

RUNNING HEAD: COMORBIDITY OF IGD WITH OTHER MENTAL DISORDERS

Internet Gaming Disorder explains unique variance in psychological distress and disability after controlling for comorbid depression, OCD, ADHD and anxiety.

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Abstract

This study extends knowledge about the relationship of Internet Gaming Disorder (IGD) to other established mental disorders by exploring comorbidities with anxiety, depression, Attention-Hyperactivity Disorder (ADHD), and Obsessive-compulsive Disorder (OCD), and assessing whether IGD accounts for unique variance in distress and disability. An online survey was completed by a convenience sample that engages in Internet gaming (N=404). Participants meeting criteria for IGD based on the Personal Internet Gaming Disorder Evaluation – 9 (PIE-9) reported higher comorbidity with depression, OCD, ADHD and anxiety compared to those who did not meet the IGD criteria. IGD explained a small proportion of unique variance in distress (1%) and disability (3%). IGD accounted for a larger proportion of unique variance in disability than anxiety and ADHD, and a similar proportion to depression. Replications with clinical samples using longitudinal designs and structured diagnostic interviews are required.

Introduction

Internet Gaming Disorder (IGD) was included in section III of the Diagnostic and Statistical Manual of Mental Disorders (5th Ed., DSM-5¹) as an emerging diagnosis for further study. The aim of providing a set of proposed diagnostic criteria was to improve consistency in future research² and to provide a framework from which further refinements could be investigated³. Debate around IGD and its underlying structure remains contentious⁴⁻⁷, so further research into the validity of measures assessing the proposed criteria is required. The Personal Internet Gaming Disorder Evaluation (PIE-9)⁸ was recently developed to directly assess the proposed DSM-5 criteria, which will allow for further evaluations of the IGD construct.

One of the key questions to be addressed in further research of IGD is whether the proposed disorder is related to elevated levels of distress and disability compared to those who do not have the disorder. This question was examined as part of an initial development study of the PIE-9⁸, which found that individuals who met IGD criteria according to the PIE-9 had significantly higher rates of distress and disability compared to those who did not meet the criteria⁸. However, the DSM-5 notes that IGD may be comorbid with other mental disorders, mentioning specifically Major Depressive Disorder, Attention Deficit Hyperactivity Disorder (ADHD), and Obsessive Compulsive Disorder (OCD)¹. Generalized Anxiety Disorder (GAD) is also highly comorbid with other mental disorders⁹, and one of the proposed DSM-5 criteria suggests an explicit functional link between internet-gaming and emotions such as anxiety, whereby internet gaming may be used as an emotion regulation strategy (Criterion 8: use of internet games to escape or relieve a negative mood, such as helplessness, guilt, anxiety or depression⁷). Therefore, it is unclear whether the higher distress and disability reported by Percy et al.⁸ in their IGD group were attributable to IGD per se, or rather comorbid disorders. It is therefore imperative that research demonstrates that IGD is uniquely associated with problematic levels of distress and disability. Additionally, since the release of the DSM-5 criteria for IGD¹, there has been limited research examining comorbidities with IGD. To date, three studies have investigated specific relationships with IGD. The first study reported that the IGD and ADHD were comorbid, with 39.08% of individuals who met IGD criteria also meeting ADHD criteria¹⁰. The second study reported that individuals with IGD were more likely to have symptoms of depression compared to the

control group, and that comorbid depression symptoms were associated with poorer emotion regulation in participants with IGD¹¹. The third study reported that in a sample of 14-17 year olds, IGD was associated with a range of comorbid psychosocial and psychological symptoms, including anxiety, depression, and attention problems.¹² However, no previous studies have explored all of the proposed comorbidities in the DSM-5.

The first aim of the current study was to investigate the prevalence of Major Depressive Disorder, ADHD, OCD and Generalized Anxiety Disorder(GAD) symptoms in individuals who did and did not meet criteria for IGD. The second aim was to investigate whether IGD explains unique variance in distress and disability after accounting for symptoms of comorbid depression, OCD, ADHD, and GAD. The first hypothesis was that participants with IGD based on the PIE-9 would display higher rates of comorbid symptoms compared to those who did not meet the IGD criteria. The second hypothesis was that IGD would explain unique variance in distress and disability after accounting for symptoms of comorbid disorders.

Methods

Participants

Convenience samples of adult community members (N= 285) and university students (N=119) who reported engaging in Internet gaming participated in this research. The sample included 70% Males (N = 282) and 30% females (N = 121), with an age distribution between 16 and 60 ($M = 23.8$ years, $SD = 7.2$). Please see Percy et al.,⁸ for further demographic characteristics.

Measures

The Personal Internet Gaming Disorder Evaluation (PIE-9)⁸ is a 9-item scale developed as a self-report measure of the proposed IGD criteria¹. Participants rate the frequency of symptoms over the past 12 months using a 5 point Likert scale ranging from never (1) to very often (5). Percy et al.⁸ reported a single factor structure, and high internal consistency ($\alpha = 0.89$) and test-retest reliability (ICC = 0.77). Convergent validity was assessed with the Internet Gaming Disorder test (IGD-20)¹⁴ ($r = .64$), Gaming Addiction Scale¹⁵ ($r = .57$) and the Problematic Video-game Playing scale (PVP)¹⁶ ($r = .43$). The psychometric properties and suggested caseness cut off scores for the mental disorder measures used in this research are summarised in Table 1.

<insert Table 1 about here>

The following established measures were utilised to assess related symptoms or disorders, and each scale has demonstrated adequate reliability and validity for research purposes. The Kessler-10 scale^{17,18} is an established 10-item measure of non-specific psychological distress. The World Health Organisation Disability Assessment Schedule 2.0 (WHODAS) self-report^{19,20,21} is a 12-item measure intended for use as a measure of general disability, applicable across cultures. The Adult Self-Report Scale is an adult measure of ADHD, developed by the World Health Organisation²². The Generalised Anxiety Disorder-7 (GAD-7) scale is a brief measure to assess Generalised Anxiety Disorder²³. The Obsessive Compulsive Inventory – Revised (OCI-R) is a brief measure designed to assess Obsessive-compulsive Disorder (OCD)²⁴. The Personal Health Questionnaire 9 (PHQ-9) is a brief measure designed to assess depressive symptoms²⁵.

Procedure

Following approval from the University’s Human Research Ethics Committee (Approval No. RDHS-09-15), two online surveys were hosted on Qualtrics.com, one survey for students and one for the general public. Questionnaire data was downloaded into SPSS v22 for analysis.

Results

Descriptive information for each of the scale measures by sample is reported in Table 2. Twenty two participants in the community sample and 12 participants in the student sample met the criteria for Internet Gaming Disorder based on their PIE-9 scores. Table 3 provides the number of participants who met the diagnostic criteria for each of the mental disorder measures by Internet Gaming Disorder status. Table 3 also provides the results of chi-square tests in a combined sample between IGD and non-IGD groups. The chi-square tests demonstrated that participants with IGD were more likely to meet criteria for each of the mental disorders than participants in the non-IGD group.

<insert Table 2 about here>

<insert Table 3 about here>

A series of independent samples t-tests indicated that participants who met the criteria for IGD scored significantly higher than those who did not on the mental disorder measures (ASRS²², GAD-7²³, OCI-R²⁴ and PHQ-9²⁵). The effects sizes were large (Table 4).

<insert Table 4 about here>

Table 5 reports the two hierarchical multiple regression analyses (HMRA) used to test whether ‘caseness’ (meeting the criteria for IGD) on the PIE-9 accounted for a unique proportion of variance in distress (K10^{17,18}) and disability (WHODAS-II^{19,20}), beyond that accounted for by caseness on the GAD-7, PHQ-9, ASRS and OCI-R. The two analyses were conducted on a combined sample of both the community and student samples to preserve power and minimise Type II error.

The first HMRA predicted distress. On step 1 the GAD-7, PHQ-9, ASRS, and OCI-R, accounted for 67% of the variance in distress, $R^2 = .67$, $F(4, 399) = 205.98$, $p < .001$. On step 2, the PIE-9 was added to the regression and accounted for an additional 1% of the variance in distress, $\Delta R^2 = .01$, $F(1, 398) = 8.95$, $p = .003$. In combination, the five predictor variables explained 68% of the variance, $R^2 = .68$, adjusted $R^2 = .67$, $F(5, 398) = 169.86$, $p < .001$. The effect size for IGD was small. Depression was the strongest predictor.

The second HMRA predicted disability. On step 1, the GAD-7, PHQ-9, ASRS, and OCI-R accounted for 39% of the variance in disability, $R^2 = .39$, $F(4, 399) = 65.05$, $p < .001$. On step 2, the PIE-9 was added to the regression and accounted for an additional 3% of the variance in disability, $\Delta R^2 = .03$, $F(1, 398) = 22.54$, $p < .001$. In combination, the five predictor variables explained 43% of the variance, $R^2 = .43$, adjusted $R^2 = .42$, $F(5, 398) = 59.35$, $p < .001$. As noted in Table 5, Each of the predictors of disability were significant in step 2 except anxiety (GAD-7). Interestingly, IGD accounted for more unique variance than both Anxiety and ADHD and was approaching the effect size for Depression. The largest effect size was for OCD.

<insert Table 5 about here>

Discussion

This study examined the comorbidity of Internet Gaming Disorder with other mental disorders. The first hypothesis, that participants with IGD based on the PIE-9 would display higher rates of comorbid symptoms of GAD, depression, OCD, and ADHD compared to those who do not meet the IGD criteria, was partially supported. Participants who met the criteria for IGD, compared to those who did not meet the IGD criteria, reported higher rates of comorbid symptoms of depression (59% vs. 27%), ADHD (91% vs. 67%), GAD (47% vs. 17%), and OCD (47% vs. 18%). The second

hypothesis, that IGD would explain unique variance in distress and disability after accounting for symptoms of comorbid disorders, was supported. IGD caseness explained unique variance in distress and disability after accounting for GAD, depression, ADHD, and OCD caseness. For disability, IGD explained a higher proportion of unique variance than GAD and ADHD, and a similar proportion of unique variance to depression.

IGD comorbidity with other mental disorders

The findings from this study were consistent with suggestions in the latest edition of the DSM¹ that IGD is likely to be co-morbid with Major Depressive Disorder, ADHD, and OCD. In addition, GAD was investigated as a probable co-morbid disorder because of the potential relationship to two of the criteria for IGD, withdrawal symptoms and to ‘escape or relieve a negative mood’⁷. In the current study, participants who met the criteria of IGD were more likely to have higher scores on each of the existing mental disorder measures. In the community sample, the strongest effect sizes were for OCD, ADHD, and major depressive disorder, in descending order. In the student sample, the strongest effect sizes were for ADHD and major depressive disorder followed by GAD and OCD. Our findings were consistent with recent research that also found higher rates of comorbid anxiety and attention problems¹² and ADHD¹⁰ symptoms in people who met, or who were at risk of meeting, IGD criteria.

Unique variance in distress and disability

It is now often accepted that comorbidity across mental disorders is the norm rather than the exception¹. In building evidence that IGD may be considered a separable disorder it is important to demonstrate that IGD uniquely contributes to distress and disability. The findings of the current study provide evidence that IGD is associated with statistically significant but limited unique variance in distress and disability. Specifically, IGD explains a relatively small proportion of unique variance in distress compared to symptoms of comorbid disorders such as depression, anxiety, ADHD, and OCD. However, IGD explained a similar proportion of unique variance in disability to depression and more than GAD and ADHD. The PIE-9 accounted for a larger portion of unique variance in disability (3%) compared to distress (1%).

IGD may have shown a stronger unique relationship with disability than distress due to the nature of the primary activity of IGD. Gaming itself is a pleasurable activity (i.e., not distressing per se),

however, when the criteria of IGD are met this activity may become disabling. Similarly, individuals who excessively gamble typically do not find the activity of gambling distressing²⁶, but considerable disability can ensue from the consequences of excessive gambling. The main impact of the disorder may therefore be reflected in adverse effects in the domains of life goals, social functioning, schooling, physical health, and mental wellbeing, which cumulatively account for what has been captured by the measure of disability. This is particularly the case for individuals who meet the criteria for IGD, which require the symptoms to be present for at least 12 months¹.

Limitations

The effect sizes for IGD in each of the MRAs were relatively small and, as such, this does not necessarily imply practical significance. The limited number of cases of IGD in the sample may have reduced power to detect true effects, however this was addressed in part through combining the two samples for the MRA. Additionally, although the measures used for existing mental disorders are well established, caseness was not determined by structured diagnostic assessments. We would recommend that future studies utilise structured clinical interviews with clinical samples, rather than an online survey approach, if attempting to replicate or extend the results of the current study.

Future research direction

Perhaps one of the more interesting incidental findings of the current study was the high number of cases that met both ADHD and IGD criteria. In particular, all participants who met the criteria for IGD in the student sample also met the criteria for likely having ADHD. There is currently research underway to investigate whether video game play can improve ADHD symptoms²⁷ based on the premise that those with ADHD appear to be able to better focus for extended periods of time on video games, compared to other activities. Additionally, there appears to be a relationship between video game play and ADHD, with early research suggesting there may be bidirectional causality between ADHD and increased video game play²⁸.

In addition to exploring the relationship between ADHD and IGD, continuing to develop our understanding of the underlying nature of IGD may further our understanding of why these relationships exist, both theoretically and practically for treatment purposes. As a first step towards this, we recommend investigating whether the results of the current study can be replicated by

conducting a follow up study in a clinical setting to assess whether these comorbidities present during diagnostic interviews in clinical samples. Finally, alternative brief measures of IGD were recently developed (The Internet Gaming Disorder Scale²⁹, Internet Gaming Disorder Scale – Short Form³⁰), so it would be useful to compare these instruments to the PIE-9 in terms of the ability to discriminate between IGD and other mental disorders, and uniquely predict distress and disability. Convergence between research using these instruments will strengthen confidence in our findings.

Conclusions

This study extends knowledge about the relationship of IGD to existing mental disorders. Despite comorbidities, the finding that IGD contributes unique variance in explaining distress and disability helps to build the case for including IGD in further editions of the DSM as a distinct disorder. However, further evidence of the uniqueness of IGD would assist in supporting the findings of the current study.

Author Disclosure Statement

No competing financial interests exist.

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Table 1. Summary of existing disorder measures.

Measure name	Purpose	Number of items	Response format	Sample item	Factor structure	Internal Consistency (α)	Caseness criteria
GAD-7	Generalised Anxiety Disorder	7	4 point Likert, not at all(0) to nearly every day(3)	Not being able to stop or control worrying	1	.92	$>10^{14}$
PHQ-9	Major Depressive Disorder	9	4 point Likert, not at all(0) to nearly everyday(3)	Little interest or pleasure in doing things	1	.89	$>10^{16}$
ASRS	Adult ADHD	18	5 point Likert from never(0) to very often(4)	How often are you distracted by activity or noise around you?	2	.88	$>17^{13}$
OCI-R	Obsessive Compulsive Disorder	18	5 point Likert, not at all(0) to extremely(4)	I collect things I don't need	6	.83 - .90	$\geq 21^{15}$
K10	Non-specific psychological distress	10	5 point Likert, none of the time (1) to all of the time(5)	During the last 30 days, how often did you feel that everything was an effort?	1	.93	
WHODAS	Disability	12	5 point Likert, none to extreme or cannot do.	In the past 30 days, how much difficulty have you had in standing for long periods, such as 30 minutes?	1	.94 - .98	

Note. ASRS = World Health Organisation adult Attention Deficit Hyperactivity Disorder self-report scale, GAD-7 = Generalized Anxiety Disorder 7 scale, OCI-R = Obsessive Compulsive Inventory – Revised, PHQ-9 = Patient Health Questionnaire 9, Kessler-10 = Kessler 10 scale, WHODAS 2.0 = World Health Organization Disability Assessment Schedule 2.0 12 item version. α = Cronbach's alpha for the current sample.

Table 2. Mean, standard deviation and range of mental health disorder, distress and disability scales by sample.

Measure	Community sample (n = 285)				Student sample (n = 119)			
	Mean	SD	Min	Max	Mean	SD	Min	Max
GAD-7 (total score)	5.28	5.37	0	21	4.66	4.86	0	21
PHQ-9 (total score)	7.49	6.47	0	27	6.18	5.92	0	25
ASRS (total score)	23.27	13.12	0	72	25.8	12.38	0	53
OCI-R (total score)	11.85	12.65	0	72	15.12	13.39	0	52
K10 (total score)	21.21	9.14	10	50	20.24	9.14	10	41
WHODAS (total as a percentage)	15.73	17.59	0	100	15.86	15.25	0	56

Note. PIE-9 Mean data has been reported by Percy et al.⁸, Kessler-10 = Kessler 10 scale, WHODAS 2.0 = World Health Organization Disability Assessment Schedule 2.0 12 item version, GAD-7 = Generalized Anxiety Disorder 7 scale, PHQ-9 = Patient Health Questionnaire 9, ASRS = World Health Organisation adult Attention Deficit Hyperactivity Disorder self-report scale, OCI-R = Obsessive Compulsive Inventory - Revised.

Table 3. Number and percentage of cases who did or do not meet cut-off criteria for GAD, Depression, ADHD and OCD by Internet Gaming Disorder classification.

	Community sample (n=285)				Student sample (n=119)				Combined sample (n=404)				X^2
	<i>IGD group</i>		<i>Non-IGD group</i>		<i>IGD group</i>		<i>Non-IGD group</i>		<i>IGD group</i>		<i>Non-IGD group</i>		
	n	%	n	%	n	%	n	%	n	%	n	%	
GAD-7													18.87*
criteria met	12	54.5	44	16.7	4	33.3	17	15.9	16	47.1	61	16.5	
criteria not met	10	45.5	219	83.3	8	66.7	90	84.1	18	52.9	309	83.5	
PHQ-9													15.08*
criteria met	13	59.1	80	30.4	7	58.3	20	18.7	20	58.8	100	27.0	
criteria not met	9	40.9	183	69.6	5	41.7	87	81.3	14	41.2	270	73.0	
ASRS													8.5**
criteria met	19	86.4	170	64.6	12	100.0	78	72.9	31	91.2	248	67.0	
criteria not met	3	13.6	93	35.4	0	0.0	29	27.1	3	8.8	122	33.0	
OCI-R													16.43*
criteria met	10	45.5	36	13.7	6	50.0	30	28.0	16	47.1	66	17.8	
criteria not met	12	54.4	227	86.3	6	50.0	77	72.0	18	52.9	304	82.2	

Note. * $p < .001$, ** $p = .002$. GAD-7 = Generalized Anxiety Disorder 7 scale, PHQ-9 = Patient Health Questionnaire 9, ASRS = World Health Organisation adult Attention Deficit Hyperactivity Disorder self-report scale, OCI-R = Obsessive Compulsive Inventory - Revised.

Table 4. Independent samples t-tests comparing scores on mental illness disability measures by Internet Gaming Disorder classification

Community sample		n	Mean	SD	<i>t</i>	<i>df</i>	<i>p</i>	Effect Size (Cohen's <i>d</i>)
GAD-7	IGD	22	9.32	5.83	3.75	283	<.001	0.83
	Non-IGD	263	4.94	5.21				
PHQ-9	IGD	22	13.32	8.03	4.55	283	<.001	1.01
	Non-IGD	263	7.00	6.09				
ASRS	IGD	22	35.82	18.18	3.44 ^a	22.57	.002	1.07
	Non-IGD	263	22.22	12.07				
OCI-R	IGD	22	26.77	23.76	3.17 ^a	21.68	.005	1.36
	Non-IGD	263	10.6	10.39				
Student sample		n	Mean	SD	<i>t</i>	<i>df</i>	<i>p</i>	Effect Size (<i>d</i>)
GAD-7	IGD	12	8.33	5.19	2.84	117	<.001	0.86
	Non-IGD	107	4.24	4.68				
PHQ-9	IGD	12	13	6.81	4.55	117	<.001	1.38
	Non-IGD	107	5.41	5.32				
ASRS	IGD	12	40.17	9.08	4.58	117	<.001	1.39
	Non-IGD	107	24.17	11.67				
OCI-R	IGD	12	22.58	16.75	2.06	117	<.001	0.62
	Non-IGD	107	14.28	12.79				

^aEqual variances not assumed

Note. IGD = Internet Gaming Disorder, PIE-9 = Personal Internet Gaming Disorder Evaluation 9, GAD-7 = Generalized Anxiety Disorder 7 scale, PHQ-9 = Patient Health Questionnaire 9, ASRS = World Health Organisation adult Attention Deficit Hyperactivity Disorder self-report scale, OCI-R = Obsessive Compulsive Inventory - Revised.

Table 5. IGD as a predictor of distress and disability after controlling for co-morbidities in two hierarchical multiple regression analyses.

Variables predicting distress (N = 404)		<i>B</i> [95% CI]	β	sr^2
Step 1				
	Anxiety (GAD-7)	5.48 [3.90, 7.06]**	.25	0.04
	Depression (PHQ-9)	9.19 [7.79, 10.57]**	.48	0.14
	ADHD (ASRS)	3.20 [2.06, 4.34]**	.17	0.02
	OCD (OCI-R)	3.74 [2.35, 5.12]**	.17	0.02
Step 2				
	Anxiety (GAD-7)	5.24 [3.67, 6.81]**	.23	0.03
	Depression (PHQ-9)	9.09 [7.72, 10.47]**	.47	0.13
	ADHD (ASRS)	3.09 [1.95, 4.23]**	.16	0.02
	OCD (OCI-R)	3.52 [2.14, 4.90]**	.16	0.02
	IGD (PIE-9)	2.77 [.95, 4.59]**	.09	0.01
Variables predicting disability (N = 404)		<i>B</i> [95% CI]	β	sr^2
Step 1				
	Anxiety (GAD-7)	5.76 [1.61, 9.91]*	.13	0.01
	Depression (PHQ-9)	10.25 [6.60, 13.89]**	.28	0.05
	ADHD (ASRS)	4.02 [1.02, 7.03]*	.11	0.01
	OCD (OCI-R)	13.07 [9.43, 16.71]**	.31	0.08
Step 2				
	Anxiety (GAD-7)	4.77 [.71, 8.84]*	.11	0.01
	Depression (PHQ-9)	9.86 [6.31, 13.42]**	.27	0.04
	ADHD (ASRS)	3.57 [.64, 6.50]*	.10	0.01
	OCD (OCI-R)	12.18 [8.62, 15.45]**	.29	0.06
	IGD (PIE-9)	11.36 [6.66, 16.07]**	.19	0.03

* $p < .05$ ** $p < .001$

Note. *B* = Unstandardized regression coefficient, β = Standardised regression coefficient, sr^2 = squared semi-partial correlations, CI = Confidence Interval, ADHD = Attention Deficit Hyperactivity Disorder, OCD = Obsessive Compulsive Disorder, IGD = Internet Gaming Disorder GAD-7 = Generalized Anxiety Disorder 7 scale, PHQ-9 = Patient Health Questionnaire 9, ASRS = World Health Organisation adult Attention Deficit Hyperactivity Disorder self-report scale, OCI-R = Obsessive Compulsive Inventory - Revised.