

Assessment of Problematic Internet Use by the Compulsive Internet Use Scale and the Internet Addiction Test: A Sample of Problematic and Pathological Gamblers

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Key Words

Internet addiction · Validity · Psychometric properties · Assessment · Pathological gambling

Abstract

This study aims to analyze psychometric properties and validity of the Compulsive Internet Use Scale (CIUS) and the Internet Addiction Test (IAT) and, second, to determine a threshold for the CIUS which matches the IAT cut-off for detecting problematic Internet use. A total of 292 subjects with problematic or pathological gambling (237 men, 55 women) aged 14–63 years and with private Internet use for at least 1 h per working or weekend day were recruited via different recruitment channels. Results include that both scales were internally consistent (Cronbach's $\alpha = 0.9$) and had satisfactory convergent validity ($r = 0.75$; 95% CI 0.70–0.80). The correlation with duration of private Internet use per week was significantly higher for the CIUS ($r = 0.54$) compared to the IAT ($r = 0.40$). Among all participants, 25.3% were classified as problematic Internet users based on the IAT with a cut-off ≥ 40 . The highest proportion of congruent classified cases results from a CIUS cut-off ≥ 18 (sensitivity 79.7%, specificity

79.4%). However, a higher cut-off (≥ 21) seems to be more appropriate for prevalence estimation of problematic Internet use.

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Introduction

There is disagreement about the classification of Internet addiction, particularly whether it is better characterized as an obsessive-compulsive spectrum disorder or as behavioral addiction. So far, Internet addiction was not considered in the Fourth Edition of the Diagnostic and Statistical Manual of the American Psychiatric Association (DSM) [1] but has been discussed for being mentioned in DSM-V [2]. At present, Internet gaming disorder was included in Section III for further research [3]. Internet addiction has been compared with other addictions using dependence criteria. Criteria such as tolerance development, mood modification, salience, conflict, relapse and withdrawal symptoms include similarities to Internet addiction [4]. Questionnaires that have been developed for the assessment of Internet addiction are pre-

dominantly based on criteria of pathological gambling or substance dependence [5, 6].

One main problem in prevalence estimation of Internet addiction is the lack of agreement concerning criteria and consistent terminology. The majority of studies used samples that have not been recruited from the general population [6]. Furthermore, the stated proportion of individuals with pathological Internet use varies from 0.3% [7] to 38% [8] according to the assessment used and the population studied. For purposes of prevalence estimation, brief assessment instruments are needed. The Internet Addiction Test (IAT) [9] is an often used questionnaire. It has been developed on grounds of the Diagnostic Questionnaire (DQ) [10] that is based on DSM criteria for pathological gambling. Internet addiction can be assumed if at least five symptoms of DQ are fulfilled during the past 6 months. The proposed cut-offs for the IAT are not empirically based but widely used in research and practice. They allow the differentiation between pathological Internet use (≥ 70) and problematic Internet use (≥ 40) as a lower threshold diagnosis [9]. In contrast to the prevailing clinical research, the identification of problematic Internet use is particularly relevant to define target groups for early interventions in general population settings.

One main disadvantage of the IAT for purposes of prevalence estimation is that the number of 20 items makes it rather time-consuming. Furthermore, the factorial structure strongly varies across studies and some items are not clearly related to addiction (e.g. forming of new relationships online or checking of emails) as well as not applicable to the general population (e.g. prefer Internet to intimacy with the partner or neglecting of school). A more recent development, the Compulsive Internet Use Scale (CIUS) [11], seems to be slightly more appropriate for epidemiological research because of only 14 items and development in general population settings. Initial data revealed good psychometric properties in non-treatment settings [11]. Unfortunately, there is no established cut-off to differentiate between addicted and non-addicted Internet users. The proposed cut-offs for the CIUS were not tested in larger samples. Meerkerk [12] suggested that problems described by the items should play an important role in the Internet users' life to constitute pathological Internet use. This would be the case if specified Internet use behaviors occur on average at least 'sometimes' which corresponds to a cut-off of 28 points. Only one study attempted to define empirically a CIUS cut-off [13]. Using a university students sample in Iran ($n = 400$) the authors came to the conclusion of a cut-off of 23 (scale 0–4) for the Persian version of CIUS. A clinical

interview diagnosis that was based on the criteria for pathological gambling was the gold standard.

The main goal of the present study was to compare the psychometric properties of the CIUS and the IAT in their German versions to investigate whether the CIUS may be appropriate for epidemiological research. The second goal was to determine a threshold for the CIUS which matches the IAT cut-off for problematic Internet use to enable a first classification with the CIUS.

Methods

Sample

We used an existing sample of problematic and pathological gamblers which were recruited as part of the project 'Pathological Gambling and Epidemiology' [14]. It might be assumed that Internet addiction is particularly prevalent among populations of pathological gamblers due to known co-occurrence with other behavior addictions [15–17] and the role of the Internet as a medium for gambling [18].

Within the project PAGE, participants were recruited proactively in a national telephone survey sample and in a sample from gambling locations (fig. 1). For the telephone survey, a random sample of landline and mobile phone numbers had been drawn in Germany. In total, 28,503 target individuals were reached fulfilling the inclusion criterion, i.e. age between 14 and 64, and 15,023 (52.7%) took part in this telephone survey. To reach sufficient sample size, participants were also recruited reactively in a sample of former and current gamblers who responded to media solicitation and in a sample from counseling facilities for pathological gamblers, debt counseling and probation service facilities.

Among all samples, we personally interviewed a total of 594 individuals with problematic or pathological gambling, i.e. they fulfilled one or more criteria defined for pathological gambling in the DSM-IV [1]. Among these 594 individuals, 52.5% ($n = 312$) had an average time of Internet use of 1 h or more per working or weekend day. As part of the telephone and personal interview they were asked to answer the CIUS and the IAT. 20 subjects did not answer to any of the CIUS or IAT items and were removed from the analysis. The final sample consisted of 292 participants. Among them, 4 did not answer to one or more items of the CIUS and 10 did not answer to one or more items of the IAT. We computed sum scores of both scales and subscales with the intraindividual mean of the answered items if less than half of items were missing. Of the 292 participants, 36.0% were recruited via telephone survey, 10.3% on gambling locations, 5.5% on treatment facilities, 27.4% via media and 20.8% via other ways of recruitment, i.e. counseling facilities or self-help groups for pathological gamblers.

This study was approved in accordance with the ethical standards. All participants gave their informed consent prior to inclusion in the study.

Measures

Demographics. Data were collected about the respondents' age, sex, nationality, family status, years of school, and unemployment.

Internet Use. We assessed the hours of Internet use on a working and on a weekend day with two items ('How much time do you

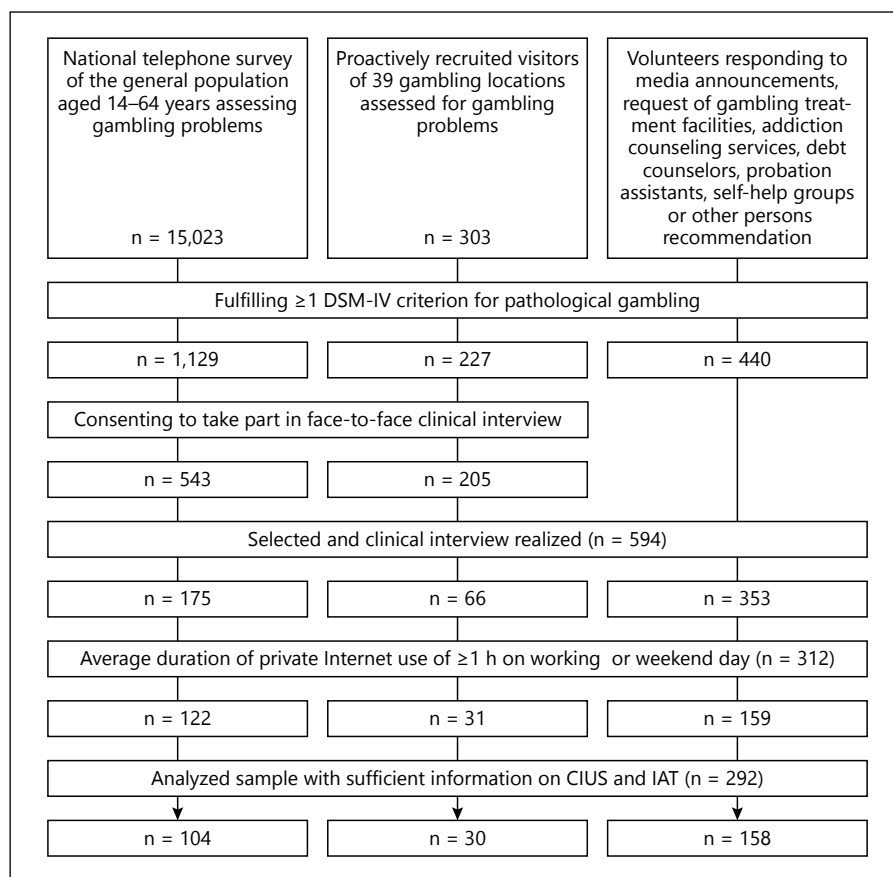


Fig. 1. Flow diagram of study recruitment and participation.

spend privately on the Internet on an average working day/on a weekend day?'). We calculated total time of Internet use per week.

Problematic and Pathological Gambling. The Gambling Section of World Mental Health (WMH) Composite Diagnostic Interview (CIDI) [19] is a standardized clinical interview that allows to assess the number of criteria for pathological gambling of the DSM. Participants who fulfilled 1–4 criteria were classified as problematic gamblers. Respondents who met more than 4 criteria were classified as pathological gamblers. The English version of the CIDI was translated into German by a psychologist, and was validated with translation and back-translation procedure.

Compulsive Internet Use Scale. The CIUS [11] is based on the DSM-IV criteria for substance addiction and pathological gambling. It consists of 14 Likert-scaled items (0, never; 1, seldom; 2, sometimes; 3, often; 4, very often) and has a theoretical value range of 0–54. The items cover five symptoms of addiction: loss of control, withdrawal, mood modifications, preoccupation and conflict. One-dimensionality, validity and reliability of the CIUS have been suggested by data [11, 20–22]. The Dutch version of the CIUS was translated into German with validation by translation and back-translation in English.

Internet Addiction Test. The IAT [9] contains 20 Likert-scaled items (1, never; 2, seldom; 3, sometimes; 4, often; 5, very often) with a theoretical value range of 20–100. A score of 40–69 has been proposed to be interpreted as indicating problems, a score of 70–100 as indicating significant problems. Previous studies have

shown high internal consistency (Cronbach's $\alpha = 0.89$ – 0.93) of the IAT [23–26]. According to Widyanto and McMurrin [27] the IAT consists of six factors: salience (e.g. Do you choose to spend more time online over going out with others?), excessive use of Internet, anticipation (e.g. Do you find yourself anticipating when you go online again?), lack of control over Internet use, neglect of work and neglect of social life due to Internet use. We used a German version of IAT after translation of English IAT items and back-translation [9].

Data Analysis

For the statistical analysis we used STATA version 10.1 [28]. First descriptive statistics were calculated. The internal consistencies of the CIUS and the IAT were assessed using Cronbach's α and were then statistically compared with the method of Feldt et al. [29]. Average part-whole corrected discrimination index was calculated for each item. Item difficulties were computed by dividing the difference of mean item score of all participants and the individual minimum obtainable item score by the difference of the highest obtainable individual item score and minimum obtainable item score [30]. To evaluate convergent validity, we computed the Pearson correlation between the CIUS and the IAT sum scores and also the IAT subscale scores. To assess criterion validity, we computed Pearson correlations between the CIUS and the IAT with time spent online. These correlations were then statistically compared with the method of Meng et al. [31]. In addition, Pearson

correlations were calculated of the CIUS and the IAT with number of fulfilled DSM-IV criteria for pathological gambling.

To determine a threshold for the CIUS which matches the IAT cut-off for problematic Internet use, we computed the sensitivity (proportion of congruent to the IAT classified problematic Internet users) and specificity (proportion of congruent to the IAT classified non-problematic Internet users) for different CIUS cut-off points. The percentage proportions for problematic Internet use of both instruments were then compared. In absence of a gold standard, the IAT served as comparison for determining a CIUS cut-off because the IAT is one of the most commonly used instruments.

Results

Study participants were between 14 and 63 years of age and predominantly male. Further sample characteristics were displayed in table 1. For the CIUS, the data revealed a mean sum score of 15.04 (SD 10.49) and a range of 0–43. The mean sum score of the IAT was 33.97 (SD 10.96) with a range of 20–83. Significant correlation coefficients were found between age and the sum scores of the CIUS ($r = -0.16$; $p < 0.005$) and the IAT ($r = -0.19$; $p < 0.001$). Sex was neither associated with the CIUS ($r = -0.04$; $p = 0.479$) nor with the IAT ($r = 0.02$; $p = 0.774$). Since only 1 participant met the IAT criterion for pathological Internet use, we only differentiate in the following between problematic and non-problematic Internet users. Accordingly, among all participants, 25.3% (74) were classified as problematic and 74.7% (218) as non-problematic Internet users.

Reliability

Data for internal consistency revealed a Cronbach's $\alpha = 0.90$ for the CIUS and 0.89 for the IAT (table 2). We found no significant difference between the Cronbach's α coefficients ($t(275) = 0.47$, $p = 0.639$). The average part-whole corrected discrimination index for the CIUS was 0.59 (range 0.49–0.67) and for the IAT 0.53 (range 0.12–0.71). Only one IAT item had a part-whole corrected discrimination index < 0.2 ('Do you check your e-mails before something else that you need to do?', $r = 0.12$). For the CIUS, item difficulties ranged between 0.18 and 0.38 (mean difficulty = 0.27), for the IAT between 0.05 and 0.45 (mean difficulty = 0.17). Eight items of the CIUS and 17 items of the IAT had difficulties < 0.3 .

Validity

The correlation coefficient between the CIUS and the IAT was $r = 0.75$ (95% CI 0.70–0.80). The data revealed the highest correlation coefficients of the CIUS with the

Table 1. Demographic characteristics of the sample ($n = 292$)

| Characteristics | n (%) ¹ |
|-------------------------------|--------------------|
| Age, years (mean \pm SD) | 35.28 \pm 11.93 |
| Male sex | 237 (81.16) |
| Nationality | |
| German | 266 (91.10) |
| Other | 26 (8.90) |
| Family status | |
| Married or stable partnership | 178 (60.96) |
| Other | 114 (39.04) |
| Years of school | |
| <10 | 64 (21.92) |
| 10 | 99 (33.90) |
| >10 | 122 (41.78) |
| Still at school | 7 (2.40) |
| Unemployed | 56 (19.18) |

¹ If not specified otherwise.

Table 2. IAT subscales: internal consistencies and correlation with the CIUS

| IAT subscale | Cronbach's α | Correlation ¹ with CIUS (95% CI) |
|------------------------|---------------------|---|
| Excessive use | 0.78 | 0.72 (0.66–0.77) |
| Loss of control | 0.72 | 0.67 (0.60–0.73) |
| Salience | 0.75 | 0.65 (0.56–0.71) |
| Neglect of social life | 0.38 | 0.47 (0.38–0.56) |
| Neglect of work | 0.52 | 0.46 (0.37–0.55) |
| Anticipation | 0.09 | 0.33 (0.23–0.43) |

¹ Pearson correlations, all significant with $p < 0.001$.

IAT subscales 'Excessive use', 'Loss of control' and 'Salience' (table 2). Correlation analysis also revealed an association of the time spent online with the CIUS ($r = 0.54$) and IAT ($r = 0.40$). All correlation coefficients were significant with $p < 0.001$. Comparing the CIUS and IAT correlation with time spent online revealed a significantly higher correlation coefficient for the CIUS with time spent online ($z = -3.81$; $p < 0.001$). As depicted in table 3, mean CIUS and IAT scores monotonically increased with increasing time spent online. No associations of time spent online with age ($r = -0.11$; $p = 0.058$), sex ($r = 0.04$; $p = 0.532$) or number of fulfilled DSM-IV criteria for pathological gambling ($r = 0.9$; $p = 0.125$) were present. Among the study participants, 90 (30.8%) were classified as problematic gamblers, i.e. they fulfilled 1–4 DSM-IV

Table 3. Hours per week spent online and means of IAT and CIUS

| Hours per week | Number (% of participants) | Mean IAT score (SD) | Mean CIUS score (SD) |
|----------------|----------------------------|---------------------|----------------------|
| 1–9 | 87 (29.79) | 29.55 (8.53) | 9.08 (6.77) |
| 10–19 | 96 (32.88) | 32.48 (8.29) | 13.23 (8.17) |
| 20–29 | 49 (16.78) | 34.29 (10.14) | 18.06 (10.30) |
| 30–39 | 30 (10.27) | 40.77 (13.35) | 21.02 (9.88) |
| ≥40 | 30 (10.27) | 44.20 (13.95) | 27.20 (12.44) |
| Total | 292 (100.00) | 33.97 (10.96) | 15.04 (10.49) |

criteria for pathological gambling, and 202 (69.2%) were classified as pathological gamblers, i.e. they fulfilled 5–10 DSM-IV criteria for pathological gambling. Correlation coefficients of number of fulfilled DSM-IV criteria for pathological gambling with CIUS sum score ($r = 0.10$; $p = 0.079$) and IAT sum score ($r = -0.02$; $p = 0.759$) were not significant.

Classification of Problematic Internet Use with CIUS

The highest proportion of congruent classified cases of the CIUS and the IAT (defined as the maximum sum score of sensitivity and specificity) was reached at a CIUS cut-off point of 18 (sensitivity 79.7%, specificity 79.4%). For higher or lower cut-offs, congruence declined. The area under the curve was 0.86 (95% CI 0.82–0.91).

Equivalence of Prevalence Estimation for Problematic Internet Use

For the highest classification congruence at 18 points, prevalence is 35.6% for problematic Internet use among problematic and pathological gamblers according to the CIUS. At a CIUS cut-off point of 21, the prevalence of 24.7% is most similar to the respective proportion for the IAT (25.3%).

Discussion

This study explored the psychometric properties of the CIUS and IAT. Our data confirm internal consistencies of the CIUS and the IAT that had been suggested by previous studies [11, 23–27]. Low Cronbach's α scores were found for IAT subscales 'Neglect of work', 'Anticipation' and 'Neglect of social life'. In the study by Widyanto and McMurrin [27] these subscales also had the lowest internal consistencies (0.54–0.75). Except one item of the IAT, we found sufficiently high part-whole corrected discrim-

ination indices >0.2 for both scales [32]. Generally, item difficulties should be medium, ranging between 0.3 and 0.7 [33]. We found high item difficulties for both scales which might be explained by the low proportion of individuals with Internet problems in our sample. However, the slightly lower item difficulties found for the CIUS indicates that the CIUS is more suited to differentiate at the lower end of problem severity.

Our results revealed good convergent and criterion validity for the CIUS and the IAT. The questionnaires themselves were found to be positively correlated with each other. The highest correlations with the CIUS existed for the IAT subscales 'Excessive use', 'Loss of control' and 'Salience'. This indicates that excessive Internet use without control was the aspect sufficiently covered by both instruments. In contrast to the IAT, the CIUS was conceptualized as an instrument for assessing core elements of Internet addiction instead of related problems [12]. In line with this intention, we found lower correlations coefficients for CIUS with the IAT subscales 'Neglect of work' and 'Neglect of social life'. The low correlation of CIUS with the IAT subscale 'Anticipation' might be due to the very low reliability of this subscale. Correlations of CIUS and IAT with time spent online were higher compared to previous studies reporting [11, 27, 34, 35] and contradict studies reporting no association [36]. One possible reason for these contradicting results is that the relation of time spent online and health is not linear but rather inverse U-shaped [37]. Grohol [38] argued that a high amount of time spent online does not necessarily suggest a pathology as it also includes healthy behaviors, e.g. communication with friends or reading. Thus, time spent online is may not be a good indicator for diagnostic purposes, but an important feature for anamnesis. Our data are in line with previous studies indicating an association of Internet addiction and gambling problems [39, 40]. Given the cross-sectional design of our study, the direction of this association is unclear. Generally, there is a controversy about whether Internet addiction is the cause or the effect of other pathologies or whether they reinforce each other in their genesis. Indeed, the link is probably a more complex one as switching from one addiction to another is possible [41]. Hence, longitudinal studies are needed to explain the etiological association between these behavior addictions in detail. However, neither the CIUS nor the IAT were associated with the number of fulfilled DSM-IV criteria for pathological gambling. One reason for this result might be the specific sample of this study, i.e. all participants fulfilled at least one DSM-IV criterion for pathological gambling and a majority suf-

ferred from severe problems. Thus a ceiling effect might be active that precludes detection of an association to some extent. The negative correlations between age and mean sum scores of CIUS and IAT suggest that younger participants were experiencing more problems concerning Internet usage. This finding is consistent with former studies [6, 42]. However, in contrast to previous research [6] which indicated that more males than females were addicted to Internet, our data revealed that there were no significant sex differences. This result might be due to the small proportion of women in our sample and the inclusion of subjects with gambling problems. According to the second aim of the present study, the highest congruence for detecting those participants classified as problematic Internet users via the IAT was reached by a CIUS cut-off of 18. Equivalent prevalence estimates of both instruments were reached by applying a CIUS cut-off of 21. Whether a cut-off of 18 or 21 is used depends on the purpose of the screening. For case finding within a two-step diagnostic procedure using the CIUS, the more sensitive cut-off 18 is to be recommended. If the goal is an estimation of the prevalence for problematic Internet use, 21 seems to be more appropriate. Our proposals for CIUS cut-offs in detecting problematic Internet use add to the cut-offs proposed for pathological Internet use [12, 13].

The major limitation of our study is that the IAT cut-offs for Internet addiction were not well validated. The cut-offs might not discriminate well between addicted and non-addicted as one study [36] found that IAT scores were not associated with clinical severity of Internet addiction. Therefore, it is necessary to investigate in detail whether or not the present cut-offs represent a threshold with respect to clinical relevance and impairment. Further limitations of our study include that in contrast to the six-factor structure we used for our analysis within subscales [27], more recent studies found strongly varying factor solutions for the IAT [23, 26, 43]. This discrepancy should be topic of future research. Although we included a general population-based sampling procedure, other recruitment channels used in our study may be subject to sample selection bias. In addition, due to the inclusion of individuals with predominantly severe gambling problems, the results may be affected by specific characteristics of gamblers. Thus, our study should be replicated in more representative samples to allow generalization to broader populations. Furthermore, the proposed cut-offs for the CIUS should not be thoughtless transferred to other populations because sensitivity and specificity might vary within different subpopulations [44]. Last, due to the heterogeneity of problematic Internet use with respect to

the specific activities involved, it is uncertain whether our participants with high scores in CIUS or IAT primarily suffered from problems related to Internet gambling or distinct problems related to other Internet usage [45]. However, we can argue that participants' online gambling behavior did not fully account for their high CIUS or IAT scores for three reasons: First, participants reported an average of gambling frequency of 97.96 (SD 112.15) days in the last 12 months. If gambling was the predominant reason for Internet use, one may expect daily gambling frequency for meeting our inclusion criteria of having an average private Internet use of at least 1 h/day. Secondly, referring to participants with a gambling frequency exceeding 100 days in the last year, a proportion of 52.0% (52 of 100) reported that they did not use the Internet as the predominant access for any kind of reported gambling offer those participants were engaged in. Thirdly, 43.8% of our sample did not report any gambling problem within the last 12 months.

This study demonstrated good psychometric properties of the CIUS, suggesting its potential for use in epidemiological research. The CIUS has advantages over the IAT. It has a higher correlation with duration of private Internet use than the IAT. Furthermore, it is more time-saving because of fewer items and it contains items which are particularly appropriate for application in the general population, whereas the IAT seems to suffer from problems regarding wording of single items and internal consistencies of some subscales. Therefore, other studies used different translations or reformulations to be more appropriate for the general population [26, 27, 46].

The cut-off points for problematic Internet use as suggested by our data allow a crude classification and complete the cut-offs for pathological Internet use for the CIUS with a lower threshold. Furthermore, the proposed cut-offs might be used to compare samples and prevalence estimates based on the assessment of either the CIUS or the IAT. Next steps of research should include clinical diagnostic interviews in validating the CIUS for problematic Internet use in general population samples.

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Disclosure Statement

The authors have no conflicts of interest to disclose.

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