The Gaming Problem: A Latent Class Analysis of DSM-5 Criteria For Internet Gaming Disorder In A Non-Clinical Sample

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Abstract

Background: We aimed to test whether suggested DSM-5 criteria for Internet Gaming Disorder (IGD) share a similar latent structure to formally recognised addiction.

Methods: To do this we used latent class analysis on a dichotomous measure of IGD. The data was collected from a convenient general population sample (500) and a targeted gaming forum sample (236).

Results: We found a four or six-class model to be most appropriate, ranging from '*casual/non-gamer*' to '*potentially disordered*' with increasing symptom severity. The majority of '*potentially disordered*' gamers (5+ criteria) were found to be 18-30 years old, and no '*potentially disordered*' gamers were over 42.

Conclusion: The results suggest that gaming may share a similar latent structure to established addictions, with adolescents and young adults being more at risk. Studies replicating these results would be beneficial, with further emphasis on a critical evaluation of the criteria and symptom cut-off point.

Background

Gaming Disorder (GD) was recently recognised by the World Health Organization^[1] as a behavioural addiction in the eleventh edition of the International Classification of Diseases (ICD-11), while the apparently synonymous Internet Gaming Disorder (IGD) is not recognised diagnostically, but was included in the Diagnostic and Statistical Manual (DSM-5) to foster research in the area ^[2].

A comparison of both systems in Mexico found that prevalence estimates of the DSM were almost twice as high as the ICD ^[3]. Similarly, Jo, Bhang^[4] found that while all ICD-11 cases were found by the DSM-5, not all DSM-5 cases were found by the ICD-11. This could suggest that the current DSM-5 criteria are too inclusive, or that the ICD-11 criteria are not sensitive enough. We have focused this study on the DSM-5 criteria, since evidence has shown the measure to have robust psychometric properties ^[5]. In addition, Aarseth, Bean^[6] highlighted a number of concerns with the inclusion of GD in the ICD-11.

Previous studies on gaming have been inconsistent in classification, and results on prevalence, course, treatment, and biomarkers have been inconclusive ^[7]. Many researchers believe that gaming can become problematic ^[8, 9], while some are cautious ^[10] and do not regard IGD as a genuine behavioural addiction. Some of the concerns highlighted by ^[6] around gaming in the ICD-11 are relevant to the IGD, and these suggest that the introduction of gaming in any diagnostic manual is premature. In fact, Przybylski and Weinstein^[11] suggested that disordered gaming may actually be a symptom of a different underlying issue.

Latent class analyses help researchers to determine the number and type of classes a potential disorder may be split into, however the results are generally a function of the sample characteristics, and so may not be representative of 'definite' classes. Despite this, we can examine the classes found across several studies and see that research on problem gambling typically reports a three- ^[12-14] or four-class pattern ^[15, 16], with increasing severity between classes. Similarly, substance use has been found to fit a three-class ^[17-20], or four-class model ^[21, 22], categorised by severity. Interestingly, Deleuze, Rochat^[23] investigated both

behavioural and substance addiction and found three theoretical subgroups. These included addiction-prone individuals, at-risk users, and not-prone individuals. They noted that although only a small sample of participants reported gaming, it was associated with loss of control and negative outcomes over half of the time.

Previous research into IGD has found a similar three-class model [5, 24], with Peeters, Koning^[24] suggesting that the DSM-5 criteria could be helpful in identifying what they called 'problematic' gamers. However, they note that a strict cut-off point could lead to false positives. In contrast, Myrseth and Notelaers^[25] found a five-class model using the Gaming Addiction Scale-Adolescents. Despite this, Deleuze, Nuyens^[26] determined in their study that a two-class system was more able to distinguish between 'problematic' and 'regular' gamers. This dichotomous outcome hints at gaming being different to established addiction disorders and suggests a need for more research into how gaming compares to formally recognised addictions.

The listed studies either used a small sample, did not include adults, or used non-DSM criteria.

Although Clement^[27] reported that most gamers in the UK during 2019 were young adults (16-24), a significant number were older. In fact, 52% aged 25-34 were identified as gamers, 36% aged 35-44, and 40% aged 45-54. This would suggest that including a range of ages in gaming analysis could be beneficial.

Methods

Design

Using data collected from a cross-sectional online survey we conducted latent class analysis of DSM-5 criteria for IGD. Data was collected from a sample of adults (18+) to provide evidence towards whether IGD has a similar class structure to established addictions.

Participants

Five-hundred participants from the general population were recruited using convenience sampling through prolific.com in return for £7.50 (US\$10.02). There were 244 females, 250 males, and six selected the option 'other'. The average age was 29.67 years ($sd = 10.04$). A further 236 participants were recruited from online gaming forums (Discord and Reddit). Eighty-two were female, 139 were male, seven selected 'other', and five did not answer. The average sample age was 25.41 years ($sd = 6.52$).

Procedure

Participants from the general population completed an IGD checklist (here referred to as IGD-9) that listed the nine DSM-5 symptom criteria as dichotomous yes/no questions. The survey was hosted at Qualtrics.com as part of a preregistered study [28] that gained ethical approval from the Aston University ethics committee. The targeted gamer sample also completed the IGD-9 at Qualtrics.com in a study approved by Aston University.

Statistical Analysis

We conducted latent class analysis on the samples separately using poLCA in R [29], and then combined samples to examine IGD distribution across non-gamers, casual gamers, and dedicated gamers as a whole. Following this, we analysed the relationship between age and gaming using regression and descriptive statistics.

Results

Latent class analysis of the separate samples (Additional File 1) suggested a two-, four-, or five-class model in the general population, and a two-, four- or six-class model in the gaming sample. The lowest Bayesian-Information Criteria (BIC), Akaike Information Criteria (AIC), and Likelihood ratio (LR) indicated different models, suggesting high model uncertainty.

We then compared the distribution of participant responses (Figure 1) and found left-skewed results for both samples, with a more normal distribution in the gamers. This suggests that a large number of the general population were casual/non-gamers, while most of the gaming sample scored 2-3 checklist items. Interestingly, participants scoring 5+ were similar in both samples, suggesting an equal share of potential candidates for diagnosis.

We then repeated analysis in the combined sample, testing model fit up to six classes since the BIC was consistently larger (Table 1). The three- and five-class models failed to reach significance, whereas the two-, four-, and six-class models were significant. The lowest BIC indicated a four-class model, however the lowest AIC and LR suggested six-classes. We therefore analysed both in more detail (Table 2).

Table 1
Model fit for Latent Class Analysis of Gaming Data in a Combined Sample

	2 Classes	3 Classes	4 Classes	5 Classes	6 Classes
AIC	5441.266	5310.379	5290.404	5287.812	5289.223
BIC	5528.689	5443.815	5469.852	5513.273	5560.695
G ²	472.8254	321.9388	281.9641	259.3721	240.7824
χ ²	1730.994	478.5486	679.2437	469.0852	632.6213
Df	492	482	472	462	452
p	.000	.536	.000	.400	.000
<i>Note:</i> Included are the Akaike Information Criteria, Bayesian Information Criteria, G ² Likelihood-Ratio, Pearson X ² , Degrees of Freedom, and p values.					

Table 2

Probability of positive response to IGD Questions based on a four- and six-class latent analysis model

Item	1	2	3	4	1	2	3	4	5	6
Preoccupation	0.051	0.595	0.626	1.000	0.052	0.536	1.000	0.628	0.826	1.000
Withdrawal Symptoms	0.000	0.117	0.163	0.825	0.000	0.026	1.000	0.156	0.495	1.000
Increased Gaming	0.005	0.278	0.184	0.817	0.004	0.252	0.312	0.164	1.000	0.748
Unable to Stop	0.005	0.054	0.651	0.659	0.005	0.054	0.000	0.631	0.216	0.919
Lost Interest in Hobbies	0.119	0.299	0.526	0.528	0.116	0.308	0.129	0.543	0.149	0.724
Play despite Life Impact	0.029	0.431	0.428	0.784	0.026	0.423	0.396	0.825	0.816	1.000
Lying	0.019	0.057	0.428	0.784	0.021	0.022	0.066	0.427	1.000	0.694
Escape	0.092	0.781	0.707	1.000	0.073	0.787	0.687	0.712	0.930	1.000
Relationship Issues	0.000	0.000	0.193	0.401	0.000	0.000	0.000	0.202	0.000	0.567

A '*casual/non-gamer*' class (1) with low likelihood of symptoms, and '*potentially disordered*' class with high likelihood of all symptoms (4/6) was present in both models.

In the four-class model we also found a group who are more likely than not to be preoccupied with gaming and use games to escape (2: '*mild gamer*'), and a group who are additionally likely to be unable to stop and have lost interest in other hobbies (3: '*at-risk*'). Similarly, the six-class model included class 2 '*mild gamers*', and '*at-risk*' gamers as class 4. In addition, we found class 3 '*moderate gamers*' who are likely to be preoccupied, gaming to escape, and have withdrawal, and class 5 '*borderline*' gamers who are likely to be preoccupied, increasing play, playing despite life impact, lying and gaming to escape. Averaged probability scores suggest a potential path of increasing severity in the four-class (1 – 0.036; 2 – 0.290; 3 – 0.434; 4 – 0.755), and six-class model (1 – 0.033; 2 – 0.268; 3 – 0.399; 4 – 0.476; 5 – 0.604; 6 – 0.850). To check the validity of this we asked R to predict participant class (Additional File 2), and cross-tabulated predictions against IGD scores (Table 3).

Table 3
Number of Identified Criteria and Most Common IGD Score for Each Latent Class

Model	Class	Number of Criteria	Most Common IGD Score(s)
4	1 - <i>Casual/Non-Gamer</i>	0-2	0
	2 - <i>Mild</i>	1-5	2-3
	3 - <i>At-Risk</i>	2-7	4-5
	4 - <i>Potentially Disordered</i>	5-9	6-9
6	1 - <i>Casual/Non-Gamer</i>	0-2	0
	2 - <i>Mild</i>	1-5	2-3
	3 - <i>Moderate</i>	2-5	4
	4 - <i>At-Risk</i>	2-7	4-5
	5 - <i>Borderline</i>	3-7	5-6
	6 - <i>Potentially Disordered</i>	6-9	7-8
<i>Note:</i> Where a range of IGD scores are provided the frequency of participants was the same for each value			

Age related to IGD Score ($F_{1,735} = 68.373$, $R^2 = .085$, $p = .000$), and accounted for 9% of symptom variation. We found that 15.65% of participants aged 18-20 selected 5+ criteria, compared to 13.75% aged 21-30, 8.28% aged 31-40, 4.44% aged 41-50, and 0% over 50. Further analysis on average results by age found that participants 18-20 were more likely to have mild symptoms and a higher mean IGD score (Table 4).

Table 4
Average IGD Score and Predicted Class for each Age Group

Age	Mean Score	Standard Deviation	Most Common Predicted Class		
18-20	2.73	2.03	<i>Mild Gamers</i>	Four-Class	46.96%
				Six-Class	43.48%
21-30	2.14	2.08	<i>Casual/Non-Gamer</i>	Four-Class	46.75%
				Six-Class	41.00%
31-40	1.40	1.84	<i>Casual/Non-Gamer</i>	Four-Class	63.45%
				Six-Class	56.55%
41-50	1.13	1.56	<i>Casual/Non-Gamer</i>	Four-Class	71.11%
				Six-Class	60.00%
51+	0.26	0.68	<i>Casual/Non-Gamer</i>	Four-Class	93.55%
				Six-Class	87.10%

Despite this, 71.43% (four-class) and 63.64% (six-class) of '*potentially disordered*' gamers were over 21, while only 17.14% (four-class) and 14.63% (six-class) were over 30. There were none over the age of 42. This suggests that while some older adults display potentially disordered gaming, young adults appear more at risk.

Discussion

The criteria for IGD appears to have a four- or six-class structure ranging from '*casual/non-gamers*' to '*potentially disordered*' with increasing severity, suggesting that IGD may be presenting in a similar manner to established addictions. A four-class model was identified in both the combined and separate sample analysis; however, a six-class model may offer more nuance.

We additionally found that most potentially disordered gamers were under 30 years old, and none were over 42. Additionally, mean IGD scores continued to decrease with age, reaching as low as 0.26 in those over 51. Lemmens, Valkenburg^[5] also found that 31-40 year olds scored significantly lower than young adults and adolescents, which may suggest that adolescents and young adults are more at risk. Despite this, gaming is a new activity, with the first home consoles introduced in the 1970s. Contemporary gaming is very different from these simple arcade-style games, and Olson, O'Brien^[30] reported that younger adults were more likely to use new technology, specifically computer/video games than older adults. Since the apparent addictive nature of gaming has only emerged recently it is therefore possible that future studies will find more potentially disordered gamers among older participants who have had more exposure to 'modern' videogaming from a young age.

In exploring the current DSM-5 symptom criteria, relationship issues were less than 50% likely in all classes except model-six '*potentially disordered*' gamers (57%), suggesting it may not be an appropriate criterion. However, without additional information on relationships we cannot test this result. Similarly, lying, and increased involvement were both less than 50% likely for low-moderate classes, but at least 70% likely in '*borderline*' or '*potentially disordered*' gamers. These may therefore be signs of maladaptive gaming. In contrast, preoccupation and gaming to escape were over 50% likely in all but the '*casual/non-gamer*' class and therefore may be facets of gaming generally rather than an indication of potentially disordered use.

Withdrawal symptoms were found to be 100% likely in the '*moderate gamer*' and '*potentially disordered*' class (six-class), suggesting a group of non-clinical gamers who experience withdrawal. Despite this, Kaptsis, King^[31] found the evidence on withdrawal in behavioural addiction was underdeveloped, and symptoms were reported in less than 50 participants across five studies. They noted that withdrawal in IGD can be mistaken for reactions to imposed deprivation, and many studies did not specify the expected withdrawal symptoms proposed by the DSM-5. Further to this, Orford, Morison^[32] reported that emotional withdrawal in gambling did not significantly contribute to maintaining the addiction, while Rosenthal and Lesieur^[33] found that some abstaining gamblers experienced symptoms which did not correlate with substance abuse withdrawal. Studies relying on a participant's understanding of withdrawal therefore may not accurately reflect potential symptoms.

In our sample we found a suggested prevalence of 2.98 – 4.74% of '*potentially disordered*' gamers. There appears to be a lot of variation in estimated prevalence rates for IGD, (0.7-27.5% - Mihara and Higuchi^[34]; 0.7%-15.6% - Feng, Ramo^[35]; 1.6% - Müller, Janikian^[36]; 3.1% - Ferguson, Coulson^[37]; 3.7% - Kuss, van Rooij^[38]) however our results were in the expected range. Despite this, the prevalence rates of participants endorsing 5+ criteria were 11.82%, suggesting that the current cut-off may be too low. In fact, when amending this to 7+ symptoms we found a prevalence of 3.26%.

Future research into IGD should continue to build evidence on whether gaming is addictive, with an emphasis on critically evaluating the suggested criteria. Additionally, research comparing online and offline play, and various game types, may help to explain the different findings between studies. Subtle differences may arise as the social benefits of online multiplayer are likely to be significantly different from local multiplayer. Similarly, while most online games involve multiplayer competitive elements, offline gaming is often single-player storylines.

Conclusion

This study found that a four- or six- latent class model was most appropriate with classes increasing in severity, suggesting a similar structure to established addiction disorders. However, the current diagnostic cut-off of five criteria appears to be too inclusive, and relationship issues, preoccupation, and gaming to escape may not be appropriate criteria for diagnosis. This suggests that IGD in the DSM-5 may need revisions following further research, to accurately identify individuals with a potential addiction to gaming.

Abbreviations

AIC – Akaike Information Criteria

BIC - Bayesian-Information Criteria

DSM – Diagnostic and Statistical Manual

GD - Gaming Disorder

ICD – International Classification of Diseases

IGD – Internet Gaming Disorder

LR – Likelihood Ratio

Declarations

Ethical Approval: Ethical approval [Ref: 1598] for this study was granted by the ethics committee at Aston University, Birmingham. All methods were carried out in accordance with relevant guidelines and regulations. Informed consent was obtained from all participants.

Consent for Publication: Not applicable.

Availability of Data: The study was pre-registered at osf.io/en2md and datasets analysed during the current study are available in the OSF repository, osf.io/v472b/files/

Competing Interests: The authors JR, DW, RT, and ML declare that they have no competing interests.

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Contributions: JR and RT contributed to study concept and design. Material preparation and data collection was conducted by JR and DW. Data analysis was performed by JR. The first manuscript draft was written by JR. ML and RT commented on previous manuscript versions, providing supervision for JR. All authors read and approved the final manuscript.

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Figures

Figure 1

Distribution of IGD criteria in a General Population and Gaming forum sample

Supplementary Files

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