

Prevalence and Correlates of Internet Gaming Problem among Internet Users: Results from an Internet Survey

Mythily Subramaniam,¹ MBBS, MHSM, Boon Yiang Chua,¹ MSc, Edimansyah Abidin,¹ PhD, Shirlene Pang,¹ MSc, Pratika Satghare,¹ MSc, CRRA, Janhavi A Vaingankar,¹ MSc, Swapna Verma,² MBBS, Say How Ong,^{3,4} MBBS, Mmed, Louisa Picco,¹ MPH, Siow Ann Chong,¹ MBBS, Mmed, MD

Abstract

Introduction: The current study aimed to establish the prevalence of internet gaming disorder (IGD) and its association with demographic characteristics, game genre, game use (time spent on gaming), as well as psychological distress, social phobia and well-being among current online gamers in Singapore. **Materials and Methods:** A total of 1251 participants aged 13 to 40 years completed the study which was administered as a web survey. The online questionnaire was designed using QuestionPro, and consisted of 8 sections and 105 questions. The 9-item Internet Gaming Disorder Questionnaire was used to establish the prevalence of IGD in the study. A series of logistic regression models were used to examine the associations between IGD, demographic characteristics and game genre, as well as IGD and psychological distress, social phobia and well-being. **Results:** The prevalence of IGD established using a cutoff of 5 among those who were current online gamers was 17.7%. Multiple logistic regressions revealed that those meeting criteria of IGD were more likely to be older, reported an earlier age of onset of playing online games, had primary and secondary education versus tertiary education, were currently students versus being currently employed and played massively multiplayer online role-playing games. Distress and social anxiety were higher while satisfaction with life was significantly lower among those who met criteria for IGD than those who did not meet the criteria. **Conclusion:** The prevalence of IGD and its negative consequences in our sample of current online gamers was significant and point towards the need for further clinical studies and innovative interventions to address the problem.

Ann Acad Med Singapore 2016;45:174-83

Key words: Gamers, Massively multiplayer online role-playing games, Psychological distress

Introduction

The internet has become indispensable to societies across the world as it continually creates new ways for people to communicate, congregate, and share information. Given the multifaceted ways in which individuals can interact with the internet, there is a growing appreciation that the internet serves different purposes and that these individuals may be quite different from each other in terms of their preferred choice of online activities. Increasingly, reports have begun to focus on the preoccupation that some people develop with certain aspects of the internet, particularly online games.

Internet gaming is a booming market. In 2012, more than 1 billion individuals played computer games.¹ While most users enjoy these games and use them as a form of recreation, for some, it leads to problematic use and research has shown that under certain conditions, gaming may become psychologically, socially and/or physically detrimental to the user.^{2,3} Internet gaming addiction is a behavioural problem that has been described in numerous ways. According to Griffiths,⁴ biopsychosocial processes lead to the development of addictions, such as internet gaming addiction, which include the following components

¹Research Division, Institute of Mental Health, Singapore

²Department of Early Psychosis Intervention, Institute of Mental Health, Singapore

³Department of Child & Adolescent Psychiatry, Institute of Mental Health, Singapore

⁴Department of Psychological Medicine, KK Women's & Children's Hospital, Singapore

Address for Correspondence: A/Prof Mythily Subramaniam, Research Division, Institute of Mental Health, Buangkok Green Medical Park, 10 Buangkok View, Singapore 539747.

Email: Mythily@imh.com.sg

–the salience of the behaviour (preoccupation with gaming); use of the behaviour in order to modify mood (i.e. gaming is used to escape reality or create the feeling of euphoria); development of tolerance (the individual needs increasingly more time to feel the same effect); withdrawal symptoms subsequent to the discontinuation of the behaviour (the individual feels anxious, depressed, and irritable if they are prevented from playing) as well as interpersonal and intrapersonal conflict develops as a consequence of the behaviour (the individual has problems with relationships, studies, job, and hobbies). Finally, upon discontinuation of the behaviour, the individual experiences relapse (they reinstate gaming).⁴ The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) Workgroup has recommended the inclusion of internet gaming disorder (IGD) in Section III of DSM-5 as “a condition warranting more clinical research and experience before it might be considered for inclusion in the main book as a formal disorder”.⁵ Under the new DSM-5 framework, IGD refers to the “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 5 (or more) criteria in a 12-month period”.⁵ The diagnostic criteria include a preoccupation with gaming, withdrawal symptoms, tolerance (i.e. spending more time gaming), lack of control, loss of other interests, use despite negative consequences, deception, mood modification, and losing a relationship, job, and similarly important aspects of life.⁵ A recent article by Petry et al⁶ has attempted to standardise the DSM-5 internet gaming criteria and made a case for the use of structured questions with consistent wording, while ensuring that clinicians and researchers in different countries could contribute to the development and wording of these items.

Research on gaming addiction dates back to 1983,⁷ however, these early studies as well as those conducted in recent years suffer from lack of comparability. Conceptualisation of internet gaming addiction, varied use of terminology (internet gaming addiction, dependence, excessive play), diverse instruments and lack of standardised diagnostic criteria have all contributed to the problem—possibly resulting in varying prevalence rates ranging from as low as 0.1% to more than 50%.^{8,9} A growing number of studies indicate that internet gaming addiction is associated with various negative consequences.² The psychological consequences include sacrificing offline relationships, sleep, work, education and socialising,¹⁰⁻¹⁷ obsession with gaming and a lack of offline face-to-face relationships,¹⁸ lack of attention,^{10,19} aggression and hostility,^{19,20} stress,¹⁰ dysfunctional coping,^{10,21,22} poor academic achievement,^{15,23} low well-being and loneliness.²⁴ Other issues identified include problems with sleeping^{18,25} and seizures.²⁶

The problem has reached worrying proportions in a number of Asian countries. In South Korea, internet gaming addiction is viewed as a public health concern,²⁷ where up to 24% of children who have been diagnosed with internet addiction are hospitalised.²⁸ In Japan, the government has recognised the problem following a study by the Ministry of Education, which has led to the development of “fasting camps” where individuals suffering from internet and gaming addiction are helped by being cut off from technology completely.²⁹ It has been stated that “the higher the internet penetration and social acceptance of gaming, the higher the prevalence of gaming problems”.³⁰ Singapore is a sovereign city-state and island country in Southeast Asia. The country is placed highly among international rankings with regard to education, healthcare, and economic competitiveness. Singapore also has one of the highest broadband penetration rates in the world³¹ where 84% of households have home internet access and almost all of such households are connected to the internet via broadband. About 97% of households with children attending school have home computer access and about 96% have home internet access. The easy access to and increasing use of internet games among Singaporean children and adolescents, contribute to public concerns regarding pathological or obsessive gaming. However, scientific evidence regarding the extent of the problem in the Singapore context is scant although anecdotal accounts of local clinicians indicate a growing problem in the clinical setting. The current study aimed to establish the prevalence of IGD using the IGD questionnaire⁶ and its association with demographic characteristics, game genre, game use (time spent on gaming), as well as psychological distress, social phobia and well-being among a sample of online gamers using an internet survey.

Materials and Methods

Participants

The inclusion criteria comprised those residing in Singapore when the survey was conducted, aged between 13 to 40 years, able to read and understand English and current internet users. The study was largely targeted at adolescents and young adults (15 to 39 years)³² who are internet savvy and consumers of internet games. To be more inclusive, the lower age limit was set at 13 years to include those who had at least completed primary school (to ensure a better understanding of the research procedures and the survey) and the upper age limit was set at 40 years.

A total of 1251 participants aged 13 to 40 years completed the study which was administered as a web survey. Fifteen records were excluded for unreliable data. The survey was launched and completed in October 2014. Two recruitment

strategies were adopted. One of the strategies was to advertise the study through printed flyers which were distributed to retail game stores. The other strategy was to create awareness by placing the flyer digitally on social media platforms and various gaming forums. Individuals who participated in the survey could share the link to the web survey with their friends and relatives using mobile messaging and emails. Individuals were asked to indicate their willingness to participate by going through an online consent form. The study was approved by the relevant institutional and ethics committees. All respondents who completed the survey were given a SGD \$20 voucher as an inconvenience fee.

Procedure

The online questionnaire was opened for 4 days. The survey ended automatically when the survey quota was reached. The online questionnaire was designed using QuestionPro, an online survey tool. The web survey consisted of 8 sections and 105 questions, and took about 10 to 15 minutes to complete. The participants remained anonymous. The data collected was downloaded from QuestionPro in SPSS's data file format.

Measurements

Sociodemographic and background variables such as age, gender, average playing time during weekdays, average playing time during weekends, game genres played by participants and for how many years they had played internet games were captured. Game genres included in the questionnaire were based on the extant literature that reported on the popularity of games based on player subscriptions as well as their identification as a prominent genre in Asian settings.^{33,34} These included: (i) Massively multiplayer online role-playing games (MMORPGs) which are multiplayer role-playing games (RPGs) played online over the internet wherein a large number of people simultaneously interact and play the same game. The players assume the role of a character, and development of this character by reaching "higher levels" is the primary goal of the game. These include games like 'World of Warcraft', 'Runescape' and 'MapleStory'; (ii) Real-time strategy games (RTS) which are based typically in a war setting. The participant builds structures, forms an army, manoeuvres structures and units under his control and engages in battle to destroy the opponent's assets;³⁵ (iii) First-person shooter games (FPS) which involve interacting with objects in a virtual world through a first-person perspective. The interactions largely comprise shooting the objects using guns and other projectile weapons.³⁶ These games can be played either by a single player or they can be team-based;

and (iv) Others – participants were asked to report on any other type of game genres/games they had played as open text under this category.

The 9-item Internet Gaming Disorder Questionnaire⁶ was used to assess IGD. The questionnaire is developed such that each item is intended to reflect a DSM-5 criterion for IGD in whole. Each question is answered as a Yes/No and relates to a period of the past 12-months, with affirmative responses to any item indicative of meeting the criterion. The proposed cut-point of 5 criteria was conservatively chosen in the DSM-5 for determining those who met criteria for IGD. The internal consistency reliability of the scale assessed by Cronbach's alpha coefficient in this sample was 0.725.

The 12-item General Health Questionnaire (GHQ-12) is a self-administered screening questionnaire, aimed at detecting individuals with a diagnosable psychiatric disorder.³⁷ The GHQ-12 is the most extensively used screening instrument for common mental disorders, in addition to being a more general measure of psychiatric well-being. The brevity makes it attractive for use in internet surveys. The customary scores used are a bimodal scale (0-0-1-1) which was adopted in our study. The validity of this instrument has been demonstrated in previous studies in Singapore.^{38,39} The Cronbach's alpha coefficient in the current study was 0.85. We used a cutoff score of 3 and above as indicating psychological distress in our study.

The Social Phobia Inventory (SPIN)⁴⁰ is a 17-item scale for social anxiety disorder (social phobia). The items were rated over the past week and assessed each of the symptom domains of social anxiety disorder (fear, avoidance, and physiologic arousal). Each item was rated on a 5-point scale from 0 = not at all to 4 = extremely. Scores were summed to determine a total score ranging from 0 to 68. A cutoff point of 19 was used to determine the presence of social phobia. The Cronbach's alpha coefficient for SPIN in the study was 0.93.

The 5-item Satisfaction with Life Scale⁴¹ was designed to measure global cognitive judgments of one's life satisfaction (not a measure of either positive or negative affect). Participants indicated how much they agree or disagree with each of the 5 items using a 7-point scale that ranged from 7 = strongly agree to 1 = strongly disagree. Higher scores indicate greater satisfaction with life. This scale has been validated in a previous study among Singapore college students.⁴² The Cronbach's alpha coefficient in the current study was 0.89.

Statistical Analysis

Mean and standard deviations or median (if normality was not satisfied) were calculated for continuous variables, and frequencies and percentages for categorical variables.

In order to adjust for a large number of variables, a series of logistic regression models was used to examine the associations between IGD, demographic characteristics and game genre, as well as IGD and psychological distress, social phobia and well-being. First regression models were run separately for each specific online game played and IGD; the final model included all sociodemographic variables and controlled for other games. Similarly, regression models were first run for psychological distress, social phobia and well-being (adjusted for sociodemographic variables) and IGD. Subsequently, the final model was run for psychological distress, social phobia and well-being, adjusted for sociodemographic variables as well other scales. Statistical significance was evaluated at the <0.05 level using two-sided tests. All statistical analyses were carried out using the Statistical Analysis Software (SAS) System version 9.⁴³

Results

The sociodemographic characteristics of the study sample are shown in Table 1. All further analyses were conducted on those who indicated that they played online games currently.

The most popular games played by current gamers were 'Counterstrike' (47.2%) followed by 'MapleStory' (45.2%) and 'Defense of the Ancients (DotA) 2' (39.5%). The prevalence of IGD established by using a cutoff of 5 among current online gamers was 17.7% (n = 172/972). Among current online gamers, there were significant differences in game playing frequency in terms of days in a week, hours during weekdays and hours on weekends between those who met DSM-5 criteria for IGD and those who did not. The duration of play in terms of mean days in a week (5.0 vs 3.8, $P < 0.001$), and mean hours during weekdays (4.1 vs 3.0, $P < 0.001$) and weekends (6.5 vs 4.5, $P < 0.001$) were

Table 1. Sociodemographic Characteristics of the Overall Sample and of Current Online Gamers

Variable	Sample n = 1236		Current Online Gamers n = 972		
	Mean	SD	Mean	SD	
Age	23.7	5.3	23.6	5.0	
	n	%	n	%	
Sex	Female	550	44.5	358	36.8
	Male	686	55.5	614	63.2
Nationality	Singapore citizen	1172	94.8	926	95.3
	Permanent resident	64	5.2	46	4.7
Ethnic group	Chinese	1153	93.3	903	92.9
	Malay	52	4.2	42	4.3
	Indian	23	1.9	20	2.1
	Others	8	0.7	7	0.7
Education level (completed)	Primary	29	2.4	24	2.5
	Secondary	28	2.3	19	2.0
	'O'*/'N'† level	209	16.9	167	17.2
	'A'‡ level	191	15.5	134	13.8
	ITE	28	2.3	28	2.9
	Polytechnic and other diplomas	345	27.9	279	28.7
Employment	University	406	32.9	321	33.0
	Student	636	51.5	496	51.0
	Employed	543	43.9	436	44.9
	Unemployed	45	3.6	35	3.6
Ever played internet games?	Housewife/husband	12	1.0	5	0.5
	Never	150	12.1		
	Yes	1085	87.9		

ITE: Institute of Technical Education

*Equivalent to Grade 10.

†Exams taken after 4 years of secondary education.

‡Equivalent to Grade 12.

significantly higher among those who met criteria for IGD than those without IGD.

Multiple logistic regressions revealed that those who met criteria for IGD were more likely to be older, had an earlier age of onset of play, with primary and secondary education, were currently students and played MMORPGs (Table 2). Multiple logistic regression with adjustment for demographic characteristics revealed that those who play ‘World of Warcraft’ remained significantly associated with meeting IGD criteria (Table 3). Figures 1 and 2 show the relationship between IGD, GHQ-12 and SPIN. After adjusting for sociodemographic characteristics and the score in other scales, these relationships remained significant throughout the regression models (Table 4).

Discussion

The prevalence of IGD among a sample of online gamers was 17.7%. A previous study from Singapore reported that 17.1% of adolescents reported “excessive use” of the internet, where excessive use was defined as internet use of more than 5 hours a day.⁴⁴ Yen et al⁴⁵ have suggested that sociocultural differences might partly account for the higher prevalence of internet addiction in some Asian countries than in the United States.⁹ The authors proposed that in Asian countries where academic success is highly sought after, and adolescent face strong competition in the school environment, the “internet provides a virtual world in which they can temporarily forget the stress of academic performance”. These influences may partly explain the high prevalence of IGD among current online gamers in Singapore.

Table 2. Sociodemographic Correlates of Internet Gaming Disorder

Variable		IGD				Multiple Logistic Regression				
		No		Yes		OR	95% CI	P Value*		
		n	%	n	%					
Age	Mean (SD)	23.5	4.9	24.0	5.6	1.1	1.1	1.2	<0.0001	
Age of onset	Mean (SD)	13.5	4.2	13.2	3.8	0.9	0.9	1.0	0.017	
Sex	Female	300	83.8	58	16.2	Ref.				
	Male	500	81.4	114	18.6	1.0	0.7	1.5	0.965	
Nationality	Singapore citizen	763	82.4	163	17.6	Ref.				
	Permanent resident	37	80.4	9	19.6	1.3	0.6	2.9	0.502	
Ethnic group	Chinese	741	82.1	162	17.9	Ref.				
	Malay	35	83.3	7	16.7	0.9	0.2	3.2	0.830	
	Indian	17	85	3	15	1.0	0.4	2.5	0.929	
	Others	7	100	0	0					
Education level (completed)	University	265	82.6	56	17.4	Ref.				
	Primary	16	66.7	8	33.3	3.4	1.2	9.4	0.019	
	Secondary	12	63.2	7	36.8	4.3	1.5	12.4	0.008	
	‘O’*/‘N’ [†] level	133	79.6	34	20.4	1.3	0.8	2.3	0.301	
	‘A’ [‡] level	115	85.8	19	14.2	0.8	0.4	1.5	0.498	
	ITE	23	82.1	5	17.9	1.1	0.4	3.0	0.910	
Employment	Polytechnic and other diplomas	236	84.6	43	15.4	0.9	0.6	1.4	0.606	
	Unemployed	30	85.7	5	14.3	Ref.				
	Student	404	81.5	92	18.5	1.8	1.1	2.9	0.028	
	Employed	362	83	74	17	0.9	0.3	2.6	0.889	
Type of game played	Housewife/husband	4	80	1	20	1.0	0.1	10.4	0.973	
	MMORPG	540	79.9	136	20.1	1.6	1.0	2.4	0.032	
	MOBA	431	80.3	106	19.7	1.3	0.8	1.9	0.243	
	FPS	530	81.8	118	18.2	0.9	0.6	1.4	0.797	

FPS: First-person shooter; IGD: Internet gaming disorder; ITE: Institute of Technical Education; MMORPG: Massively multiplayer online role-playing games; RTS/MOBA: Real time strategy/multiplayer online battle arena

*<0.05 significant.

[†]Equivalent to Grade 10.

[‡]Exams taken after 4 years of secondary education.

[§]Equivalent to Grade 12.

^{||} Multiple logistic regression adjusting for sociodemographic characteristics.

Table 3. Specific Online Games Played by Respondents and Associations with Internet Gaming Disorder

	Current Gamers (n = 972)		IGD (n = 172)		Multiple Logistic Regression Adjusting for Sociodemographic Characteristics				Multiple Logistic Regression Adjusting for Sociodemographic Characteristics and Other Games			
	Yes		Yes		OR	95% CI	P Value	OR	95% CI	P Value		
	n	%	n	%								
a) Massively multiplayer online games role-playing games (MMORPG)												
1) Runescape	184	18.9	38	22.1	1.3	0.9	2.0	0.168	1.2	0.7	1.8	0.545
2) Eve	10	1	4	2.3	3.1	0.9	11.5	0.086	2.6	0.7	10.5	0.173
3) World of Warcraft	184	18.9	43	25	1.6	1.0	2.4	0.031	1.6	1.0	2.5	0.040
4) MapleStory	439	45.2	87	50.6	1.4	1.0	2.0	0.074	1.3	0.9	2.0	0.139
5) Guild Wars 2	107	11	22	12.8	1.2	0.7	2.0	0.549	1.0	0.6	1.9	0.939
6) Star Wars: The Old Republic	37	3.8	7	4.1	0.9	0.4	2.3	0.900	0.8	0.3	2.1	0.643
7) Elder Scrolls Online	51	5.2	8	4.7	0.8	0.4	1.8	0.634	0.7	0.3	1.7	0.432
8) Others	193	19.9	33	19.2	0.9	0.6	1.3	0.469	0.9	0.5	1.4	0.522
b) Real-time strategy (RTS)/ multiplayer online battle arena (MOBA)												
1) Defense of the Ancients (DotA) 2	384	39.5	75	43.6	1.3	0.9	1.9	0.160	1.1	0.7	1.7	0.593
2) Star Craft 2	147	15.1	27	15.7	1.0	0.7	1.7	0.869	0.9	0.6	1.5	0.792
3) Others	138	14.2	24	14	0.9	0.6	1.5	0.765	0.9	0.5	1.5	0.714
c) First-person shooter (FPS)												
1) Counterstrike	459	47.2	85	49.4	1.1	0.8	1.6	0.485	1.0	0.7	1.5	0.900
2) Call of Duty: Ghosts	153	15.7	26	15.1	0.9	0.5	1.4	0.595	0.8	0.4	1.3	0.291
3) Team Fortress 2	188	19.3	30	17.4	0.8	0.5	1.3	0.443	0.7	0.4	1.2	0.172
4) Battlefield 4	199	20.5	37	21.5	1.0	0.7	1.6	0.879	1.0	0.6	1.6	0.954
5) Blacklight: Retribution	33	3.4	10	5.8	1.7	0.8	3.9	0.187	2.0	0.8	5.0	0.139
6) Others	133	13.7	23	13.4	1.0	0.6	1.6	0.883	1.1	0.7	2.0	0.656
d) Others	193	19.9	25	14.5	0.7	0.4	1.0	0.077	0.7	0.4	1.1	0.128

Comparison across studies is difficult as questionnaires as well as sampling methodologies vary widely. A study from France using a modified Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition-Text Revision (DSM-IV-TR) substance dependence adapted scale reported that among MMORPG players, 27.5% of subjects screened met addiction criteria to MMORPGs.⁴⁶ A study from Hungary on 5045 secondary school students using the Problematic Online Gaming Questionnaire Short-Form (POGQ-SF), and latent class analysis revealed 8.2% of gamers (4.6% of total sample) belonged to the high risk group.⁴⁷ While Festl et al⁸ measured problematic game use with the Gaming Addiction Short Scale (GAS) on 580 adolescents, 1866 younger and 1936 older adults (overall n = 4382) and reported that 3.7% of the respondents could be considered problematic users,

the percentage of problematic gamers among adolescents was higher at 7.6%. Using random cluster sampling and the GAS in a sample of 920 participants recruited from 4 secondary schools in different districts of Hong Kong, Wang et al⁴⁸ found the prevalence of gaming addiction to be 13%.

Increasing age was a significant risk factor for IGD. The mean age of those with IGD was 24.1 years in our sample, while that of the overall sample was 23.7 years. It has been pointed out that computer games are no longer aimed at the adolescent audience⁴⁹ but also at adults. Our study also highlights the need to examine IGD not just in school-based population but also among those in institutions of higher learning as well as young working adults. Age of onset was another important factor associated with IGD with those initiating play at an earlier age showing a significant

Table 4. Relationship between Internet Gaming Disorder and GHQ-12, SPIN and SWLS Scores among Current Online Gamers

	IGD				Multivariate Logistic Regression Adjusting for Sociodemographic Characteristics			Multivariate Logistic Regression Adjusting for Sociodemographics Characteristics and Other Variables*				
	No		Yes		OR	95% CI	P Value	OR	95% CI	P Value		
	n	%	n	%								
GHQ-12 cutoff score 3+	142	18.3	77	47.8	4.6	3.1	6.7	<0.001	3.4	2.2	5.4	<0.001
SPIN cutoff point of 19+	240	33.1	81	56.3	2.7	1.9	4.0	<0.001	2.0	1.3	3.2	<0.001
	Mean	SD	Mean	SD								
SWLS total score	21.2	6.9	18.5	6.5	0.95	0.92	0.97	<0.001	0.97	0.94	0.998	0.038

GHQ-12: General Health Questionnaire-12; SPIN: Social Phobia Inventory; SWLS: Satisfaction with Life Scale

*Adjusted for any 2—GHQ-12, SPIN and SWLS scores as applicable.

association with IGD. Our findings are similar to that of Achat et al⁴⁶ who reported that a young age of online gaming onset was a stronger variable associated with MMORPG addiction compared to the number of years of play.

MMORPGs mix the genres of role-playing video games and massively multiplayer online games, involving a large number of players in a virtual environment interacting via ‘Avatars’ with each other.¹⁶ Playing MMORPGs was a significant predictor of IGD after adjusting for sociodemographic factors in our study. Our results are similar to that reported by others. In a sample of 696 MMORPG players, achievement, socialising, and escapism motivations were found to be predictive of addictive play, and together with gender accounted for 19% of variance in the MMORPG addiction score.⁵⁰ In a sample of 175 primarily Dutch MMORPG players, escapism and game mechanics predicted excessive gaming over and above the contribution of the time spent gaming, together explaining 46% of the variance in problematic gaming.⁵¹ It has been suggested that the social, multiplayer nature of the game

may increase the desire to play or there might be an element of peer pressure that leads to continued playing among MMORPG players.⁸ Structural game characteristics such as positive reinforcements within the game may also support and encourage problematic behaviour in MMORPG play.⁵²

While, overall the most popular game was ‘Counterstrike’, the most popular MMORPG in this sample was ‘MapleStory’, which currently has over 11 million account holders worldwide.⁵³ However, adjusting for demographic characteristics and other games played revealed that only those who played ‘World of Warcraft’ were consistently associated with IGD, however, we are unable to explain this finding.

Distress as measured by GHQ-12 and social anxiety as measured by SPIN were higher while the mean score on satisfaction with life scale were significantly lower among those who met criteria for IGD. As compared to those who did not meet criteria for IGD, more than twice of those meeting IGD criteria expressed significant distress (GHQ ≥ 3). A growing number of studies indicate that internet

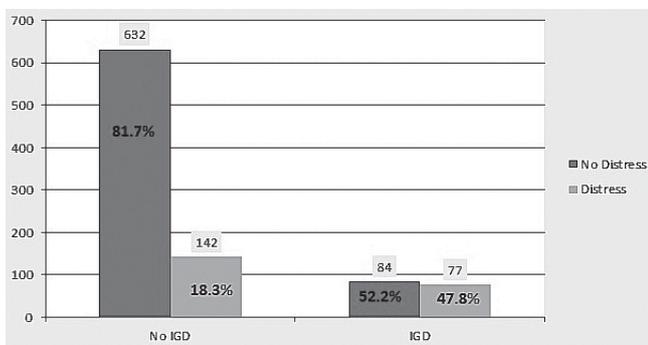


Fig. 1. Graph showing psychological distress as measured by GHQ-12 among those respondents with IGD versus those without IGD. IGD: Internet gaming disorder; GHQ-12: General Health Questionnaire-12. GHQ-12 cutoff scores of 3 and more signify distress. $P < 0.001$.

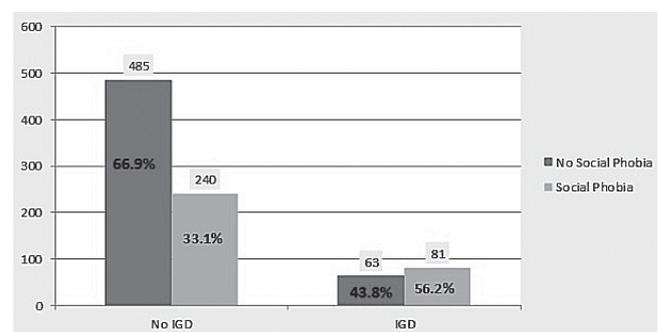


Fig. 2. Graph showing social phobia as measured by SPIN among those respondents with IGD versus those without IGD. IGD: Internet gaming disorder; SPIN: Social Phobia Inventory. SPIN cutoff scores of 19 and above are indicative of social phobia. $P < 0.001$.

gaming addiction is associated with various negative consequences. Wei et al⁵⁴ reported a positive correlation between online gaming hours and depressive symptoms in their internet-based study among 722 online gamers in Taiwan. Wenzel et al⁵⁵ similarly found a high prevalence of self-reported depression and anxiety with increasing playing time among Norwegian adults. A longitudinal study by Seay et al⁵⁶ suggests that low psychological well-being results in game addiction, and not vice versa. The authors postulate that with increasing severity of depression, the self-regulatory processes are blunted and they become less effective in preventing problematic use. Thus, while depression is not a necessary precursor of problematic use, they suggest its presence may catalyse and accelerate the development of problematic use.

Our study also found that the majority of those who met the criteria for IGD also met the criteria for social phobia as assessed by SPIN (56.2%). A cross-sectional study by Lo et al⁵⁷ reported significant differences in degree of social anxiety among the heavy, light, and non-players of online games, with heavy players experiencing significantly higher levels of social anxiety compared to both light and non-players. Several researchers have suggested that social interaction in online games particularly appeals to people who are socially unskilled; who may not have an active social life in their offline lives; and feel anxious over establishing real-life interpersonal relationships.^{58,59}

Festl et al⁸ examined the implications of problematic game use on psychosocial well-being; their data showed a significant negative relationship between life satisfaction and problematic game use. Lemmens et al⁶⁰ similarly found a negative correlation between scores on the Game Addiction Scale (GAS) and life satisfaction. A panel study by Lemmens et al⁶¹ similarly suggests that social competence, self-esteem, and loneliness were significant predictors of pathological gaming 6 months later.

The strengths of the study include the relatively large sample size, the first use of the IGD diagnostic scale based on DSM-5 and the collection of data that was largely complete (overall missing data was less than 2.5%) and verification of unique internet protocol (IP) addresses by the data manager. The results of the study must however, be considered in view of some of the limitations to the study. The sample was self-selected which might affect generalisability of the findings. It is possible that heavy gamers may not have participated as they may have felt that the study was stigmatising and casual gamers may have felt that the study does not apply to them though the flyers advertising the study clearly indicated that both gamers with different habits and non-gamers could participate in the study. All measures were self-reported and were not verified by a trained clinician. Although an online, anonymous survey format may facilitate

greater self-disclosure, the self-administered nature of the questionnaire is less robust than directed interviewing. Self-administered online questionnaires have been used in other studies in these fields and have been described as a satisfactory method.¹⁶ Research has also indicated that self-diagnosis correlates with standardised measures of addiction, suggesting that the individual's perception of problems can be relatively accurate.⁶² The IGD measure is yet to be clinically validated in Singapore's population. Thus, it is possible that there are false positives leading to a higher than true prevalence rate.

It must also be pointed out that the pathophysiology of IGD remains contentious. The concept of IGD could evolve in the future as researchers have argued the need for a deeper consideration of the developmental, social and cognitive processes involved in internet gaming.^{63,64} Researchers have also suggested that gaming does not always occur online, and to encompass both online and offline gaming they propose the use of 'video-gaming disorder'⁶⁵ as an alternative to IGD. Future research is thus needed to understand the phenomenon better and studies must be conducted using random samples to establish the clinical validity and true prevalence of the disorder in the population.

Acknowledgement

The study was funded by the Singapore Ministry of Health's National Medical Research Council under its Centre Grant Funding. Grant Number: NMRC/CG/004/2013.

REFERENCES

1. PC Gaming Alliance. PC Gaming Alliance releases two member-exclusive reports covering all aspects of the still-dominant PC gaming industry 2013. Available at: <http://pcgamingalliance.org/press/entry/pc-gaming-alliance-releases-two-member-exclusive-reports-covering-pc-gaming>. Accessed on 5 April 2014.
2. Kuss DJ, Griffiths MD. Internet Gaming Addiction: A Systematic Review of Empirical Research. *Inter J Ment Health Addiction* 2012;10:278-96.
3. Kuss DJ. Internet gaming addiction: current perspectives. *Psychol Res Behav Manag* 2013;6:125-37.
4. Griffiths MD. A "components" model of addiction within a biopsychosocial framework. *J Subst Use* 2005;10:191-7.
5. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-5)*. Arlington, VA: American Psychiatric Association, 2013. p. 795-798.
6. Petry NM, Rehbein F, Gentile DA, Lemmens JS, Rumpf HJ, Möble T, et al. An international consensus for assessing internet gaming disorder using the new DSM-5 approach. *Addiction* 2014;109:1399-406.
7. Soper WB, Miller MJ. Junk time junkies: an emerging addiction among students. *School Counsellor* 1983;31:40-3.

8. Festl R, Scharrow M, Quandt T. Problematic computer game use among adolescents, younger and older adults. *Addiction* 2013;108:592-9.
9. Zhang L, Amos C, McDowell WC. A comparative study of Internet addiction between the United States and China. *Cyberpsychol Behav* 2008;11:727-9.
10. Batthyány D, Müller KW, Benker F, Wöfling K. Computer game playing: clinical characteristics of dependence and abuse among adolescents. *Wien Klin Wochenschr* 2009;121:502-9.
11. King DL, Delfabbro P. Understanding and assisting excessive players of video games: a community psychology perspective. *Aust Community Psychol* 2009;21:62-74.
12. Liu M, Peng W. Cognitive and psychological predictors of the negative outcomes associated with playing MMOGs (massively multiplayer online games). *Comput Human Behav* 2009;25:1306-11.
13. Peng W, Liu M. Online gaming dependency: a preliminary study in China. *Cyberpsychol Behav Soc Netw* 2010;13:329-33.
14. Peters CS, Malesky LA. Problematic usage among highly-engaged players of massively multiplayer online role playing games. *Cyberpsychol Behav* 2008;11:480-3.
15. Rehbein F, Kleimann M, Mößle T. Prevalence and risk factors of video game dependency in adolescence: results of a German nationwide survey. *Cyberpsychol Behav Soc Netw* 2010;13:269-77.
16. Yee N. The psychology of MMORPGs: emotional investment, motivations, relationship formation, and problematic usage. In: Schroeder R, Axelsson A, editors. *Avatars at Work and Play: Collaboration and Interaction in Shared Virtual Environments*. London, UK: Springer-Verlag, 2006. p. 187-207.
17. Yee N. The demographics, motivations and derived experiences of users of massively-multi-user online graphical environments. *PRESENCE: Teleoperators and Virtual Environments* 2006;15:309-29.
18. Allison SE, von Wahlde L, Shockley T, Gabbard GO. The development of the self in the era of the Internet and role-playing fantasy games. *Am J Psychiatry* 2006;163:381-5.
19. Chan PA, Rabinowitz T. A cross-sectional analysis of video games and attention deficit hyperactivity disorder symptoms in adolescents. *Ann Gen Psychiatry* 2006;5:16-26.
20. Chiu SI, Lee JZ, Huang DH. Video game addiction in children and teenagers in Taiwan. *Cyberpsychol Behav* 2004;7:571-81.
21. Hussain Z, Griffiths MD. Excessive use of massively-multi-player online role-playing games: a pilot study. *Int J Ment Health Addict* 2009;7:563-71.
22. Hussain Z, Griffiths MD. The attitudes, feelings, and experiences of online gamers: a qualitative analysis. *Cyberpsychol Behav* 2009;12:747-53.
23. Jeong EJ, Kim DW. Social activities, self-efficacy, game attitudes, and game addiction. *Cyberpsychol Behav Soc Netw* 2011;14:213-21.
24. Lemmens JS, Valkenburg PM, Peter J. Psychosocial causes and consequences of pathological gaming. *Vol Comput Human Behav* 2011;27:144-52.
25. Dworak M, Schierl T, Bruns T, Struder HK. Impact of singular excessive computer game and television exposure on sleep patterns and memory performance of school-aged children. *Pediatrics* 2007;120:978-85.
26. Chuang YC. Massively multiplayer online role-playing game-induced seizures: a neglected health problem in internet addiction. *Cyberpsychol Behav* 2006;9:451-6.
27. Starcevic V. Is Internet addiction a useful concept? *Aust N Z J Psychiatry* 2012;47:16-9.
28. Ahn DH. Korean policy on treatment and rehabilitation for adolescents' internet addiction. In: Commission NY, editor. *2007 International Symposium on the Counseling and Treatment of Youth Internet Addiction*. Seoul, Korea: National Youth Commission; 2007. p. 49.
29. Majumdar A. Japan plans 'fasting camps' for Web-addicted children. *Tech 2*. 2013. Available at: <http://tech2.in.com/news/general/japan-plans-fasting-camps-for-webaddicted-children/912284>. Accessed on September 2, 2013.
30. King DL, Delfabbro PH, Griffiths MD. Clinical interventions for technology-based problems: excessive Internet and video game use. *J Cogn Psychother* 2012;26:43-56.
31. IDA Singapore. Annual survey on infocomm usage in households and by individuals for 2012. Available at: <https://www.ida.gov.sg/~media/Files/Infocomm%20Landscape/Facts%20and%20Figures/SurveyReport/2012/2012HHmgt.pdf>. Accessed on 31 March 2016.
32. Geiger AM, Castellino SM. Delineating the age ranges used to define adolescents and young adults. *J Clin Oncol* 2011;29:e492-3.
33. Chen KT, Huang P, Lei CL. Game traffic analysis: An MMORPG perspective. *Computer Networks* 2006;50:3002-23.
34. Achterbosch L, Pierce R, Simmons G. Massively multiplayer online role-playing games: the past, present, and future. *ACM Comput Entertain* 2008;5:Article 9. Available at: <http://doi.acm.org/10.1145/1324198.1324207>. Accessed on 31 March 2016.
35. Hagelbäck J. Multi-agent potential field based architectures for real-time strategy game bots. PhD thesis. Karlskrona, Blekinge, Sweden: Blekinge Institute of Technology, 2012. Available at: <https://www.diva-portal.org/smash/get/diva2:805274/FULLTEXT01.pdf>. Accessed on 6 September 2015.
36. Isokoski P, Martin B. Eye tracker input in first person shooter games. In: *Proceedings of COGAIN 2006: Gazing into the Future*, 78-81. Available at: http://www.cogain.org/cogain2006/COGAIN2006_Proceedings.pdf. Accessed on 31 March 2016.
37. Goldberg DP, Hillier VF. A scaled version of the General Health Questionnaire. *Psychol Med* 1979;9:139-45.
38. Boey KW. Distressed and stress resistant nurses. *Issues Ment Health Nurs* 1999;20:33-54.
39. Lim L, Ng TP, Chua HC, Chiam PC, Won V, Lee T, et al. Generalised anxiety disorder in Singapore: prevalence, co-morbidity and risk factors in a multi-ethnic population. *Soc Psychiatry Psychiatr Epidemiol* 2005;40:972-9.
40. Connor KM, Davidson JR, Churchill LE, Sherwood A, Foa E, Weisler RH. Psychometric properties of the social phobia inventory. *Br J Psychiatry* 2000;176:379-86.
41. Diener E, Emmons RA, Larsen RJ, Griffin S. The satisfaction with life scale. *J Pers Assess* 1985;49:71-5.
42. Diener E, Scollon CN, Oishi S, Dzokoto V, Suh EM. Positivity and the construction of life satisfaction judgments: global happiness is not the sum of its parts. *J Happiness Stud* 2000;1:159-76.
43. SAS Institute Inc. *SAS/STAT 9.2 User's Guide: Introduction to Survey Sampling and Analysis Procedures*. Book Excerpt. Cary, NC: SAS Institute Inc, 2008.
44. Subramaniam M, Qiu S, Winslow M. Prevalence and correlates of excessive Internet use among youth in Singapore. *Ann Acad Med Singapore* 2008;37:9-14.
45. Yen CF, Yen JY, Ko CH. Internet addiction: ongoing research in Asia. *World Psychiatry* 2010;9:97.
46. Achab S, Nicolier M, Mauny F, Monnin J, Trojak B, Vandel P, et al. Massively multiplayer online role-playing games: comparing characteristics of addict vs non-addict online recruited gamers in a French adult population. *BMC Psychiatry* 2011;11:144.
47. Pápay O, Urbán R, Griffiths MD, Nagygyörgy K, Farkas J, Kökönyei G, et al. 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;16:340-8.

48. Wang CW, Ho RT, Chan CL, Tse S. Exploring Personality Characteristics of Chinese Adolescents with Internet-Related Addictive Behaviors: Trait Differences for Gaming Addiction and Social Networking Addiction. *Addict Behav* 2015;42:32-5.
 49. Griffiths MD, Davies MNO, Chappell D. Breaking the stereotype: the case of online gaming. *CyberPsychol Behav* 2003;6:81-91.
 50. Zanetta DF, Zermatten A, Billieux J, Thorens G, Bondolfi G, Zullino D, et al. Motivations to play specifically predict excessive involvement in massively multiplayer online role-playing games: evidence from an online survey. *Eur Addict Res* 2011;17:185-9.
 51. Kuss DJ, Louws J, Wiers RWW. Online gaming addiction? Motives predict addictive play behavior in massively multiplayer online role-playing games. *Cyberpsychol Behav Soc Netw* 2012;15:480-5.
 52. Chumbley J, Griffiths M. Affect and the computer game player: the effect of gender, personality, and game reinforcement structure on affective responses to computer gameplay. *Cyberpsychol Behav* 2006;9:308-16.
 53. Maple Story. Available at: <http://maplestory.nexon.net/landing>. Accessed on 12 November 2014.
 54. Wei HT, Chen MH, Huang PC, Bai YM. The association between online gaming, social phobia, and depression: an internet survey. *BMC Psychiatry* 2012;12:92.
 55. Wenzel HG, Bakken IJ, Johansson A, Götestam KG, Øren A. Excessive computer game playing among Norwegian adults: self-reported consequences of playing and association with mental health problems. *Psychol Rep* 2009;105:1237-47.
 56. Seay AF, Jerome WJ, Lee KS, Kraut RE. Project Massive: A Study of Online Gaming Communities. Proceedings of the CHI 2004 Conference on Human Factors in Computing Systems, Vienna, Austria, 24-29 April, 2004. Available at: <http://social.cs.uiuc.edu/class/cs598kgk-04/papers/p1421-seay.pdf>. Accessed on 7 April 2016.
 57. Lo S, Wang C, Fang W. Physical interpersonal relationships and social anxiety among online game players. *Cyberpsychol Behav* 2005;8:15-20.
 58. Chak K, Leung L. Shyness and locus of control as predictors of Internet addiction and Internet use. *Cyberpsychol Behav* 2004;7:559-70.
 59. Peters CS, Malesky LA. Problematic usage among highly-engaged players of massively multiplayer online role playing games. *Cyberpsychol Behav* 2009;11:481-3.
 60. Lemmens JS, Valkenburg PM, Peter J. Development and validation of a game addiction scale for adolescents. *Media Psychology* 2009;12:77-95.
 61. Lemmens JS, Valkenburg PM, Peter J. Psychosocial causes and consequences of pathological gaming. *Comput Human Behav* 2011;27:144-52.
 62. Widianto L, Griffiths MD, Brunsten VA. Psychometric comparison of the Internet Addiction Test, the Internet-Related Problem Scale, and self-diagnosis. *Cyberpsychol Behav Soc Netw* 2011;14:141-9.
 63. Allison SE, von Wahlde L, Shockley T, Gabbard GO. The development of the self in the era of the internet and role-playing fantasy games. *Am J Psychiatry* 2006;163:381-5.
 64. King DL, Delfabbro PH. The cognitive psychology of Internet gaming disorder. *Clin Psychol Rev* 2014;34:298-308.
 65. King DL, Delfabbro PH. Issues for DSM-5: video-gaming disorder? *Aust N Z J Psychiatry* 2013;47:20-2.
-