Impulsivity, implicit attitudes and explicit cognitions, and alcohol dependence as predictors of pathological gambling

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ABSTRACT

Impulsivity, implicit attitudes and explicit cognitions regarding gambling, and alcohol abuse have been pointed out by past research as significant contributors to the development and maintenance of gambling disorders. In this study, we tested the relationship among these contributors and pathological gambling. Forty-four pathological gamblers (DSM-5 criteria), of whom 23 were active gamblers and 17 were alcohol dependent, were compared with 100 controls, consisting of patients with a lifetime history of alcohol use disorder in remission for at least 2 years. The following protocol was used for the comparison: National Opinion Research Center Diagnostic Screen for Gambling Disorders, Barratt Impulsiveness Scale Version 11 (BIS-11), Gambling Related Cognitions Scale (GRCS), Obsessive Compulsive Drinking Scale, Alcohol Use Disorders Identification Test, and Gambling Implicit Association Test (IAT). Impulsivity (BIS-11) and changes in implicit attitudes (IAT) were able to discriminate between pathological gamblers and controls, the latter being less impulsive and having fewer implicit attitudes towards gambling. Cognitive impulsivity (BIS-11), explicit gambling cognitions (GRCS), and alcohol dependence were able to discriminate between active and non-active pathological gamblers, the latter having less cognitive impulsivity and less explicit gambling cognitions and alcohol dependence. Using these simple tools can help clinicians in the assessment of pathological gambling.

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1. Introduction

Gambling is a popular recreational pastime. Annual episodes of gambling in some Western countries have been reported in up to 70–85% of the adult population (Toce-Gerstein et al., 2009). A small group of these gamblers will lose control and escalate into pathological or problematic gambling. The international prevalence of this problem varies between 0.2–5.3% (Hodgins et al., 2011).

In the 5th edition of the DSM “pathological gambling” was relabelled as “gambling disorder” and moved into the Substance-Related and Addictive Disorders section (APA, 2013) due to the underlying etiology it shares with other addictions (Xavier, 2014).

Several factors are regarded as significant contributors to gambling disorder. Impulsivity is a central one (Blanco et al., 2015), not only for gambling disorder in particular, but also for addictions in general (Holden, 2010). Its standard scores significantly correlate with gambling disorder severity scores (Krueger et al., 2005), and also with vulnerability to the disorder (Leeman et al., 2014; Verdejo-Garcia et al., 2008). Gambling disorder seems to be more related to trait than state impulsivity (Leeman et al., 2014; Leeman et al., 2014; Leeman et al., 2014), and also with vulnerability to the disorder (Leeman et al., 2014; Leeman et al., 2014; Leeman et al., 2014). Another important issue is that, in patients treated for pathological gambling, impulsivity is related to cognitive distortions so that an impulsive decision-making style might increase the chance of unquestioning acceptance of erroneous beliefs (Michalczuk et al., 2011).

Another important factor is the cognitive distortions that play a crucial role in the development and maintenance of gambling disorder (Goodie and Fortune, 2013). The most frequently detected distortions are the “illusion of control” and the “gamblers fallacy”, but others such as “overconfidence”, “trends in number picking”, “near-miss effects”, “self-serving bias” and “impaired control” have also been described (Goodie and Fortune, 2013; Spurrier and
Blaszczynski, 2014). At first, the ‘thinking aloud method’ was used to assess these cognitive distortions, but psychometrically validated instruments are now preferred as they have shown discriminant validity (Goodie and Fortune, 2013).

But cognitive distortions, which are explicit and therefore amenable to introspection and deliberate decision making, may not be so central for gambling disorder (Dickerson and Baron, 2000). Several studies suggest that implicit cognitions, which are activated in an automatic way by motivational and situational cues, may play a more important role in addictions, including gambling disorder (McCarthy and Thompsen, 2006; Ostafin et al., 2008; Ostafin and Palfai, 2006; Snagowski et al., 2015; Yen et al., 2011). The Implicit Association Test (IAT) is a tool for assessing implicit attitudes that comes from the social cognition field (Greenwald et al., 2003). This task is of special value when participants deny or are unaware of their true thoughts and feelings (Greenwald et al., 2003). It has been used in the addictions field, including gambling disorder, with promising results (De Houwer et al., 2004; de Jong et al., 2007; Ostafin et al., 2008; Ostafin and Palfai, 2006; Yen et al., 2011).

Finally, as previously mentioned, there is a clear aetiological relationship between gambling disorder and addictions (Blanco et al., 2015). It is no surprise that they have been found to frequently co-occur (Cowlishaw et al., 2014). In particular, alcohol use disorder, with a five to six times higher odds in disordered gamblers versus the general population, is the most common addiction – psychiatric disorder in these patients (Bischof et al., 2013). An association has been found between gambling severity and alcohol consumption (French et al., 2008). Higher levels of impulsivity are detected in alcohol-dependent pathological gamblers (Lister et al., 2015). Gambling, especially when winning, may become a conditioned cue for alcohol use, particularly in gamblers with severe alcohol problems (Zack et al., 2005). This is why an association between winning at gambling and alcohol use has been found using the IAT (Zack et al., 2005).

In light of the literature discussed above, it is reasonable to hypothesise that having a gambling disorder will correlate with impulsivity, explicit cognitive distortions and implicit attitudes related to gambling, as well as alcohol abuse. This study is the first to examine the relation among these four factors in pathological gamblers.

2. Methods

2.1. Participants

The protocol was approved by the Pontevedra-Vigo-Ourense Local Research Ethics Committee (2014/453), and all participants provided written informed consent. The study was conducted in accordance with the Declaration of Helsinki. All participants were recruited as a convenience sample from a government-run outpatient addiction treatment center.

Inclusion criteria for the gambling disorder group were: meeting a lifetime DSM-5 gambling disorder diagnosis with a National Opinion Research Center (NORC) Diagnostic Screen for Gambling Disorders (NODS) score of 5 or more. Criteria for the control group were: meeting a lifetime DSM-5 alcohol use disorder diagnosis, being alcohol abstinent for at least the past 24 months, and not meeting criteria for lifetime DSM-5 gambling disorder with a NODS score of 0.

Normal or corrected-to-normal vision was mandatory for all participants, as well as being free from neurological or psychiatric disorders other than gambling disorders, alcohol dependence, and nicotine dependence.

Forty-seven patients fulfilled the inclusion criteria for the gambling disorder group, but 3 were not included as they had other psychiatric disorders than the ones mentioned in the previous paragraph. One hundred patients were enrolled in the control group as they fulfilled the inclusion and exclusion criteria.

2.2. Procedures and measures

All participants attended a single test session in a quiet, well-lit room, where they completed the following protocol after confirmation by breathalyser that their blood alcohol level was zero and by urinalysis that they were not under the influence of any drug.

2.2.1. Gambling diagnosis and severity

NORC Diagnostic Screen for Gambling Disorders (Hodgins, 2004) is a hierarchically structured 17-item scale. The 17 NODS items yield a score that ranges from 0 to 10. This score correlates with the number of discrete DSM-IV pathological gambling criteria. A score of 5 or more is considered pathological. Scores of 3 or 4 correspond to the subclinical syndrome of problem gambling, and scores of 1 or 2 to an at-risk population with increased likelihood of progression to gambling disorder compared with individuals with scores of zero. The scale assesses presence of gambling disorder (lifetime and past 12 months).

2.2.2. Impulsivity

The Barratt Impulsiveness Scale Version 11 (BIS-11) (Patton et al., 1995) is a 30-item self-report questionnaire using a four-point Likert scale from 0 (rarely or never) to 4 (always or almost always) that provides a total score and three subscale scores: Attentional-Cognitive Impulsiveness, Motor Impulsiveness, and Motor Planning. The higher the score the greater the impulsivity.

2.2.3. Explicit gambling related cognitions

The Gambling Related Cognitions Scale (GRCS) (Raylu and Oei, 2004) is a 23-item self-report questionnaire using a seven-point Likert scale from 1 (strongly disagree) to 7 (strongly agree) that provides a total score and five subscale scores: Predictive Control, Illusion of Control, Interpretive Bias, Gambling Expectancies, and Inability to Stop. The higher the score the greater the gambling-related cognitions.

2.2.4. Alcohol use disorder

The Obsessive Compulsive Drinking Scale (OCDS) (Anton et al., 1995) is a 14-item self-report questionnaire using a five-point Likert scale from 0 (never) to 4 (always) that provides a total score and two subscale scores: compulsive and obsessive. The OCDS is sensitive to alcoholism severity (Anton et al., 1996). The higher the score the greater the problem drinking behaviour.

The Alcohol Use Disorders Identification Test (AUDIT) (Saunders et al., 1993) is a 10-item self-report questionnaire using a five-point Likert scale from 0 to 4 that assesses the following domains: alcohol consumption, drinking behaviour, and alcohol-related problems. Eight is the general cut-off for harmful alcohol use (Saunders et al., 1993). The higher the score the greater the problem drinking behaviour.

2.2.5. Implicit gambling related attitudes

In this study, we used a modification of the original procedure described by Greenwald et al. (2003) and Wiers et al. (2005). The target category was gambling games versus non-gambling games. The stimuli included pictures from six different gambling games and six different non-gambling games. The attribute category was positive versus negative, and eight words with positive valence and another eight with negative valence were used as stimuli. With this procedure, the positive and negative implicit associates
with gambling games can be measured. The key idea is that stimuli whose concepts are automatically associated will smooth the way for a common response (e.g. press the "E" key to exit) in comparison with stimuli where that association does not exist. Participants make two dimensional categorical choices, positive-negative and gambling games–non-gambling games, by pressing one of two keys. The dependent measure is response time, and the difference seen in this measure during the test is called "the IAT effect". In this study, the response time to positive words when coupled with a gambling game picture was expected to be faster in pathological gamblers than in the control group.

Millisecond Software’s Inquisit 4 was used to run the IAT and collect the data. The software gives all instructions needed to complete the test.

First the patients completed the IAT, and then stopped for a five-minute break before starting the scales. The AIT was counterbalanced in a randomized way to control for the order of task performance blocks artefact, the software also includes practice trials to ensure minimal influence of this artifact.

All measures and instructions were provided in Spanish.

2.2.6. Statistical analyses

All statistical analyses were performed using R software. The mean and standard deviations were calculated for all continuous study variables. Discrete variables are described combining the number of individuals in each category. The differences between two groups in continuous variables were checked by using a t-test while Chi-square and Fisher’s tests were used to find statistically significant differences in categorical variables. Finally, a multivariate logistic regression analysis was performed to search for variables that would discriminate between the following groups of patients: pathological gamblers vs controls, active vs non-active pathological gamblers, and alcohol dependent vs non-alcohol dependent pathological gamblers.

3. Results

Table 1 shows all baseline variables for both groups. The mean age of the control group was higher than the mean age of the gambling disorder group (43.20 (11.80) vs 50.33 (8.38), p = 0.001). There were also statistically significant differences in employment status, as the proportion of pensioners was higher in the control group than in the gambling disorder group (13.64% versus 19%, p < 0.001).

The IAT score was higher in the control group than in the gambling disorder group (0.75 (0.36) vs 0.51 (0.71), p = 0.04), which means that their response time to positive words when

<table>
<thead>
<tr>
<th>Variables</th>
<th>Gambling disorder group (N=44) Mean (S.D)</th>
<th>Control group (N=100) Mean (S.D)</th>
<th>t. Fisher or X2 tests (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>43.20 (11.80)</td>
<td>50.33 (8.38)</td>
<td>T = 3.62 (p = 0.001)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>43</td>
<td>95</td>
<td>p = 0.6671 (Fisher's exact test)</td>
</tr>
<tr>
<td>Female</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Years of study</td>
<td>10.82 (3.57)</td>
<td>10.03 (2.90)</td>
<td>T = -1.29 (0.201)</td>
</tr>
<tr>
<td>Nicotine dependence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>21</td>
<td>31</td>
<td>X² = 3.706 (p = 0.0542)</td>
</tr>
<tr>
<td>Yes</td>
<td>23</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>Alcohol dependence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>27</td>
<td>0</td>
<td>p &lt; 0.001 (Fisher's exact test)</td>
</tr>
<tr>
<td>Yes</td>
<td>17</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>15</td>
<td>24</td>
<td>p = 0.3899 (Fisher's exact test)</td>
</tr>
<tr>
<td>Married</td>
<td>25</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>Divorced or separated</td>
<td>4</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Employment status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worker</td>
<td>38</td>
<td>81</td>
<td>X² = 55.197 (p &lt; 0.001)</td>
</tr>
<tr>
<td>Pensioner</td>
<td>6</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>IAT</td>
<td>0.5098 (0.7123)</td>
<td>0.7482 (0.3563)</td>
<td>T = 2.11 (p = 0.04)</td>
</tr>
<tr>
<td>Barratt Scale (BIS-11)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive</td>
<td>14.75 (5.31)</td>
<td>5.71 (3.34)</td>
<td>T = -10.43 (p &lt; 0.001)</td>
</tr>
<tr>
<td>Motor</td>
<td>16.07 (7.80)</td>
<td>5.14 (3.35)</td>
<td>T = -8.94 (p &lt; 0.001)</td>
</tr>
<tr>
<td>Nonplanning</td>
<td>20.59 (6.89)</td>
<td>10.36 (4.61)</td>
<td>T = -9.00 (p &lt; 0.001)</td>
</tr>
<tr>
<td>Total</td>
<td>51.41 (16.28)</td>
<td>21.21 (9.09)</td>
<td>T = -11.54 (p &lt; 0.001)</td>
</tr>
<tr>
<td>NODS 1 year</td>
<td>4.55 (4.00)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>GRCS scale</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gambling-related expectancies</td>
<td>11.93 (8.17)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Illusion of control</td>
<td>6.85 (5.08)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Predictive control</td>
<td>15.73 (10.51)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Inability to stop</td>
<td>15.25 (9.85)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Interpretative control/bias</td>
<td>13.73 (8.50)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>63.48 (37.38)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>OCDS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obsessive</td>
<td>1.73 (4.12)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Compulsive</td>
<td>3.09 (4.30)</td>
<td>0.19 (0.81)</td>
<td>T = -4.44 (p &lt; 0.001)</td>
</tr>
<tr>
<td>Total</td>
<td>4.86 (8.02)</td>
<td>0.19 (0.81)</td>
<td>T = -3.86 (p &lt; 0.001)</td>
</tr>
<tr>
<td>AUDIT</td>
<td>5.59 (7.06)</td>
<td>2.18 (0.81)</td>
<td>T = -3.19 (p &lt; 0.001)</td>
</tr>
</tbody>
</table>

IAT: Implicit Association Test, BIS-11: Barratt Impulsiveness Scale Version 11, NODS: NORC Diagnostic Screen for Gambling Disorders, GRCS: Gambling Related Cognitions Scale, OCDS: Obsessive Compulsive Drinking Scale, AUDIT: Alcohol Use Disorders Identification Test
coupled with a gambling game picture was slower. For the total BIS-11 scale and all the subscales, the average values were higher in the gambling disorder group than in the control group (p < 0.001). NODS and GRCS, values were different from zero and one, respectively, only in the gambling disorder group, as expected. Also as expected, there were statistically significant OCDS and AUDIT differences in the control group and the gambling disorder group, inasmuch as control participants had been alcohol abstinent for at least the past 24 months (p < 0.001 and p = 0.003, respectively). Finally, the percentage of nicotine dependence was higher in the gambling disorder group compared with the control group, with a p-value of 0.0542, close to a 5% alpha level of significance.

According to the results of the NODS scale, patients in the gambling disorder group can be divided into active (23) and non-active (21) pathological gamblers for the past 12 months. All of the active patients had been gambling during the prior month to the study. When these two subsets are compared for statistically significant differences in the mean values of the different dimensions of the BIS-11 scale, such differences were found only for the cognitive dimension (t = −2.19, p = 0.034) but not for the other subscales (motor: t = −0.95, p = 0.348, non-planning: t = −1.59, p = 0.119) or for the total scale (t = −1.85, p = 0.072). For the GRCS, there were statistically significant differences in the average values of the total scale (t = −3.98, p < 0.001) and the subscales between groups: gambling-related expectancies (t = −2.54, p = 0.015), illusion of control (t = −2.65, p = 0.013), predictive control (t = −3.53, p = 0.001), inability to stop (t = −3.21, p = 0.003) and interpretive control-bias (t = −5.15, p < 0.001).

No significant differences were found in alcohol consumption between active and non-active gamblers in the gambling disorder group (X² = 0.06, p = 0.8065). There were also no significant differences in IAT, AUDIT or OCDS scores.

Gambling disordered patients can also be divided into subgroups based on wether they are alcohol dependent (17) or not (27). Obviously, OCDS and AUDIT scores show statistically significant differences. IAT, GRCS, and BIS-11 showed non-statistically significant differences.

Table 2 shows the results of a multiple logistic regression model able to classify pathological gambling patients using the domains of the BIS-11 and IAT scales as input variables and controlling for age and gender. The cognitive domain of the BIS-11 scale was clearly significant, while the motor and non-planning domains were significant only at an alpha level of 10%. The same was true of the IAT scale. The odds ratio (OR) was influenced only by the cognitive and motor domains of the BIS-11 scale. Each point increase in the cognitive scale meant a 35.06% increase in the chances of being a pathological gambler. In the case of the motor scale, that value was 16.54%. The sensitivity of this model is 0.93, with a specificity of 0.70 and an accuracy of 0.96.

Table 3 shows a similar model for classifying active versus non-active pathological gamblers. BIS-11, IAT, and GRCS scales were used as input variables, and again age and gender were control variables. Using this model, only the GRCS predictive control and inability to stop subscales were found to be significant at an alpha level of 5%. At an alpha level of 10%, the cognitive domain of the BIS-11 was also significant. For the cognitive domain of the BIS-11 and the inability to stop domain of the GRCS, the higher the score, the greater the chances of being an active pathological gambler. The sensitivity of this model is 0.96, with a specificity of 0.90 and an accuracy of 0.96.

Finally, Table 4 shows the multivariate logistic regression analysis for detection of alcohol dependent versus non-alcohol dependent pathological gamblers according to BIS-11, IAT, and GRCS scales, based on wether the pathological gambler is active or not, and, as in the previous two models, controlling for age and gender. The inability to stop dimension of the GRCS scale and active pathological gambling were significant in this model, active pathological gambling also achieved significance. The non-planning dimension of the BIS-11 was very close to significance, as was the GRCS gambling-related expectancies subscale. The sensitivity of this model is 0.98, with a specificity of 0.70 and an accuracy of 0.85.

### 4. Discussion

Our results demonstrated a positive relationship between pathological gambling and impulsivity, explicit cognitive distortions and implicit attitudes related to gambling, and to a lesser extent alcohol dependence. But the specific interaction seen among these four domains with pathological gambling, active pathological gambling, and pathological gambling plus alcohol dependence is of greater interest.

Impulsivity assessed with the BIS-11 clearly indicated a difference between pathological gamblers and controls. In all its subscales in the univariate analysis, with the cognitive subscale clearly...
significant and the other two nearly so in the multivariate analysis. However, this important level of significance almost disappeared when comparing active versus non-active pathological gamblers, as only the cognitive subscale reached significance in the univariate analysis and near significance in the multivariate analysis. The same was true when alcohol-dependent pathological gamblers were compared with non-alcohol-dependent ones, and only the non-planning subscale was close to significance in the multivariate analysis. We can not fully guarantee that this tool might be useful to detect people whose gambling has turned pathological, but it would not be suitable for evaluating current gambling or response to treatment. It is not surprising that GRCS scores, as a measure of explicit gambling-related cognitions, are sharply different when comparing controls, with a NODS score of 0, and pathological gamblers. However, the GRCS subscales can discriminate between active and non-active pathological gamblers, both at the univariate and multivariate levels, is of greater value. GRCS and BIS–11 cognitive scores can be coupled for screening purposes in order to detect active pathological gamblers in different settings (Michalczuk et al., 2011). The GRCS inability to stop subscale had a significant correlation with alcohol dependence. As in previous studies, this might indicate that alcohol abuse reduces the odds of pathological gamblers halting their gambling behaviour, thus worsening their gambling disorder (Lister et al., 2015; Rash et al., 2011). Thus, in order to evaluate current gambling problems and response to treatment clinicians may rely on the GRCS.

Our BIS–11, IAT and GRCS data also suggest, like in previous research (Michalczuk et al., 2011; Robbins et al., 2012), that impulsivity in pathological gambling is about making impulsive choices related to active implicit and explicit cognitive distortions. At the multivariate level, alcohol dependence is significantly associated with the inability to stop dimension of the GRCS scale, as previously mentioned, and with active pathological gambling. The non-planning dimension of the BIS–11 was very close to significance, as was the GRCS gambling-related expectancies subscale. All these data point to the relation between loss of control and pathological gambling in this study, as no significant differences were found between active and non-active pathological gamblers. While impulsivity is more linked to pathological gambling vulnerability, it is also present during the premorbid phase (Leeman et al., 2014; Verdejo-Garcia et al., 2008), so changes in implicit attitudes related to gambling are probably more related to emergence of the illness and may be a key mechanism. If this is the case, a gambling-related IAT could be used, alone or with other instruments, as a diagnostic tool. Alcohol dependence did not increase implicit gambling-related attitudes in this group of pathological gamblers and vice versa. Therefore, clinicians interested in using an IAT to assess pathological gambling have to remember that this tool might be useful to detect people whose gambling has turned pathological, but it would not be suitable for evaluating current gambling or response to treatment.
population, as it is a convenience sample, and for this reason our findings may not be generalisable. As these patients have been able to achieve such a long period of alcohol abstinence we cannot exclude that they might represent a low impulsivity group. To control this potential bias a general population control group with similar sociodemographic variables will be needed.

Despite these limitations, the present study is capable of proving that impulsivity scores measured with the BIS–11 and changes in implicit attitudes assessed with an IAT might be used for detecting pathological gamblers; and that cognitive impulsivity scores measured with the BIS–11, explicit gambling-related cognitions measured with the GRCS, and alcohol dependence may discriminate active versus non-active pathological gamblers. In summary, the combination of these easy-to-use tools can help clinicians detect pathological gamblers, wether active or non-active. For highly busy clinicians combining these three easy and fast tools can have a high impact in their effectiveness to detect pathological gamblers, especially active ones.

Conflicts of interest

None.

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