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Original Article

Pathological Video-Gaming among Singaporean Youth

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Abstract

Introduction: Increase in internet use and video-gaming contributes to public concern on pathological or obsessive play of video games among children and adolescents worldwide. Nevertheless, little is known about the prevalence of pathological symptoms in video-gaming among Singaporean youth and the psychometric properties of instruments measuring pathological symptoms in video-gaming. Materials and Methods: A total of 2998 children and adolescents from 6 primary and 6 secondary schools in Singapore responded to a comprehensive survey questionnaire on sociodemographic characteristics, video-gaming habits, school performance, somatic symptoms, various psychological traits, social functioning and pathological symptoms of video-gaming. After weighting, the survey data were analysed to determine the prevalence of pathological video-gaming among Singaporean youth and gender differences in the prevalence. The construct validity of instrument used to measure pathological symptoms of video-gaming was tested. Results: Of all the study participants, 8.7% were classified as pathological players with more boys reporting more pathological symptoms than girls. All variables, including impulse control problem, social competence, hostility, academic performance, and damages to social functioning, tested for construct validity, were significantly associated with pathological status, providing good evidence for the construct validity of the instrument used. Conclusion: The prevalence rate of pathological video-gaming among Singaporean youth is comparable with that from other countries studied thus far, and gender differences are also consistent with the findings of prior research. The positive evidence of construct validity supports the potential use of the instrument for future research and clinical screening on Singapore children and adolescents' pathological video-gaming.

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Key words: Construct validity, Prevalence of video-gaming, Singapore children and adolescents

Introduction

Video-gaming and internet use are a part of the lives of children and adolescents today. Among countries that are highly wired with high speed internet access, Singapore had the second highest broadband penetration rate in 2008 next to South Korea in the world, with 88% of households having broadband internet.[1] Schools are also encouraged to incorporate the use of computers in the curriculum, and some teachers use games to complement lessons in the classrooms.[2] The easy access to and increasing use of internet and video games among Singaporean children and adolescents, however, contribute to public concerns regarding pathological or obsessive video-gaming. Recent studies conducted in the US, Spain, South Korea, and China have reported 8% to 14% of their study participants manifested pathological symptoms related to video-gaming.[3-6] Although anecdotal reports from parents, teachers and school counsellors of children and adolescents seeking professional help for excessive video-gaming are increasing in Singapore, scientific evidence regarding the extent of the problem in the Singapore context is scanty. As such, this study aims to explore the prevalence of pathological video-gaming among children and adolescents in Singapore and to examine the construct validity of pathological video-gaming based on Diagnostic and Statistical Manual of Mental Disorders (DSM) criteria, using a large-scale sample.

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While there is still considerable debate about how to define pathological use of video-games or video-game addictions,[7-9] most researchers studying pathological use of computer or video game have defined it similarly to the DSM criteria for pathological gambling. This is sometimes justified because both are assumed to be behavioural addiction,[3] and appears to be a valid starting place as they share common traits of behavioural addiction. Both gambling and video-games are forms of games. As such, they are initially played as a form of entertainment, because they are stimulating and produce positive (and sometimes negative) emotions. The activities may also produce "flow" states, in which the player is focused, may lose a sense of place or time, have a sense of control, and find it intrinsically rewarding.[10] At first, the activity is not pathological. But for some, it becomes pathological when the activity begins to produce serious negative life consequences. As the way pathological gambling is defined in the DSM-IV, pathological use of video games in empirical research is generally measured in the main elements of addictive behaviour, such as Brown's core facets of addiction:[11] *salience* (the activity dominates the person's life, either cognitively or behaviourally), *euphoria/ relief* (the activity provides a 'high' or relief of unpleasant feelings), *tolerance* (greater activity is needed to achieve the same 'high'), *withdrawal symptoms* (the experience of unpleasant physical effects or negative emotions when unable to engage in the activity), *conflict* (the activity leads to conflict with others, work, obligations, or the self) and *relapse and reinstatement* (the activity is continued despite attempts to abstain from it).

Scientific studies using DSM criteria for pathological gambling to investigate pathological computer or video gaming first began to be reported in the mid 1990s.[12-14] Most of the published studies on the pathological use of computer, Internet, and video game have focused on the psychometric properties of DSM-style instruments for pathological video gaming, producing generally consistent results. However, the reported psychometric properties of pathological video-gaming are subjected to further investigation in the Singapore context as the DSM-based instrumentation measuring pathological video-gaming has not been validated with any Singapore population. Moreover, the tested constructs are mostly limited to frequency and duration of playing, self-perception of excessive playing and psychological dependence,[3,12,14] but are not extended to poor psychological status, such as impulse control problem, low social competence, high hostility, and damages on functioning in health, family and school as being pertinent to pathological behaviours in general. While prior research has supported the convergent validity of pathological video-gaming in relation to higher frequency or longer time of playing video-games,[3] empirical evidence for the validity of pathological video-gaming measures based on other relevant constructs, such as aggression, hostility, impulse control problem, impaired psychosocial functioning and somatic problems is still inadequate.

According to the DSM-IV,[15] substance dependence or abuse or pathological gambling is often associated with antisocial personality disorder or aggressive behaviours and become diagnosable as pathological when the problems lead to impairment in normal social and occupational/academic functioning. Given that the definition of pathological video-gaming in this study shares the similar conceptual domains of pathology in the above disorders based on the DSM-IV, it is expected that pathological video game players show antisocial or aggressive behaviours, hostility and serious damages in school functioning and significant social relationships if the construct of pathological video-gaming is valid. Some studies have found increasing aggression, decreasing pro-social tendency, and impairment in normal social and occupational/educational functioning in relation to video-gaming or heavy play of video-game.[3,16-18] However, these relationships were not tested for the construct validity of pathological video-gaming scales.

A significant association between impulse control problem and pathological status of video-gaming is also expected as items measuring pathological video-gaming are adapted versions of the DSM criteria for pathological gambling classified as an impulse control problem in the diagnostic system.[15] In addition, a correlation between pathological use of video games and health problems must not be overlooked in testing the construct validity. While the evidence of negative health consequences from wrist pain to peripheral neuropathy due to lengthy hours of playing abound,[19-21] whether pathological gaming empirically correlates with health problems is unknown. If the construct of pathological gaming is empirically validated in relation to health problem, it would indicate that although not involving physiological intoxication, video-gaming can be pathological as it results in health problems.

Based on findings from prior studies and theoretical assumptions, this study hypothesises that pathological gamers will spend more time playing, be more likely to have video-game systems in the bedroom, get worse grades in school, have more trouble with impulse control, have poorer social competence, show higher hostility, have more health-related problems associated with computer or video game use, be more likely to neglect self-care and school work, have less interaction and more trouble with peers and have higher family conflict over games. Demonstrating these would be indication of convergent validity.

Prior research fails to test the divergent construct validity of pathological use of computer- or video- games. To test divergent construct validity, correlations of pathological status with intelligence and socioeconomic status (SES)

are tested in this study. These variables may be relevant, but there is no theoretical basis at this time to assume they should be. This assumption of the absence of correlations between pathological use of computer- or video-games and the above constructs requires empirical examination. Also, the amount of time playing is not a criterion for pathology, just as how much one gambles is not a criterion for pathological gambling.[6] Nonetheless, the amount of time playing is often described in the popular press as a marker of pathological game use. Hence, it is necessary to empirically address the conceptual distinction between the amount of time playing and pathological status. One study conducted in the US has found pathological status to be predictive of poorer academic performance, after controlling the amount of time playing.[6]

Materials and Methods

Participants

A total of 2998 children in Primary 3 (n = 738), Primary 4 (n = 700), Secondary 1 (n = 902) and Secondary 2 (n = 658) were included in the sample. Students were recruited from 6 primary and 6 secondary schools, 5 of which were boys' schools. The sample included 2179 males and 819 females. The overall average age of participants was 11.2 [*Standard Deviation* (*SD)* = 2.06; primary students *Mean* (*M*) = 9.2, *SD* = 0.7; secondary students *M* = 13.0, *SD* = 0.8]. The racial makeup was 72.6% Chinese, 14.2% Malay, 8.8% Indian, and 4.3% other races. All levels of socioeconomic status were represented, as assessed by housing type, with 18.5% living in 3-room or smaller public housing, 26.6% living in 4-room public housing, 26.9% living in 5-room public housing or government-built executive flats, and 28.0% living in private housing. Housing type, which is classified by the size of residence (e.g. 1 to 2 room public housing, 3 room public housing etc), is a major demographic characteristic in studies on Singapore youth[22] as a proxy indicator of socioeconomic status in the Singapore context. Although SES could be measured more precisely if the number of family members living under the household is incorporated into the housing type by size, the information of family size was unavailable in the data. Partial information on each parent's education level was available in the data. However, more than half of the total cases (57.5% for mother's education and 59.4% for father's education) have missing or unusable values on these items whereas 16.9% have missing information on housing type. Thus, housing type was chosen as the best available indicator of socioeconomic status from the data.

Procedures

Primary and secondary school principals were invited to participate in the study. We selected 12 schools that were widely distributed across Singapore, including both public and private schools from each main region (e.g. East, West, South and North regions), and that were interested to understand the video-gaming behaviour of their students. Each school chose 4 classes in each level of Primary 3, Primary 4, Secondary 1, and Secondary 2 to participate in the study. Informed consents were sought from the parents through the schools. A liaison teacher from each school collated the information and excluded students whose parents refused consent from the study. Assent was obtained from the students through informing them that participation in the survey was voluntary and they could withdraw at any time. Privacy of the students' responses was assured by requiring the teachers to seal collected questionnaires in the envelopes provided in the presence of the students. It was also highlighted on the questionnaires that the students' responses would be read only by the researchers. Because the entire survey questionnaire consisting of about 400 items was considered to be lengthy, surveys were administered several times. At each time, a few subsets of the survey questionnaire were administered in the classrooms with the help of school teachers.

Measures

The entire survey questionnaire consisted of 10 subsets covering various areas of questioning including, but not limited to demographic information, gaming habits, personal strengths, social attitudes, aggression and hostile traits, pathological video-gaming, gaming experiences, home environment and parental control, and somatic symptoms. Pathological video-gaming was measured with a 10-item screening instrument derived from the pathological gambling items of the DSM-IV. This scale had been used previously in a national study of American youth.[6] Several prior studies had also used pathological video-gaming scales based on the criteria of pathological gambling in DSM editions.[3,12-14,23] Participants could respond "no," "sometimes," or "yes" to each of the 10 symptoms. The items are displayed in Table 1. Based on the DSM criteria, participants were required to report at least half (5) of the symptoms to be classified as pathological. As it is unclear whether "sometimes" should be considered to be equivalent to a "yes," a "no," or in-between, 3 versions were calculated to test different algorithms. The first version treated "sometimes" to be equivalent to a "yes" and yielded reasonable reliability ($\alpha = 0.71$) and the highest prevalence of pathological video-gaming (27.4%, which seems unreasonably high). The second version treated "sometimes" as a "no" and also yielded a lower alpha score of 0.68 and the lowest and most conservative prevalence (5.1%). The third version treated "sometimes" to be equivalent to half of a yes (yes = 1, sometimes = 0.5, no = 0). This approach also yielded a reasonable reliability score ($\alpha = 0.71$), and had a prevalence that was much closer to the second version

than to the first (8.7%). Thus, the third version was adopted as it was conservative in its prevalence while still allowing participants who "sometimes" experienced symptoms to be considered. This approach was also used in the recent national American study.[6] The variables selected for video game habits and the construct validity test of the pathological video-gaming included the number of hours of playing video games per week, frequency of visiting Local Area Network (LAN) centres, academic performance, impulse control problems, social competence, hostile cognition, somatic complaints, intelligence, socioeconomic status defined by housing type, and damages on functioning in self-care, family, peer interaction, and schooling. Gentile and colleagues[24] have provided data demonstrating the validity of self-report measures regarding video-gaming behaviours. The specific details of the measurements of these variables are presented in Table 1.

Data Weighting and Statistical Analysis

The data were gathered from a wide range of schools and response rates were high (99%). Nonetheless, to adjust for the oversampling of boys and discrepancies in other demographic characteristics, the data were weighted to reflect the general population of 10- to 14-year-old in Singapore according to sex and race based on 2000 Census[34] and 2005 General Household Survey data.[35]

Chi-square tests and t-tests were performed to compare the prevalence of each symptom of pathological video-gaming and the average number of symptoms by gender, and to compare frequencies or levels in the constructs by

Table 1. Measurement of Study Variables

Variables	Adapted from of items	Number of items	Items/ Sample items	Response options	Reliability (Cronbach's α)
Video-gaming habits	General Media Habits Questionnaire (GMHQ)[25]	3	Weekly amount of video-games played	Hours spent	N.A
	Adult Involvement in Media Scale[26,27]		Presence of video-gaming system in child's bedrooms	Yes/No	
			Frequency of visiting LAN centres	Number of days per week	
Impulse control problem	Barratt Impulsiveness Scale[28]	14	e.g. "I keep my feelings under control"	Strongly disagree (1) to strongly agree (4)	0.75
			e.g. "I talk even when I know I shouldn't"		
Social competence	Personal Strengths Inventory – II[29]	4	e.g. "I know how to be accepted in a group"	Strongly disagree (1) to strongly agree (4)	0.71
			e.g. "I get along well with other people"		
Hostile cognition	Huesmann and Guerra (1997)[30]	20	e.g. "In general, it's OK to hit other people"	"It's really wrong" (1) to"It's perfectly OK" (4)	0.95
			e.g. "Suppose a boy says something bad to another boy, John, do you think it's wrong for John to hit him?"		
Somatic complaints	General mental health survey[31]	10	e.g. wrist pain, neck pain, headache, blurred vision	"Never" (1) to (4) "everyday or almost everyday"	N.A
Damages in functioning in self-care, family, peer interaction and schooling	Partly adapted from Charlton (2002)[32]	10	Self care: e.g. "Have you skipped meals, baths or sleep so you could play more computer- or video-games?"	Yes/No/Sometimes	N.A
			Family: e.g. "Have you ever hit anyone or damaged anything at home during an argument about your computer-video-game playing?"		
			Peer interaction: e.g. "Have you been spending less time with your friends or family so that you can play more computer- or video- games?"		
			Schooling: e.g. "Have you ever skipped school to play computer- or video- games?"		
Intelligence	Raven's Standard Progressive Matrices Plus (SPM Plus) (1998)[33]	60	Test of observation skills and problem solving ability	6 or 8 option categories	0.80

pathological status (i.e. pathological vs non-pathological gamer) for convergent and divergent validity tests. Hierarchical linear models were conducted to test the differences between pathological and non-pathological gamers on all continuous variables. These analyses take into account the nested nature of the data, with children being nested within schools. This allows us to test the effect of pathological status, controlling for sex, race, SES and school-level differences. A further hierarchical model tested the relation between pathological status and school performance, controlling for weekly amount of video-gaming along with sex, age, race, and SES. Controlling for weekly amount of gaming allows us to test if pathological status as measured by DSM style items is distinct from the amount of time playing. SPSS version 18 was used for data weighting and analyses.

Results

Prevalence of Pathological Video-Gaming

Most (82.6%) of the respondents reported playing video games for at least some time each week. The average child reported playing for 20.2 hours per week (*SD* = 25.5), with boys playing more (*M* = 22.1 hours/week, *SD* = 26.7) than girls (*M* = 18.2 hours/week, *SD* = 24.0, *t* = 4.18, *df* = 2985, *P* <0.001). These are substantially higher than the 13.2 hours per week reported by American youth measured with the same instrument.[6]

As displayed in Table 2, most pathological symptoms were demonstrated by a small percentage of young gamers, with some being more typical. "Playing to escape from problems, bad feelings, or stress" is the symptom most often seen among young gamers in Singapore (30% say "yes," with an additional 24% saying "sometimes"), and 22% of student respondents said they become restless or irritable when they attempt to reduce their play. The other potentially problematic symptoms were endorsed by far fewer young gamers, with the least likely symptom being stealing video games or money to buy games (3% say "yes," with an additional 4% "sometimes").

As video-gaming is known to be a gendered phenomenon, the prevalence of pathological video-gaming was compared by gender in this study. The results showed that boys were more likely than girls to report the presence of each symptom. Overall, however, the average number of symptoms endorsed was low (*M* = 2.1, *SD* = 1.7), with boys reporting more symptoms (*M* = 2.5, *SD* = 1.8) than girls (*M* = 1.7, *SD* = 1.6, *t* = 12.05, *df* = 2720, *P* <0.001). As for pathological status, almost one in 11 (8.7%) of video-gamers could be classified as pathological as defined by exhibiting at least 5 of the 10 symptoms. Boys were also more likely to be classifiable as pathological, with 12.6% of boys and 4.7% of girls (χ^2 =53.8, *df* = 1, *P* <0.001) meeting the diagnostic criteria.

Construct Validity Tests of Pathological Video-Gaming

Tables 3 and 4 display the differences between pathological and non-pathological gamers on the above dimensions. As predicted, pathological gamers, spent approximately twice as much time playing (averaging over 37 hours per week), were more likely to have a video-game system in

Table 2. Prevalence of Each Symptom of Pathological Video Game Use

	Total Sample(n = 2998)		% Yes	
In the past year,	**Yes**	**Sometimes**	**Boys**	**Girls**
Has your schoolwork suffered because you spent too much time playing computer- or video-games?	12%	34%	14%	9%*
Have you ever skipped your studies or co-curricular activities to play more computer- or video-games?	7%	9%	9%	5%*
Do you need to spend more and more time and/or money on VGs to feel the same amount of excitement?	9%	15%	13%	6%*
Have you played VGs to escape from problems, bad feelings, or stress?	30%	24%	34%	26%*
Are you thinking about computer- or video-games more and more?	17%	25%	23%	11%*
Have you stolen a VG from a store or a friend, or stolen money in order to buy a VG?	3%	4%	3%	2%*
Have you tried to play VGs less often or for shorter periods of time, but are unsuccessful?	13%	28%	14%	13%*
Have you become restless or irritable when trying to cut down or stop playing computer- or video games?	22%	23%	25%	19%*
Have you ever lied to family or friends about how much you play VGs?	10%	16%	13%	7%*
Have you ever needed to borrow money so you could get or play computer- or video-games?	4%	5%	6%	3%*
Average number of symptoms reported		2.1	2.5	1.8†
Pathological gaming prevalence (displaying at least 5 symptoms)		8.7%	12.6%	4.7%

*P <0.001 (as measured by χ^2), †P <0.001 (as measured by *t*-test)

Table 3. Convergent and Divergent Validity of Differences between Pathological and Non-pathological Gamers, as Tested with Hierarchical Linear Models

	Non-pathological (n = 2443)*	Pathological (n = 262)*	Hierarchical Test of Difference	Effect Size
Continuous variables	*M (SD)*	*M(SD)*	*t (df)*	*Cohen's d*
Weekly amount of video game play (in hours)	18.8 (24.2)	37.5 (31.6)†	9.29 (2526)	0.64
Frequency of visiting LAN centres	0.8 (0.4)	1.0 (0.5)†	6.24 (2506)	0.43
Grades last received in English	3.5 (1.4)	3.0 (1.3)†	2.53 (2421)	0.18
Grades last received in Math	3.7 (1.7)	2.9 (1.7)†	3.25 (2411)	0.23
Grades last received in Science	3.4 (1.5)	2.9 (1.4)†	2.93 (2076)	0.22
Grades last received in second language	3.7 (1.6)	3.0 (1.5)†	2.79 (2280)	0.21
Impulse control problems	2.3 (0.4)	2.5 (0.3)†	8.56 (2377)	0.60
Social competence	3.0 (0.6)	2.9 (0.6)‡	1.86 (2365)	0.14
Frequency of aches in hands and fingers in past month	1.5 (0.9)	1.8 (1.0)†	5.61 (2346)	0.40
Frequency of wrist pain in past month	1.5 (0.8)	1.9 (1.0)†	5.60 (2400)	0.40
Frequency of shoulder pain in past month	1.6 (0.9)	2.0 (1.1)†	6.00 (2409)	0.42
Frequency of neck pain in past month	1.7 (0.9)	2.0 (1.0)†	6.03 (2408)	0.43
Frequency of headaches in past month	1.9 (0.9)	2.1 (0.9)†	3.98 (2405)	0.28
Frequency of blurred vision in past month	1.4 (0.8)	1.8 (1.1)†	5.96 (2404)	0.42
Frequency of backache in past month	1.5 (0.9)	1.8 (1.0)†	5.60 (2397)	0.42
Frequency of trouble sleeping in past month	1.8 (1.0)	2.2 (1.1)†	4.82 (2403)	0.34
Normative beliefs about aggression	1.7 (0.6)	2.1 (0.7)†	6.38 (2462)	0.46
Intelligence	28.5 (4.9)	27.9 (5.6)	1.37 (2262)	0.10
Socioeconomic Status (defined by housing type)	3.9 (1.6)	3.8 (1.6)	1.56 (2522)	0.11

*Ns vary by analysis due to missing data. †P <0.10, ‡P <0.001

their bedrooms, visited LAN centres more often, received poorer grades in all school subjects measured, had more problems with impulse control, poorer social competence and greater hostile cognitions. Pathological video-gamers were also significantly more likely to report video-gaming related problems in their functioning. These included having more health problems (e.g. hand and wrist pains), more fights with parents over video games, getting too little sleep and being late for school, decreasing social contact, neglecting self-care to play games (e.g. skipping meals, baths, toilet), and relying on friends to help with homework due to gaming. The effect sizes range from what are conventionally considered to be small (d = 0.2) to moderate (d = 0.5), with a few in the large (d = 0.8) range. The tests of divergent validity showed that, as predicted, pathological video-gaming was not systematically related to intelligence or socioeconomic status.

It could be claimed that pathological status is simply isomorphic with the amount of time spent gaming, and if so, it would not be an interesting phenomenon. To test this, we performed a hierarchical linear model predicting school performance (controlling for sex, race, SES, and nesting within schools), which (based on many other studies) should be negatively related to grades. If pathological status is isomorphic with amount of gaming, then it should not be a significant predictor of grades after controlling for amount of gaming. Results from the hierarchical model demonstrated that pathological status remained a significant predictor of school performance even after controlling the weekly amount of video game playing and demographic variables (F = 7.63, df = 1.2440, P <0.01, Cohen's d = 0.20), indicating that the amount of gaming is insufficient to define pathological video-gaming.

Discussion

Using a large sample size of Singaporean children and adolescents from primary and secondary schools, this study provides a reliable estimate of the prevalence of pathological video-gaming in Singapore. As mentioned, 8.7 % of video game players were classified as pathological in video-gaming, exhibiting at least 5 out of 10 symptoms of damage to family, social, school, or psychological functioning. Notably, while the average amount of time spent per week on video-gaming is higher in this group of Singapore youth

Table 4. Convergent and Divergent Validity of Differences between Pathological and Non-pathological Gamers, as tested with chi-square tests

	Non-pathological (n = 2443)*	Pathological (n = 262)*	Effect Size
Percentage variables	%	%	Cohen's *d*
Has a video game system in the bedroom	61.7	70.0‡	0.12
Started arguing more with parents about games in past year†	14.0	52.1§	0.67
Fights with parents over games in past year†	16.0	51.1 §	0.59
Hit someone or damaged anything at home during argument over games†	8.9	37.8§	0.60
Gotten too little sleep in past year because of games†	22.4	63.8§	0.69
Been late for school in past year because of gaming†	5.2	31.1§	0.60
Skipping school to play games in past year†	4.2	24.4§	0.51
Decreasing time with friends or family in past year because of games†	17.1	61.9§	0.82
Skipping meals, baths, or toilet in past year to play games†	19.3	52.3§	0.69
Relying on friends to help with homework in past year because of games†	9.5	40.0§	0.60

Note: *Ns vary by analysis due to missing data. †Yes and sometimes responses combined.
‡P <0.01, §P <0.001 (as measured by χ^2)

(20.2 hours) than in American youth (13.2 hours),[6] the prevalence rate of 8.7 % is similar to other studies, such as a prevalence rate 9.9% of Spanish adolescents,[3] 8.5% of American youth ages 8 to 18,[6] 10.2% in South Korea[4] and 14% in China.[5] The analyses here replicate observed gender differences in pathological symptoms and overall pathological status.[6]

The study results also provide further support for the good construct validity of a DSM-based measure of pathological video-gaming. The rates or levels of all the constructs tested for convergent validity differed significantly by pathological status, with pathological gamers demonstrating higher amounts or frequencies in gaming habits and poorer physical, psychological and social functioning. These results are consistent with the findings from prior studies that used DSM-based measure of pathological video-gaming.[3,18] Furthermore, the absence of significant difference in intelligence and SES by pathological status confirmed the divergent validity of pathological video-gaming. We also replicated the findings from the US[6] where pathological status predicted poorer academic performance, after controlling the amount of time playing, demonstrating that pathological video-gaming is not simply isomorphic with excessive video game play.

Overall, this study indicates the need for parents, educators and professional practitioners to consider the problem of pathological video-gaming among youth in a more dynamic and comprehensive manner, taking into account the students' social contexts, namely that of their family, peers, school and community. The Singapore government has been actively developing the island-state into "a vibrant global media city so as to foster a creative economy and connected society",[26] but it must also look out for the needs of vulnerable youth who may have difficulty in maintaining a healthy balance.

This study is limited by its correlational nature. No claims are made about the causal relations between the variables in this study. It is likely that pathological video-gaming could result in higher aggression, and poorer impulse control, social competence and school performance, or vice versa. Another limitation is the nature of the response scale. It is unclear whether all youth would interpret the difference between "yes" and "sometimes" in the same way. The results of the reliability test of pathological video-gaming were similar regardless of how we defined "sometimes", however, suggesting that it may not be a major problem. Nonetheless, in a clinical setting, this approach would only serve as a screen for a detailed clinical assessment of the problem.

The primary strengths of this study are its large sample size, the high participation rates, and the ability to weight the data into the correct population proportions. Therefore, the findings are likely to be generalisable to Singaporean youth in Primary 3 and 4, and Secondary 1 and 2, with supporting evidence for the construct validity of the DSM-based pathological video-gaming measure. Nonetheless, several questions remain. We do not know the etiology of pathological video-gaming, who is at greatest risk, what the time course is, how long the problems persist, whether pathological gamers need help to regain the balance in their lives, what types of help would be most effective, or whether pathological video-gaming is a unique problem by itself or part of a broader spectrum of disorders. Longitudinal studies will be needed to test most of those questions, and

research using a probability sample of Singapore youth is required to replicate the findings of this study with enhanced generalisability. The present study was designed to examine whether pathological video-gaming is a significant issue to warrant further attention. With almost one out of 10 youth gamers demonstrating real-world problems due to their gaming, it seems that this study has achieved its goals of illuminating a complex problem that is becoming a challenge to parents, educators, and healthcare professionals, in an island-state like Singapore.

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