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Clinical validation of the C-VAT 2.0 assessment tool for gaming disorder: A sensitivity analysis of the proposed DSM-5 criteria and the clinical characteristics of young patients with 'video game addiction'

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ABSTRACT

Aims

Clinicians struggle with the identification of video gaming problems. To address this issue, a clinical assessment tool (C-VAT 2.0) was developed and tested in a clinical setting. The instrument allows exploration of the validity of the DSM-5 proposal for 'internet gaming disorder'.

Method

Using C-VAT 2.0, the current study provides a sensitivity analysis of the proposed DSM-5 criteria in a clinical youth sample (13–23 years old) in treatment for video gaming disorder (N = 32). The study also explores the clinical characteristics of these patients.

Results

The patients were all male and reported spending extensive amounts of time on video games. At least half of the patients reported playing online games (n = 15). Comorbid problems were common (n = 22) and included (social) anxiety disorders, PDD NOS, ADHD/ADD, Parent–Child relationship problem,

and various types of depressive mood problems. The sensitivity of the test was good: results further show that the C-VAT correctly identified 91% of the sample at the proposed cut-off score of at least 5 out of 9 of the criteria. As our study did not include healthy, extreme gamers, we could not assess the specificity of the tool: future research should make this a priority.

Conclusion

Using the proposed DSM-5 cut-off score, the C-VAT 2.0 shows preliminary validity in a sample of gamers in treatment for gaming disorder, but the discriminating value of the instrument should be studied further. In the meantime, it is crucial that therapists try to avoid false positives by using expert judgment of functional impairment in each case.

1. INTRODUCTION

(Internet) gaming disorder, also known as 'game addiction', refers to a loss of control over video gaming behavior which results in significant issues with daily functioning (American Psychiatric Association, 2013). Clinicians generally struggle with the proper identification of problems involving video game behavior. This lack of clarity can also result in incorrect diagnoses, on the grounds of moral panic about gaming or simply by using oversimplified criteria, such as a fixed number of hours of gaming per day. For now, the quality of assessment of gaming related problems depends strongly on the capabilities and knowledge of the individual therapist (or other healthcare professional) involved in the assessment process. The purpose of the current study is to develop a new clinical assessment tool for assessing gaming disorder and to test its performance among young clinical patients.

1.1. Phase 1 (2012): development of a clinical assessment tool for gaming disorder problems: C-VAT

A Dutch language clinical assessment tool was developed in 2012, in close collaboration with treatment professionals from seven leading addiction care clinics in the Netherlands. The development process was fully described in an earlier publication (Van Rooij, Van Duin, Frielink, DeFuentes-Merillas, & Schoenmakers, 2012) and involved a three step process: (1) existing models (American Psychiatric Association, 2000, American Psychiatric Association, 2013 and Griffiths, 2005) and survey questionnaires (Lemmens et al., 2009 and Van Rooij et al., 2012a) were consulted to establish a set of components for gaming disorder, (2) therapists with substantial game related treatment experience achieved consensus on the selection of components and phrasing of the question items representing the components, and (3) the phrasing of questions was tested among actual patients in treatment for problems with gaming. The final version of the instrument, the Clinical Video game Addiction Test (C-VAT) was composed of three introductory items dealing with game use, nine core questions which cover behavioral addiction symptoms, and a brief table with recommendations for establishing potential comorbid problems.

1.2. Phase 2 (2013/2014): adjustment to the DSM-5's proposal for 'internet gaming disorder': C-VAT 2.0

The DSM-5 recently introduced a set of items with the proposal for 'internet gaming disorder' (American Psychiatric Association, 2013), which led us to reassess the original item set. Seven of the nine original C-VAT items already corresponded directly with the DSM-5 criteria. With regards to the two missing DSM-5 items, dealing with continued gaming despite problems and a loss of interest in other activities, phrasing could be based on the youth addiction screening list MATE-Y (Schippers and Broekman, 2007 and Schippers and Broekman, 2013), a widely used Dutch youth addiction screening tool. The two questions included in the original item set, but not in the DSM-5, deal with the consequences of gaming for physical health and the experience of urges/craving to play games. These two non-overlapping items are maintained for exploratory reasons. This adjustment provided an opportunity to test the clinical performance of a new and expanded 11 item set. The new item set, C-VAT 2.0, covers the proposed DSM-5 criteria and includes its predecessor, C-VAT, which was developed and tested in clinical practice. Note that there is one subtle difference between the DSM-5 proposal and the C-VAT. The C-VAT items discuss gaming in general and do not rule out offline games a priori, where the DSM-5 focuses exclusively on online gaming.

1.3. Current study

Information about the characteristics of actual patients with gaming disorder within clinical settings is surprisingly scarce. From the few studies that are available, the impression arises that comorbid problems occur frequently. A large German study included 290 patients with forms of 'internet addiction', the majority playing video games, and reports that over half had comorbid problems such as depression, anxiety, or dissociation (Müller, Beutel, & Wölfling, 2014). This problem group also had a lower level of general functioning than the healthy population. In some cases substance use and personality disorders were reported. Recent institution level statistics from Dutch addiction care showed that 20% of those who report for gaming related problems display substantial comorbid problems (Wisselink, Kuijpers, & Mol, 2014). Both studies show that boys are strongly overrepresented. We will therefore also describe the clinical characteristics of patients in treatment for gaming disorder in this study.

Q1.

What are the clinical characteristics of a group of patients in treatment for gaming disorder?

We are aware that a number of authors, in various countries, are establishing screening questionnaires to fit with the DSM-5 criteria (Griffiths et al., 2014, Lemmens et al., 2015, Petry et al., 2014a, Petry et al., 2014b and Pontes and Griffiths, 2015) and that the DSM-5 criteria still require substantial critical debate (Kardfelt-Winther, 2014, Petry and O'Brien, 2013 and Van Rooij and Prause, 2014). However, the new screening tools have been validated using population survey data (Lemmens et al., 2015 and Pontes and Griffiths, 2015), while a clinical state of impairment is being implied. We aim to contribute by providing actual clinical data on the performance of the C-VAT 2.0 item set in clinical sample of young Dutch patients in treatment for game related problems. A young sample was selected as most of the patients in treatment for gaming disorder in the Netherlands are young

and treated within youth addiction care clinics, where the age ranges from 12 to 23 years (Wisselink et al., 2014).

To explore how well the C-VAT 2.0 assesses gaming disorder it is important to establish external validation criteria. In the current study we use the clinical professional opinion of the treating therapist as a main point of reference (Tao et al., 2010). Furthermore, it is relevant to establish how patients in treatment for game addiction score on the proposed items. Data were collected during the intake procedure for patients entering into specialized addiction care, as this is the setting where the assessment tool will be used. The focus of this study is specifically on the correct identification (sensitivity) of patients entering treatment for problems with video gaming. The item set now allows exploration of the proposed DSM-5 cut-off score (5 or more out of 9 items positive) as well (American Psychiatric Association, 2013). While we present a new, clinically developed and field-tested item set in this study, covering the suggested DSM-5 criteria will support measurement convergence within the field. As no data could be collected for healthy, extreme gamers within the scope of the current study, no information can be provided on specificity of the test.

Q2.

Which C-VAT 2.0 items correctly identify patients in treatment for gaming disorder?

Q3.

What is the sensitivity of the DSM-5 cut-off score in a clinical setting?

2. METHOD

2.1. Procedure

Patients were only included in the study if they reported directly for gaming disorder, or if gaming related activities were readily apparent in the intake session. The study involved only youth clinics for addiction care, limiting the possible age range from 12 to 23 years old. Written informed consent was collected. For children below the age of 16, parental consent was established in writing as well. The following criteria were grounds for exclusion, as they might result in unreliable measurement or risky situations: psychotic disorder, bipolar disorder, heavy depression with suicide risk, and heavy mental impairment.

Patients who report for treatment in Dutch addiction care are generally interviewed using a standardized set of questionnaires about addictions during intake. For the current study, existing instruments were supplemented with the C-VAT 2.0. The additional effort during the intake procedure was low, as gaming was already a topic of conversation for these patients due to their intake for gaming disorder. The study complies with the criteria for studies that have to be consulted by an accredited Medical Research Ethics Committee. Upon consultation, the committee concluded that ethical approval was not necessary. Medical case files were never directly accessed by the researchers, and non-anonymous permission forms were coded and stored separately in a locked location, removed from the actual data.

Data collection had two phases: the intake phase in which the C-VAT 2.0 assessment was conducted and a brief follow-up in the form of a survey form for the involved treatment professional, provided some time after the initial assessment (on average: 5.7 months later, range: 1 to 15 months). This written follow-up survey focused on

(1) correction/expansion of any DSM-IV axis diagnoses based on the inspection of treatment files, (2) establishing whether the patient had actually started treatment for gaming disorder, and (3) establishing the clinical opinion of the treating therapist: did this patient actually have a disorder resembling problem with video games.

2.2. Instruments

2.2.1. C-VAT 2.0

The Clinical Video game Addiction Test 2.0 is a clinician-administered assessment tool consisting of three questions about gaming, 11 yes-or-no questions about past-year gaming disorder symptoms (including 9 questions covering the 9 proposed DSM-5 criteria for Internet Gaming Disorder), and a brief table with recommendations for establishing comorbid problems. The C-VAT 2.0 was used in assessment tool form: the therapist asks the patient questions. A dichotomous answer format was used, as this is customary within DSM assessment. The C-VAT 2.0 discusses gaming in general and does not exclude offline games. More details about this list and its predecessor, the C-VAT (Van Rooij, Van Duin, et al., 2012), are found in the introduction session. Table 3 contains the full version of the assessment tool.

2.2.2. Demographics and gaming behavior

The C-VAT includes questions about gaming behavior (types of games, time spent on games during the week and weekend), age, and gender.

2.2.3. Video game Addiction Test (VAT)

The 14-item VAT self-report scale (Van Rooij, Schoenmakers, et al., 2012) incorporates various aspects of problematic (addictive) behavior (Van Rooij, Schoenmakers, et al., 2012), including: loss of control, conflict, preoccupation/salience, coping/mood modification, and withdrawal symptoms. Example VAT items include: 'How often do you find it difficult to stop gaming?' and 'How often do you think about gaming, even when you're not online?' and answer options range from 'never' (score 0), seldom (1), sometimes (2), to 'often' (3) and 'very often' (4). The average score on the 14 VAT items provides an indication of average severity of the problematic gaming across all the items.

2.2.4. Clinical impression, DSM-IV axes and Global Assessment of Functioning

In the intake procedure information was collected on all five DSM-IV axes (i.e. clinical disorders, personality disorders, somatic problems, psychosocial/environmental factors, general functioning). A specific form was supplied to assess the Global Assessment of Functioning (Havenaar et al., 2004 and Söderberg et al., 2005), which provides another indicator of clinical impairment for these patients.

2.3. Sample

In the period July 2013 to November 2014 a total of 66 patients were recruited from eleven participating institutions for addiction care in the Netherlands. A further nineteen institutions did not want participate in the study for various reasons: they did not treat gaming problems, did not view game problems as a disorder, or were having organizational issues which left no room for participation in studies. Since we

were interested in a patient sample, it was crucial to know whether after intake participants were actually admitted to treatment for gaming disorder (as assessed in the follow-up). We therefore excluded 26 cases for which no follow-up data could be obtained for various reasons, which included administrative problems at some institutions. Three cases were removed since they were older than 23 years. Two further cases were removed for having missing crucial data (including age). This left a total of 35 cases, of which 32 were identified as 'game addicted' by the treating therapist during the follow-up.

3. RESULTS

3.1. Clinical characteristics of patients in treatment for gaming disorder

Our sample consisted of 32 patients in outpatient treatment for game addictions. They were exclusively male, with an average age of 17.6 years ($SD = 2.5$, range 13–23). They indicated playing, on average, 5.3 h per session ($SD = 3.5$). Multiple sessions per day seem regular, as the average number of hours per day is 7.1 h ($SD = 4.8$). On weekend days they report playing 8.5 h on average ($SD = 3.8$). Half of the patients spontaneously reported playing online games ($n = 15$) on the open question about gaming behavior. Furthermore, Role-Playing Games ($n = 10$, e.g. World of Warcraft) and First Person Shooter games ($n = 9$, e.g. Call of Duty) were popular, but Real Time Strategy games were mentioned as well ($n = 9$, e.g. Starcraft 2). Sports games were mentioned once. The specific games League of Legends, Soccer Manager, Minecraft, Skyrim, and Grand Theft Auto were also mentioned one time.

All 32 patients were in treatment for gaming disorder. Furthermore, 21 of the patients suffered from at least one comorbid Axis 1 psychiatric problem. The most frequently mentioned were anxiety disorders ($n = 5$), Pervasive Developmental Disorder NOS ($n = 5$), ADHD/ADD ($n = 4$), Parent–Child relationship problem ($n = 4$), and various types of depressive mood problems ($n = 3$). Obesity, cannabis use, mood regulation disorder, and autism spectrum disorder were all mentioned once. Personality disorders (Axis 2) were not reported, other than one suspected case of borderline personality disorder. For Axis 3, almost a third of the patients reported some type of physical problem, ranging from knee problems to over exhaustion/tiredness, but of those, obesity was the only one mentioned multiple times ($n = 3$). The Axis 4 psychosocial and environmental factors confirm disrupted relationships: problems within the family system were found for 23 patients, problems with the social environment for 16, and with education for 13. On the self-report measure of problematic gaming (VAT) a mean of 2.48 was reported for all 14 items, which translates into experiencing symptoms more often than 'sometimes' ($SD = 0.6$). A Global Assessment of Functioning score of 54 out of 100 ($SD = 9.1$) indicates moderate symptoms/problems with functioning.

3.2. Scores on the Clinical Video Game Addiction Test 2.0 items

Table 1 shows the average item endorsement on each C-VAT item. Of the 32 patients, 27 cases were viewed as having gaming disorder as a primary problem, while for five cases it was thought to be a secondary problem. With the exception of pre-occupation (38%), all C-VAT 2.0 items were positively scored for at least half (50%) of the patients. Lying about use was only mentioned for about 66% of the patients. The item about singular interests (reducing hobbies, etc.) was endorsed for

only half the patients. However, continuing to game even though it causes problems with social or school/work commitments was scored positively for 97% of the patients. With regards to the C-VAT legacy items (A and B), craving was reported for 78% of the patients and health problems for 63%.

[TABLE 1]

3.3. Exploring the sensitivity of the suggested DSM-5 cut-off score

The DSM-5 provides a suggested cut-off score of 5 out of 9 criteria for Internet Gaming Disorder. Table 1 shows the percentage of patients in our sample who would obtain a positive score for gaming disorder with that cut-off score: 91% using the 9 DSM-5 compliant items, and 88% if we expand the item set to include the two legacy C-VAT items (A and B) and expand the cut-off correspondingly to 6 out of 11 items. A cut-off score of five out of nine or more positive items seems beneficial and the expanded item set does not seem to improve this estimate, which provides an argument for focusing on the DSM-5 core items.

Table 2 provides an overview of alternative cut-off points on the core list of nine items. The table shows the percentage of correctly identified patients in our sample for various scores. Lowering the cut-off score from six to five results in 25% more correct identification, while lowering it to four only results in a 3% additional identification (91% to 94%). Although there are no data to analyze the risk of false-positives, generally speaking any decrease in a cut-off score will raise the amount of false positives on the test, which means the cut-off score should be kept as high as possible. This provides an argument for maintaining the 5 out of 9 cut-off score for now as it provides a sizeable improvement in identification of 6 out of 9. In the current study false positives could not be identified as the entire sample consisted of patients, so the size of this tradeoff cannot be established.

[TABLE 2]

4. DISCUSSION

The original C-VAT assessment tool for gaming disorder was developed in 2012 in an iterative process involving existing instruments, treatment professionals, and patients in treatment for gaming disorder (Van Rooij, Van Duin, et al., 2012). In the current study the C-VAT was adjusted and expanded to cover the proposed DSM-5 criteria for Internet Gaming Disorder: two items were added to the tool, while two non-overlapping items dealing with craving and the neglect of physical health were designated as legacy items. They do not affect scoring and remain included for both clinical and research purposes. This resulted in the C-VAT 2.0, of which the sensitivity was studied in a clinical sample in treatment for gaming disorder.

4.1. Clinical characteristics of patients in treatment for gaming disorder

The group of patients in treatment for gaming disorder consisted exclusively of young men (average age: 18 years old). In our sample, these young men reported spending pretty much all their free time and even part of their school time on gaming: the average hours per day reported was 7.1 for weekdays and 8.5 for weekend days. The group could also be characterized by co-morbid problems, including depressive mood and anxiety problems, ADHD/ADD, and Pervasive Developmental Disorder. Moreover, the majority of the patients had problems with

their social environment: relationships with family and wider social circles were disrupted and school performance was low. The average of 2.5 on the self-reported problematic (addictive) gaming measure (VAT) could be considered high on this scale, as the VAT is largely distributed towards 0 and 1 in healthy samples (Van Rooij et al., 2014). As the VAT (self-report) is scored high and majority of C-VAT 2.0 items are answered positively (see Table 1) the two measures provide a consistent impression. An average score of 54 on the Global Assessment of Functioning scale indicated moderate problems with function. This score was slightly lower than the one found in a comparable German study with patients in treatment for gaming disorder (Müller et al., 2014).

4.2. Sensitivity of the proposed DSM-5 cut-off score

Results show that the C-VAT 2.0 correctly identified 91% of the sample at the proposed cut-off score of at least 5 out of 9 of the criteria. This cut-off score fits with the current DSM-5 proposal, and provides some evidence of high sensitivity. Table 3 contains the new, DSM-5 compliant, C-VAT 2.0 version, based on the results from the current study. The two legacy questions about craving and neglect of physical health are contained as closing items in the list for now, and we recommend maintaining them for both research and clinical reasons: they were drafted by a panel of experts and confirmed with patients in the earlier study (Van Rooij, Van Duin, et al., 2012), so it seems premature to exclude them at this point.

[TABLE 3]

One notable difference with the DSM-5 proposal is that the C-VAT 2.0 does not rule out non-online games a priori, which fits with existing debate on this issue (Petry et al., 2014a, Petry et al., 2014b and Subramaniam, 2014). While a considerable percentage of the young patients indicate playing online games with others, offline games are reported as well. Although the involvement of online games in game addiction is a consistent finding in the literature (Müller et al., 2014), it seems unwarranted to fully disqualify offline games. Moreover, the boundaries between online and offline game are rapidly blurring and distinctions are not always clear to the gamers themselves.

Providing data from an actual group of clinical patients is a necessary contribution to the scientific literature, but our current study has several limitations. Firstly, the intake procedure was the moment of data collection, but this is a difficult phase in the treatment process to collect data. Not all patients are motivated to contribute to studies when they first arrive at a clinic. Moreover, during data collection, Dutch addiction care was going through hard (financial) times, which means not all institutions were motivated to fully participate in scientific studies. This contributed to the relatively low number of patients in our final sample. Our sample cannot be viewed as representative for all patients as it only involves young patients.

Secondly, no information could be provided on specificity or false positives: this would require systematic assessment of healthy, enthusiastic gamers without problems — they were not included in the study, as they do not report for treatment in the clinics. As there are some concerns in the literature about over-inclusion of healthy gamers (Kardefelt-Winther, 2014), we recommend direct involvement of a treatment professional with any diagnostic process using this tool to assess whether clinical level impairment is both present and linked to the gaming behavior. This approach fits with earlier work in the literature (Tao et al., 2010), in which both

functional impairment as a separate and main criterion and the professional judgment of an expert therapist are given a central role.

In the future, the DSM-5 criteria will undoubtedly be validated and tested more widely. Hopefully this will include strong studies with clinical data. For now, this study, using the new C-VAT 2.0 set provides a reference point and data on the performance of a DSM-5 compliant item set among actual patients.

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Contributors

The first author wrote first drafts, collected, and analyzed the data. The first and second authors designed the study. All authors contributed to the rewriting and reviewing of the manuscript.

Conflict of interest

All authors declare that they have no conflicts of interest.

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TABLES

Table 1
Percentage of positive answers for the various C-VAT items.^a

C-VAT item	Criterion	%Yes	Yes	No	N
1	Pre-occupation	38%	12	20	32
2	Withdrawal symptoms	72%	23	9	32
3	Tolerance/loss of control	72%	23	9	32
4	Quit attempts (unsuccessful)	78%	25	7	32
5	Singular interest in gaming	53%	17	15	32
6	Continuing despite problems	97%	31	1	32
7	Lying about use	66%	21	11	32
8	Mood modification	75%	24	8	32
9	Problems (obligations/social)	88%	28	4	32
A	Craving	78%	25	7	32
B	Problems with physical health	63%	20	12	32
1-9	Equal to or higher than 5 out of 9 (DSM-5 cut-off)	91%	29	3	32
1-9, A, B	Equal to or higher than 6 out of 11	88%	28	4	32

^a The DSM-5 compliant items are numbered 1 through 9, legacy C-VAT items are A + B.

Table 2
Various cutoff points on the C-VAT and the identification of patients with gaming disorder problems.

Cut-off (equal or higher to)	Patients in treatment for gaming disorder correctly identified (N = 32)		
	Percentage (%)	Difference (%)	Test positive (n)
9	6	-	2
8	34	28	11
7	47	13	15
6	66	19	21
5	91	25	29
4	94	3	30
3	100	6	32
2	100	0	32
1	100	0	32

Table 3
C-VAT version 2.0^{a,b} (2014).

#	Questions	Answer options	Component
	Age		
	Gender		
	Which games do you play?	...	
	If you are playing video games, how many hours do you play on average?	Hours	
	How much time do you spend on playing video games?		
	Weekdays (Monday–Friday)	Days	
		Hours	
	Weekend days (Saturday–Sunday)	Days	
		Hours	
	The following questions refer to the past year (the past 12 months)		
1	Could you hardly think about anything else than playing games when you were not gaming?	Yes/no	Preoccupation
2	Did you feel stressed, annoyed, or angry if you were not allowed or could not play games?	Yes/no	Withdrawal symptoms
3	Did you spend more and more time on playing videogames?	Yes/no	Tolerance/loss of control
4	Did you unsuccessfully try to spend less time on games?	Yes/no	Attempts to stop
5	Did you have to give up or strongly reduce important activities because of gaming? Examples: sports, work, or seeing friends/family	Yes/no	Loss of interests
6	Did you regularly neglect important commitments or persons in order to play videogames? (Examples: social relationships in real-life/offline, (home) work, other hobbies, school, or work)	Yes/no	Continuation despite of problems
7	Did you sometimes lie to others about the amount of time you spend on video games?	Yes/no	Lying about use
8	Did you regularly play videogames to avoid thinking about problems (difficulties)	Yes/no	Mood modification
9	Did you play games even though you knew this was causing problems with your family, friends, at work, or at school?	Yes/no	Problems (work/social)
A	Did you have a strong urge (need) to play video games?	Yes/no	Craving
B	Did you neglect your own health because of gaming? (examples: not getting enough sleep, showering less, failing to brush teeth, drinking insufficiently)	Yes/no	Problems with health
	Axis 1 – Other psychological issues, for instance ... mood disorder (anxiety or depression), autism spectrum problems, ADHD/ADD, caffeine or energy drink use, other substance use (cannabis), etc.	...	
	Axis 2 – Personality disorders	...	
	Axis 3 – Somatic complaints/problems	...	
	Axis 4 – Psychosocial environmental factors	...	
	Axis 5 – Global Assessment of Functioning	1–100	

^a The sequence of items is presented in line with the DSM-5 proposal to facilitate comparability with other studies using the DSM-5 criteria. During data collection items were presented in a different order, for historical reasons.

^b Original items were in Dutch and available upon request, translation was done by a triple translate–retranslate–check process until consensus was reached among all three authors.