PVG in both males and females, but depressive symptoms and anxiety were not predictive of PVG when controlling for other variables in the model. Moreover, proactive aggression and extreme shyness were predictive of PVG in males, but not in females. The implications of these findings are discussed.

Keywords: video games; Internet gaming; problematic gaming; Internet gaming disorder; depression; anxiety; shyness; anhedonia; aggression; interRAI

1. Introduction

With more than 2 billion people accessing the interactive web worldwide, the popularity of Internet and offline gaming is becoming a global phenomenon [1–3]. Video gaming has become a common experience in childhood, with 90% to 97% of children reporting that they play video games [1]. In Canadian youth surveyed in Ontario, only 13.9% reported that they do not play video games [4]. Video gaming can offer cognitive, motivational, emotional, and social benefits [5,6] and even enhance creativity amongst children and youth [7]. However, there is growing concern with respect to problematic gaming in a minority of youth who suffer from social isolation and avoidance of daily activities [8]. Excessive gaming can lead to impairment of daily functioning, loss of control, and emotional distress in a minority of adolescents and young adults [8].

Problematic video gaming (PVG) consists of a persistent pattern of playing video games for a prolonged period of time that is associated with negative consequences and interference with social, occupational, and academic functioning [9,10]. Gentile and colleagues [11] found that while 83% of youth reported playing video games occasionally, pathological gaming only occurred in approximately 9% of the sample. Researchers have suggested the importance of capturing symptoms of distress and interference with daily living when assessing problematic video gaming (e.g., constant preoccupation

with gaming, lack of control, excessive use despite negative effects, loss of Internet) [12]. The fifth edition of the *Diagnostic and Statistical Manual for Mental Disorders* (DSM-5) did not formulate official diagnostic criteria for problematic Internet or gaming use, but Internet Gaming Disorder was included in the appendix (Section 3) of the DSM-5. The manual noted that more evidence on the course, onset, risk factors, manifestation of Internet gaming, and identification of a distinct cluster of symptoms is needed for inclusion in the main manual [13]. This formulating diagnosis in the appendix is described as "persistent and recurrent use of the Internet to engage in games, often with other players, leading to clinically significant impairment or distress as indicated by five (or more) of the following (criteria) in a 12-month period" [13] (p. 795). Symptoms are similar to substance and gambling addiction and include preoccupation with gaming, withdrawal symptoms when not gaming, build-up of tolerance (i.e., more time needed for game playing), loss of interest in other hobbies, use of gaming as an escape, and continued overuse of gaming, despite understanding the negative impact on day-to-day functioning [13].

Most recently, "Gaming disorder" (i.e., 6C51) was proposed as a disorder under "Disorders due to Substance Use and Addictive Behaviours" in the ICD-11 Beta draft [14]. This disorder is described as a pattern of persistent or recurrent gaming behaviour, which may be online or offline, that is causing significant impairment or interference with the individual. This includes loss of control over gaming, prioritizing gaming over daily activities and other activities of interests, and gaming despite occurrence and re-occurrence of negative consequences for at least 12 months. Overall, both the ICD and DSM have emphasized the importance of distinct characteristics to problematic video gaming, including a high frequency of gaming that leads to significant impairment to personal functioning and loss of control. These proposed criteria for problematic gaming were created to allow scientists and clinicians to distinguish individuals who game excessively, but non-problematically, compared with individuals who experience significant impairment as a result of gaming [15].

The proposed criteria are not without critics, despite the diagnostic similarities with gambling disorder—the only other behavioural addiction in both the DSM and ICD [13,14]. First, the term "Internet Gaming Disorder" in the DSM was claimed to be widely misleading for scientists and clinicians. The name implies internet games are the source of problematic gaming, yet the criteria do not stipulate that the disorder excludes excessive use of offline games [16]. Instead, leading researchers have proposed the term "video gaming disorder" or "gaming disorder" for clarity, as it suggests that the addictive behaviour can occur both online and offline [16]. Second, there is concern that healthy gamers will be affected negatively, and inclusion of the disorder would cause stigma for children who play video games as part of a regular hobby [17]. Finally, labelling problematic video gaming as a disorder may direct attention to the act of gaming itself and away from educating parents and the mass media about the problematic areas of concerns in a youth's environment that give rise to problematic gaming [17].

Given that these are not official diagnostic criteria, many Internet and computer game addiction measures have been developed, with different cutoffs that distinguish between normal and potentially addictive use [18,19]. While a set of standardized symptoms and consensual definition of Internet gaming disorder has not been established in the literature, the empirical literature provides some defining features: (1) excessive preoccupation and lack of control over technology use, (2) impairment and distress in academic, interpersonal, and other domains of functioning, and (3) negative outcomes due to overuse [20]. Like other forms of addiction [13], excessive Internet use and gaming has also been broadly defined as a quantity that exceeds normal or usual, causing significant impairment in global functioning [21].

1.1. Prevalence Estimates of Problematic Video Gaming

Several methodological shortcomings, including the heterogeneity of assessment methods, arbitrary cutoff points on video gaming measures, lack of standardization of pathological gaming terminology, and sampling biases, have led to inconsistent prevalence rates on problematic video

gaming [9,22]. Kuss and Griffiths [9] reviewed the literature on Internet gaming addiction and found a prevalence rate of 0.6% to 11.9% in adolescents. In a two-year longitudinal study, Gentile et al. [11] found a prevalence rate of 7.6% to 9.9% in problematic video gaming and 84% of those who are classified as problematic video gamers at the initial assessment remained problematic video gamers two years later. These results suggest that the problem does persist without intervention, and is not simply a normative phase that the new generation of children go through [11]. Understanding the development and manifestation of this new form of problematic behaviour can guide the implementation of best prevention and psychotherapeutic approaches.

In Canada, a survey was conducted with over 10,400 students across 220 Ontario schools who participated in the 2015 Ontario Student Drug Use and Health Survey, which is the longest-running school survey of youth in Canada. In this survey, male students were four times more likely than female students to play video games daily and report playing for more hours per day [4]. Approximately 12.5% of students in Grades 7 to 12 across Ontario, Canada reported symptoms related to a "video game problem (e.g., preoccupation, tolerance, loss of control, withdrawal, escape, disregard for consequences, disruption to family/school)" [4] (p. vi). The authors of the study noted that prevalence has increased from 9% that was found in 2009 [4]. Of note, the survey results indicated that the increase was driven by a significant linear increase in male students (i.e., increase from 9.4% to 12.5%), but not female students (stable at 3% to 5%) using problematic video gaming criteria assessed in that study (i.e., five of nine items from the Problematic Video Game Playing Scale) [23].

1.2. Risk Factors in Problematic Video Gaming

The current literature shows that males are at greater risk of problematic video gaming compared to females [24–29]. Rehbein and colleagues [30] reported that 3% and 0.3% of male and female ninth graders, respectively, have developed dependence on video gaming, while 5% and 0.5% of male and female ninth graders, respectively, are at risk of becoming dependent on video gaming [30]. Young male gamers, compared to their female counterparts, have more problems with hyperactivity, engage in less prosocial behaviour, and experience greater mental health difficulties in general according to parent reports [5].

Converging evidence suggested that PVG is associated with externalizing symptoms, such as impulsivity [31], attention-deficit hyperactive disorder [31], and aggression and hostility [25,32–35]. PVG is also associated with internalizing symptoms, such as depressive mood [36,37], social anxiety or social inhibition [11,38,39], anhedonia [40], and loneliness [34]. It appears that problematic video gaming is associated with many risk factors and associated features of mental health difficulties.

Although research on community samples is growing, few studies to date have examined problematic video gaming in clinically referred children/youth. Most of the literature consists of epidemiological studies and mostly focus on problematic Internet use, which includes a wide range of activities including watching sports on the Internet and going on video streaming platforms (e.g., YouTube) [41–43]. Hence, there is a lack of focus on video gaming that does not include these other leisure activities online [43]. In one study that investigated gaming in psychiatric patients, Wittek and colleagues [43] could not identify addiction to video games relating to specific psychiatric diagnoses, but highlighted it is positively associated with conduct and emotional problems [43].

1.3. Study Objective

The objective of the study is to investigate the prevalence of and risk factors for problematic video gaming in a large sample of clinically referred youth with a diverse range of mental health problems in Ontario, Canada.

A number of studies have investigated the effects of problematic video gaming amongst young people in schools [4,44], yet few studies have examined video gaming in clinically referred children and adolescents with pre-existing mental health concerns. This gap in the literature was evident in a recent meta-analysis including 101 studies on the effects of exposure to video games, where the

author recommended more studies examining community populations [45]. Moreover, studies with small samples investigating video gaming in the community or at schools are at risk of a sampling bias (e.g., unable to capture youth with more severe mental health risk who are not attending school). Another limitation in the current literature is that most samples only include problematic male, teenage gamers [46], as the base-rate for problematic female gamers is low [30]. However, online gaming is becoming more popular amongst females [47] and it becomes increasingly important to investigate the risk factors for this group of gamers as well. Thus, the present study will also investigate differential risk factors for problematic video games separately for males and females.

Understanding the unique effects of the risk factors of video gaming with demographic factors, mental health symptoms, and social support may help answer questions about potentially vulnerable subpopulations, which may differ from community populations.

2. Materials and Methods

2.1. Participants

The present study examined archival data from 44 public mental health agencies collected between 2012 and 2017 using the interRAI Child and Youth Mental Health (ChYMH) [48] in the province of Ontario, Canada. The referral process differs between agencies; it may include self-referral, referral by a healthcare professional (e.g., a family physician), or referral by another mental health professional (e.g., a social worker from another agency). The total sample was comprised of 5820 clinically referred children and youth (59.8% male; 40.0% female; 0.2% unspecified) between the ages of four and 18 years (M_{age} = 11.85, SD = 3.58).

The interRAI ChYMH is a holistic assessment designed for children and youth receiving services from both inpatient and community-based mental health programs that promote child-centred care for multidisciplinary practitioners (e.g., nurses, social workers, psychiatrists, psychologists, occupational therapists). The assessment comprises of 400 items to assess the child's/youth's strengths, needs, functioning, and areas of risk to inform mental health interventions. Assessors had at least two years of experience working in a mental health setting and were trained over a two full-day interRAI ChYMH training workshop designed by local, national, and international experts in children's mental health. Every clinician received a user's manual for the interRAI ChYMH, which provided the intent, definition, process to obtain the information, and coding for every item in the instrument [48]. Clinicians provided ratings on the instrument based on all sources of information available to them, including interview with the child and family, consultation with service providers who could provide information about the child (e.g., parents, counsellors), and documentations on file. All ratings are required to be gathered within a 3-day window [48,49]. Further literature can be found on the interRAI website (www.interrai.org). Only initial assessments were included (i.e., subsequent or re-assessment of youth was excluded from this sample). There is no missing data, as missing data from the assessment cannot be submitted into the database and the clinician must collect all the available information within the allocated timeframe [48].

Since the interRAI was developed, a number of reliability and validity studies have been conducted, demonstrating strong psychometric properties and criterion validity with adult, geriatric [50,51] as well as child/youth assessments [49,52]. Five interRAI instruments have demonstrated substantial interrater reliability, with an overall kappa mean of 0.75 that evaluated over 160 shared items in two or more instruments, and more than 60% of items on the interRAI family suites had a kappa mean above 0.70 [53].

The interRAI ChYMH database assigns a randomly generated study-specific participant number for each participant and includes no identifying information of the child/youth or their families. Prior to an interRAI ChYMH assessment, parents or legal guardians of the children/youth have given informed consent for the data to be used for research purposes. The data for the interRAI ChYMH instruments are based on a large study conducted by an interRAI Fellow leading the child and youth

efforts internationally, and cannot be transferred or deposited in an open-access repository. This study was approved by the University of Western Ontario Ethics Board (REB #106415).

2.2. Outcome Variables

Problematic Video Gaming (PVG): Problematic video gaming was assessed by the attending clinician to determine whether time spent video gaming was disrupting the child's/youth's ability to engage in daily activities in the last 90 days [48]. The clinician was asked to determine (1) whether the child/youth plays video games and (2) whether the child/youth has difficulty controlling the time spent on gaming. The clinician was then instructed to determine whether video gaming has interfered with day-to-day living through consulting with the child/youth, parents, and teachers to determine possible under-reporting by the child/youth. The time spent playing videos games online and offline is considered "video gaming". Non-gaming Internet use (e.g., browsing webpages) or non-gaming activities related to hobby (i.e., discussion forums, YouTube), even if it is problematic, is not considered problematic video gaming. The authors state that general Internet use was not considered, but this information might affect grouping numbers if considered more fully.

In the interRAI manual, the video gaming item is coded as none, minimal, moderate, or severe. None or minimal is considered absence of problematic video gaming, where clinicians do not have to monitor or provide care planning around that specific clinical need. Moderate or severe levels of problematic video gaming reflects the presence of problematic video gaming, where clinicians should provide close monitoring and care planning for this problem. Hence, presence of problematic video gaming will be operationalized the same way throughout this study (i.e., presence or absence of problematic video gaming). For the assessor to code for problematic video gaming, assessors must determine that the time spent video gaming is directly disrupting the child or youth's ability to become engaged in his or her daily activities in the last 90 days. The published manual of the interRAI has specific instructions for how the clinician judges whether the functional impairment is related to problematic gaming or other differentiators [48].

Specific instructions for coding of each item are as follows:

- **None:** The child/youth does not play video games or there is no effect on the child's/youth's functioning or day-to-day routines due to video gaming.
- **Minimal:** Video gaming results in some disruption for day-to-day social activities, but the child/youth has no difficulties completing normal day-to-day activities, chores, homework, and attending school.
- **Moderate:** Due to problems with excessive video gaming, reduced attention to personal needs (e.g., hygiene, sleeping, eating) is reported. The child/youth has difficulties with day-to-day activities, which may include limiting social activity outside of video gaming interactions, not completing homework, skipping school, and scholastic performance declining in terms of productivity and attendance at school due to video gaming.
- **Severe:** Child/youth does not attend to personal needs and video gaming heavily interferes with daily functioning (i.e., neglects participation for social and household activities, not attending to personal needs, not attending school or at serious risk of failing school or workplace dismissal).

2.3. Predictors

- **Internalizing Mental Health Scale:** The Internalizing Mental Health Scale is a multidimensional, 12-item measure that assesses three facets of depressive symptoms (e.g., expressions of hopelessness, expressions of guilt/shame, self-deprecation, made negative comments), anxiety (e.g., repetitive anxious complaints or concerns, unrealistic fears, episodes of panic, hypervigilance), and anhedonia (e.g., decreased energy, lack of motivation, withdrawal from activities of interest, anhedonia). Scale scores range from 0 to 36, with higher scores indicating high degree of internalizing problems. The measure demonstrated excellent psychometric properties

and strong reliability and validity [54]. In this sample, Cronbach's alpha for the full scale is 0.84, and Cronbach's alpha values in subscales of anxiety, anhedonia, and depression are 0.70, 0.78 for 0.82 respectively.

- **Externalizing Mental Health Scale:** The Externalizing Mental Health Scale is a multidimensional, 12-item measure that assesses 2 facets of proactive aggression (e.g., stealing, bullying peers, violence to others, intimidation of others or threatened violence; Cronbach's alpha for the subscale = 0.77) and reactive aggression (e.g., argumentative, outburst of anger, verbal abuse; Cronbach's alpha for subscale = 0.84). Scale scores range from 0 to 12, with higher scores indicating high degree of externalizing symptoms. The measure demonstrated excellent psychometric properties and strong reliability and validity [54]. Cronbach's alpha for the full scale in this sample is 0.85.
- **Extreme Shyness:** Extreme Shyness [48] is measured using one item that assesses a child's/youth's pervasive pattern of severe inhibition in social situations where shyness or apprehension is not warranted, whether it is present at the home, at school, or during recreation activities. The clinician codes the item based on the presence or absence of this behaviour. In this sample, 825 children/youth (14.2%) exhibited symptoms of extreme shyness.
- **Relational Strengths Scale:** The interRAI Relational Strength Scale [48] measures the quantity of strengths present in the child's/youth's ability to relate to others. Scale scores range from 0 to 6, with higher scores indicating lower degree of relational strengths. Each item measures the dichotomous presence or absence of supporting relationships within the child's/youth's environment (e.g., reports having a confidant, school engagement, strong and supportive relationship with family, strong and supportive relationship with peers, has one friend who visits or plays with regularly, social inclusion by peers; Cronbach's alpha = 0.65).
- **Demographics:** Age at time of assessment (i.e., four to 18 years) and sex (i.e., male vs. female) were examined as predictors. Note that unspecified/other sex category was removed as it less than 0.3% of the sample.

2.4. Statistical Analyses

Binary logistic regression was utilized to generate models that predict the presence or absence of problematic video gaming from internalizing symptoms, externalizing symptoms, child's/youth's relational strengths, and extreme shyness, while also examining the effects of sex and age. The partial effects of the individual facets of the internalizing mental health scale (i.e., depression, anxiety, and anhedonia) and externalizing mental health scale (i.e., proactive aggression and reactive aggression) were determined after significance of the partial effects of the full scale was analysed. Furthermore, analyses were split by sex to determine partial effects of the individual predictors. Adjusted odds ratios (AOR) and 95% C.I. were reported. Statistical analyses were conducted using SPSS Version 24 for Windows (SPSS, Inc., Chicago, IL, USA).

3. Results

3.1. Participant Demographics

Children/youth in this sample ranged between 4 to 18 years of age (M = 11.95, SD = 3.59). In terms of Aboriginal identity, 227 (3.9%) identified as First Nations, 65 (1.1%) identified as Metis, and 15 (0.3%) identified as Inuit. Among those children/youth referred for assessment at time of intake into care, 1478 (25.4%) had no contact with a community mental health agency or professional in the past year, 1630 (28.0%) had contact within 31 days or more, and 2710 (46.6%) had contact within the last 30 days.

In terms of diagnosed disorders, 2338 (41.0%) had attention deficit hyperactivity disorder, 1203 (20.6%) had disruptive behaviour disorder, 1117 (19.1%) had a learning or communicative disorder, 1961 (33.7%) had an anxiety disorder, 864(14.8%) had a mood disorder, 529 (9.1%) had autism spectrum disorder, and less than 3.0% had other disorders (e.g., reactive attachment disorder, schizophrenia and

other psychotic disorder, eating disorder). Note that the sum of total percentage is over 100, as much of the children/youth in this sample have comorbid mental health disorders. Reasons for referral included threat or danger to self (n = 1681), threat or danger to others (n = 1720), problem with addition or dependency (n = 332), specific psychiatric symptoms (n = 3653), and involvement with youth justice system (n = 292). Note that the total sum of reasons for referral exceeded the total sample size, as multiple reasons for referral were common.

Overall, in the full sample, 3814 (65.5%) had no problematic video gaming (PVG), 1221 (21.0%) had minimal, 604 (10.4%) had moderate, and 180 (3.1%) had severe problematic video gaming. Hence, a total of 784 children/youth (670 males) endorsed problematic video gaming (i.e., moderate or severe levels as rated by the clinician). In this clinically referred sample, the prevalence of excessive video gaming (i.e., ratings of moderate or severe PVG) that interferes with daily functioning was 19.2% in males and 4.9% in females. Refer to Table 1 for more details on the demographic information. Appendix A includes a table of zero-order correlations between all variables.

Table 1. Demographics table for children/youth (N = 5820) assessed using the interRAI Child and Youth Mental Health (ChYMH).

Demographics	Number (% of Sample)
Total	5820
Sex	
Male	3482 (59.8%)
Female	2329 (40.0%)
Unspecified/other	9 (0.2%)
Patient type	
Inpatient	473 (8.1%)
Outpatient	5347 (91.9%)
interRAI Assessment Method	
In-person	3900 (67.0%)
Phone	1805 (31.0%)
Video	4 (0.1%)
Other	111 (1.9%)
Legal Guardianship	
Both parents	3248 (55.8%)
Only mother	1715 (29.5%)
Only father	232 (4.0%)
Other relative(s) or non-relative(s)	303 (5.2%)
Child protection agency (e.g., CAS)	276 (4.7%)
Public guardian or child/youth cares for self	45 (0.8%)

3.2. Results of the Regression Models

An overall test of model fit was used to check that the final model with the predictors included was an improvement over the baseline intercept-only model. The chi-square difference test was significant (χ^2 = 626.113 df = 6, $p < 0.001$), and Nagelkerke's R^2 was 0.189, suggesting that the model explained approximately 19% of the variation in the outcome.

Results in Table 2 indicated that male sex, older age, high levels of internalizing symptomology, high levels of externalizing symptomatology, presence of extreme shyness, and poor relational strengths are significant in increasing the odds of problematic video gaming in children/youth. Most notably, there was a predicted 5.26 (i.e., 1/0.19) time increase in odds of problematic video gaming for males (vs. females) and 1.6 times predicted increase in odds of problematic video gaming for the presence of extreme shyness (vs. absence of extreme shyness). These values correspond to a large and small effect size respectively for male sex and extreme shyness, respectively [55].

Table 2. Regression analysis: Problematic Video gaming (PVG) as the dependent variable.

Predictor	B (S.E.)	Wald χ^2	OR (95% CI)
Age	0.09 (0.01)	52.84	1.10 (1.07–1.11) *
Sex (male = RC)			
Female	−1.66 (0.11)	213.35	0.19 (0.15–0.24) *
Relational strengths	0.17 (0.03)	46.64	1.19 (1.13–1.25) *
Extreme shyness (absence = RC)			
Presence	0.47 (0.11)	19.44	1.60 (1.30–1.98) *
Internalizing symptoms	0.04 (0.01)	65.10	1.04 (1.03–1.05) *
Externalizing symptoms	0.10 (0.01)	54.02	1.11 (1.08–1.14) *
Constant	−3.99 (0.19)	445.23	0.018

Note: RC = reference category. OR = odds ratio. CI = confidence interval. * represents $p < 0.001$. Omnibus Tests of Model Coefficients ($\chi^2 = 626.113$ *df* = 6, $p < 0.001$). Nagelkerke's $R^2 = 0.19$.

Similarly, a second binary logistic model was run to determine the specific effects of the individual facets within internalizing and externalizing symptoms on problematic video gaming (Table 3). The model also included age, sex, extreme shyness, and relational strengths as covariates. Externalizing symptoms were expanded into two predictors (i.e., proactive aggression and reactive aggression) and internalizing symptoms were expanded into three predictors (i.e., anxiety, anhedonia, depression). The chi-square difference test is significant ($\chi^2 = 668.27$ df = 9, $p < 0.001$), and Nagelkerke's R^2 is 0.20, suggesting that the model explains approximately 20% of the variation in the outcome. This new model showed that anxiety (OR = 1.00; $p = 0.99$) and depression (OR = 0.99; $p = 0.50$) were not significant predictors, and only anhedonia (OR = 1.13; $p < 0.001$) was predictive of problematic video gaming. These results indicate that internalizing symptoms had significant partial effects in the first model because it was driven by the effects of the anhedonia facet. The externalizing symptoms expanded into two predictors (i.e., proactive aggression and reactive aggression). The model shows that both reactive aggression (OR = 1.20; $p < 0.001$) and proactive aggression (OR = 1.07; $p < 0.05$) had significant partial effects, but effects for reactive aggression were stronger. While these values were significant, they reflect very small effect sizes (i.e., <0.2 when compared with a Cohen's *d* equivalent) [55].

Table 3. Regression analysis: Problematic video gaming (PVG) as the dependent variable and facets of internalizing and externalizing symptoms as predictors.

Predictor	B (S.E.)	Wald χ^2	OR (95% CI)
Age	0.07 (0.01)	27.54	1.06 (1.04–1.09) **
Sex (male = RC)			
Female	−1.64 (0.11)	207.00	0.19 (0.16–0.24) **
Relational strengths	0.15 (0.03)	34.97	1.16 (1.11–1.26) **
Extreme shyness (absence = RC)			
Presence	0.41 (0.11)	13.95	1.51 (1.22–1.87) **
Externalizing symptoms			
Reactive Aggression	0.19 (0.03)	32.28	1.20 (1.13–1.28) **
Proactive Aggression	0.06 (0.02)	6.03	1.07 (1.02–1.12) *
Internalizing symptoms			
Anxiety	<0.00 (0.01)	<0.001	1.00 (0.98–1.02)
Anhedonia	0.12 (0.01)	100.16	1.13 (1.10–1.15) **
Depression	−0.01 (0.01)	0.45	0.99 (0.97–1.02)
Constant	−3.92 (0.23)	293.61	0.20

Note: RC = reference category. OR = odds ratio. CI = confidence interval. * represents $p < 0.05$ ** represents $p < 0.001$. Omnibus Tests of Model Coefficients ($\chi^2 = 688.27$ *df* = 9, $p < 0.001$). Nagelkerke's $R^2 = 0.20$.

However, when running the logistic regression separately for males and females (Table 3), males showed significant partial effects for both reactive aggression (OR = 1.21; $p < 0.001$) and proactive aggression (OR = 1.07; $p < 0.05$). For females, only reactive aggression (OR = 1.19; $p < 0.05$) had significant partial effects. Furthermore, only males showed significant partial effects for extreme shyness (OR = 1.50; $p = 0.001$) and age (OR = 1.10; $p < 0.001$), but these values were not significant for females (Table 4).

Table 4. Regression analysis: Problematic Video gaming as the dependent variable and facets of internalizing and externalizing symptoms as predictors split by sex.

Sex	Predictor	B (S.E.)	Wald χ^2	OR (95% CI)
Male	Age	0.10 (0.02)	42.63	1.10 (1.07–1.14) **
	Relational Strengths	0.15 (0.03)	26.77	1.16 (1.10–1.22) **
	Extreme shyness (absence = RC)			
	Presence	0.40 (0.12)	10.66	1.50 (1.18–1.91) **
	Internalizing Symptoms			
	Anxiety	−0.01 (0.01)	0.20	0.99 (0.97–1.02)
	Anhedonia	0.12 (0.01)	76.23	1.124 (1.10–1.15) **
	Depression	<0.00 (0.01)	0.06	1.00 (0.97–1.02)
	Externalizing Symptoms			
	Proactive Aggression	0.06 (0.03)	6.08	1.07 (1.01–1.12) *
	Reactive Aggression	0.19 (0.04)	25.77	1.21 (1.12–1.30) **
	Constant	−4.22(0.26)	267.07	0.02
Female	Age	−0.06 (0.03)	3.96	0.94 (0.88–1.00)
	Relational Strengths	0.18 (0.06)	8.60	1.20 (1.06–1.36) *
	Extreme shyness (absence = RC)			
	Presence	0.38 (0.24)	2.47	1.46 (0.91–2.35)
	Internalizing Symptoms			
	Anxiety	0.03 (0.03)	1.07	1.03 (0.98–1.08)
	Anhedonia	0.13 (0.03)	23.65	1.14 (1.08–1.20) **
	Depression	−0.01 (0.03)	0.08	0.99 (0.94–1.05)
	Externalizing Symptoms			
	Proactive Aggression	0.03 (0.06)	0.21	1.03 (0.91–1.16)
	Reactive Aggression	0.18 (0.07)	5.74	1.19 (1.03–1.37) *
	Constant	−3.96 (0.51)	59.58	0.019

Note: RC = reference category. OR = odds ratio. CI = confidence interval. * represents $p < 0.05$ ** represents $p < 0.001$. Omnibus Tests of Model Coefficients ($\chi^2 = 348.81$ $df = 8$, $p < 0.001$ for males; $\chi^2 = 87.66$ $df = 8$, $p < 0.001$ for females). Nagelkerke's $R^2 = 0.15$ for males, 0.11 for females.

4. Discussion

With the majority of literature examining video gaming in community samples and college students, this study uniquely contributes to the literature by examining problematic video gaming in children/youth referred for mental health treatment. In this large sample of clinically referred children/youth collected across 44 mental health agencies, older age, male sex, the presence of anhedonia, externalizing symptoms, extreme shyness, and poor relational strengths are significantly associated with problematic video gaming. In this model, the most meaningful effects are related to sex and extreme shyness, while the other predictors had smaller effects. Males are about five times more likely than females to have problematic video gaming problems, which is consistent with the Ontario Student Drug Use and Health Survey [4] (p. 114). Specifically, the current observations in the interRAI assessment noted problematic video gaming in approximately 19.2% in males and 4.9% in females, which is similar to that reported in 20.2% and 4.5% in males and females, respectively, in the Ontario Student Drug Use and Health Survey [4]. However, it is important to note that the present study and the Ontario Student Drug Use and Health Survey [4] used different approaches when measuring problematic video gaming (i.e., interview with mental health intake clinician vs. survey questionnaire) and, therefore, cannot be compared equivocally.

As Gentile et al. [11] noted, many clinicians might assume that children and youth who are experiencing mental health difficulties simply use video gaming to cope. However, the present results suggest that youth engaging in PVG may have slightly higher levels of mental health symptoms and relational concerns than those who do not engage in PVG, even when compared to other clinically referred youth who also have elevated clinical symptoms. However, it is important to note that the mental health predictors, while significant, reflect on small effect sizes.

In terms of internalizing symptoms, results suggested that only anhedonia was significant in this model, such that children/youth with problematic video gaming had higher levels of anhedonia symptoms than other clinically referred counterparts. However, symptoms associated with depressed mood and anxiety did not predict problematic video gaming. With respect to depressive symptomatology, the literature extant is inconsistent with some studies suggesting that such symptoms are associated with problematic gaming [56,57] while others do not [11,58,59]. It is possible that such inconsistencies may be due to signs and symptoms related to anhedonia. Given that anhedonia may be the only driving factor of internalizing symptoms and may only be assessed as one item in an overall depressive symptoms battery, non-significant findings may have resulted in relation to problematic video gaming. In other words, those studies that did not measure low mood separately from anhedonia may have concealed the relationship between anhedonia and video gaming. The current findings of this study are aligned with those of Guillot and colleagues [40], who found that anhedonia, assessed in college students, predicted greater compulsive Internet and addiction to video games nine to 18 months later. The present study replicated the finding in a younger, clinically referred sample. It is recommended that future studies of problematic video gaming separate the specific facets of depressive symptomatology (e.g., low mood, anhedonia) to examine the individual effects. Further research on the risk factors associated with problematic video gaming is necessary and is of great importance to facilitate the development of evidence-based prevention and intervention programs.

The current study found that both proactive and reactive aggression predicted problematic video gaming in boys, but only reactive aggression predicted PVG in girls. It is important to note that these findings reflect very small effect sizes. It is possible, however, that individuals with behavioural problems (i.e., inattention, impulsivity) are more likely to have poor relational strengths use video games to retreat from difficult in-person social interactions. While recent literature suggests that exposure to aggression in video games does not increase youth aggression [45], playing competitive video games for prolonged periods of time has been found to be associated with a decline in prosocial behaviours [41,60]. Markey and Scherer [61] suggest that in college students, violence in video games may interact with pre-existing anger. However, Ferguson and Olson [62] did not find evidence to suggest an association in a cross-sectional study between aggression and playing violent games in a sample of youth with more mental health symptoms than the norm. Ferguson [45] examined 101 studies that suggested psychosocial well-being of children was not affected through exposure to both violent and nonviolent video games. Unfortunately, the present study did not assess the type of video games that males and females were playing. Perhaps future studies need to investigate the different types of games that boys and girls play, and whether these games interact with pre-existing traits, as girls are less drawn to competitive and physically-oriented games [63].

Problematic video gaming was also associated with poor relational problems for both males and females and extreme shyness in males only. This is consistent with previous literature, with greater social anxiety in new situations for online gamers compared to non-gamers [64]. Ko and colleagues [65] suggested that video gaming may enhance self-image through offering low-risk opportunities for social interaction with others and creating stronger self-identification. In the clinical treatment literature, Young [66] recommended cognitive restructuring by addressing favourable self-concepts online for gamers (e.g., virtual reality self is more significant than the real self) and identifying dissatisfaction with the offline self and how needs unmet in real world seem to be achieved in the virtual world (e.g., video game achievement). Alternative views may be constructed to rebuild a healthier self-concept (e.g., "the real world provides meaning and I am worthwhile and able to achieve goals in the real world").

Perhaps building healthier self-concepts could help enhance these relationships in the real world to restore self-concepts of children and youth, which opens new opportunities for enjoyable social interactions outside of the virtual world.

If poor relational problems are associated with problematic video gaming, part of prevention and intervention should involve building and enhancing familial and peer relationships for children and youth. Liu and colleagues [67] introduced the first multi-family group therapy (MFGT) for Internet addiction in adolescents. This is a psychotherapeutic approach derived from the substance abuse literature to improve family cohesion and peer engagement through enhancing parent–adolescent communication skills. The authors proposed that Internet addiction may decrease whilst improving parent-adolescent relationship and interaction through communication skill training, psychoeducation, and relationship building skills. Results showed that the scores on the adolescent pathological Internet use significantly decreased, with treatment effects maintained at three-month follow-up. Improved family communication was consequently achieved through addressing these problems and replacing dysfunctional patterns of emotional expression with more functional ones. This fostered functional and sincere conversations between the parents and child, which consequently decreased risk for Internet addiction. Future studies could explore whether these forms of therapeutic approaches generalize to problematic video gaming to improve relationships, rather than the broad category of Internet addiction as a whole.

Another promising intervention is Young's CBT for Internet addiction (CBT-IA) [66], which may help the development of a more positive self-concept, greater confidence, and better social skills to improve relational outcomes and extreme shyness. The intervention involves identifying problematic behaviour associated with online usage and the displacement of offline activities due to constant online activity. For instance, a client may identify that he or she is unable to manage normal routines and neglects relationships with family and friends due to consumption with online activities, which further perpetuates social isolation from family and friends. The therapist may recommend rigorous scheduling of activities to ensure the client is engaging in social activities, and abstaining from prolonged and excessive online activity. Young [66] also suggests clients enrol in support groups or family therapy to compensate for the neglected social relations. Results of CBT seem promising, as clients showed greater motivation to quit excessive technology use, exhibited more control over problematic use, engaged in more social and recreational activities, and reported improved relationship functioning post-intervention [66,68]. For more details on the efficacy and protocol for interventions in gaming disorders, refer to a systematic review conducted by King and colleagues [69].

The Strengths and Limitations of the Study

This study utilized a semi-structured interview format, where the clinician consulted multiple informants to assess gaming frequency and used informed clinical judgment to determine whether video gaming for the child or youth was considered normative or problematic. Rather than solely relying on the child's or youth's self-report of their symptoms, the semi-structure interview format decreases biases by using informed clinical judgment of underreporting of video gaming from the child only [5]. Previous research suggested children/youth tend to underestimate the impact of problematic video gaming on their own psychosocial well-being [5].

This sample also included families and youth from diverse communities. If families required an interpreter or had requested a clinician that spoke a difference language, the agency, where available, would provide that. Given that the data was collected from a large clinical sample with a diverse range of mental health problems and locations (i.e., 44 mental health sites), the results found in this study should be generalizable across mental health sites in Ontario, Canada.

This study is not without limitations. First, the study focused on children/youth who are accessing mental health service in Ontario, so the findings may not be generalizable to other mental health settings across different countries. Moreover, parental income and ethnicity (other than aboriginal status) were not assessed in the present study, and thus, it becomes unclear whether these risk factors

could generalize to youth from different cultural and socioeconomic backgrounds. Second, the present study measures PVG as a dichotomous outcome and does not differentiate between generalized and specific forms, which may include variables such as game modality (i.e., computer games, video game console, games on tablets or cellular devices), types of games (e.g., high adrenaline violent shooting games, calm life simulation games), time spent playing video games, and whether social interaction was involved in the games (e.g., multiplayer online vs. single player offline). Studies should explore whether these specific factors interact with the risk factors found in this study. Moreover, problematic video gaming, as a dependent variable, is evaluated as loss of control with an impairment criterion (e.g., not taking care of daily needs or attending school due to gaming). There are certain criteria proposed by the DSM-5 that were left unexplored (e.g., withdrawal symptoms when not playing Internet games, preoccupation with gaming, build-up of tolerance). Future studies should explore whether these predictors remain valid upon investigating these additional variables. Third, given the role of extreme shyness and poor relational strengths as demonstrable predictors, measures assessing the level and type of socialization in the video games by participants (e.g., forming a clan, developing friend lists for continued contact with other players of a similar skill level, play-style, or interests), or otherwise using the platform for socializing and remotely engaging with other players would be highly informative. Lastly, future studies should also use longitudinal samples to examine whether shift in predictors (i.e., decreased anhedonia) through intervention could change outcomes in problematic video gaming.

5. Conclusions

Overall, this study provided additional understanding for unique predictors of problematic video gaming in clinically referred children and youth. In this large sample, the number of clinically referred young people deemed to have PVG tendencies is only a small subset. Older age, male sex, the presence of anhedonia, externalizing symptoms, extreme shyness, and poor relational strengths were significantly associated with problematic video gaming. Understanding the development and manifestation of this new form of problematic behaviour can guide the implementation of the best prevention and psychotherapeutic approaches.

Author Contributions: Chloe Lau developed the research question and conceived of the approach to analyse the data, and Chloe Lau and Catalina Sarmiento conducted the primary research and literature review. Chloe Lau conducted all statistical analyses in the study. Shannon L. Stewart developed the interRAI Child and Youth Mental Health instrument and collected all the data as part of a larger research initiative. Chloe Lau and Catalina Sarmiento wrote the first draft of the paper, which was then reviewed by Shannon L. Stewart, Donald H. Saklofske and Paul F. Tremblay, who provided additional support for the article and conducted additional research as required.

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Appendix A. Correlations between Study Variables

Table A1. Zero-order correlations between all variables.

	Video Game	Sex	Age	Relational Strengths	Extreme Shyness	Internalizing Symptoms	Externalizing Symptoms
Video Game	1						
Sex (Male = 1; Female = 2)	−0.206 **	1					
Age	0.057 **	0.217 **	1				
Relational Strengths	0.125 **	−0.103 **	−0.10	1			
Extreme Shyness	0.076 **	0.006	−0.037 **	0.109 **	1		
Internalizing Symptoms	0.138 **	0.122 **	0.189 **	0.142 **	0.145 **	1	
Externalizing Symptoms	0.176 **	−0.233 **	−0.146 **	0.258 **	−0.045 **	0.189 **	1

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