Impulsivity and problem awareness predict therapy compliance and dropout from treatment for gambling disorder

Impulsividad y conciencia del problema predicen la adherencia terapéutica y el abandono del tratamiento en el trastorno por juego de azar

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Abstract

This study investigates the predictive value of impulsivity traits (as measured by the UPPS-P impulsive behaviour scale) and relevant covariates (sociodemographics, gambling severity, dysphoric mood, other potentially addictive behaviours, and non-verbal intelligence) with regard to treatment dropout and level of adherence to therapy guidelines and instructions in patients with gambling disorder. Sixty-six patients seeking treatment for gambling disorder, and recruited to participate in a larger protocol (G-Brain), were initially assessed in impulsivity traits and relevant covariates in the first six months after admission. Of these, 24 patients dropped out (DO) and 42 patients remained in therapy (NDO) during the subsequent 6-month follow-up period. A multivariate analysis of impulsivity subscales suggested prospective differences between DO and NDO, with affect-driven dimensions (positive and negative urgency) seemingly driving these differences. Among these, only positive urgency independently predicted a slight increase in the drop-out probability. In the NDO group, a higher degree of adherence to therapy was independently predicted by lower sensation-seeking scores and stronger awareness of gambling-related problems. Results suggest the presence of affect-driven impulsivity traits as dropout predictors in patients with gambling disorder. Awareness of gambling-related problems and lower sensation-seeking enhanced compliance with therapeutic guidelines and instructions.

Key words: Gambling disorder; Treatment; Impulsivity; Positive urgency; Sensation seeking; Awareness.

Resumen

Este estudio investiga el valor predictivo de la impulsividad como rasgo (evaluada con la escala de conducta impulsiva UPPS-P) y de covariados relevantes (variables sociodemográficas, severidad del juego de azar, estado de ánimo disfórico, otras conductas adictivas e inteligencia no verbal), con respecto al abandono del tratamiento y los niveles de cumplimiento de las prescripciones terapéuticas en pacientes con trastorno por juego de azar. Sesenta y seis pacientes con este trastorno, participantes del proyecto G-Brain, fueron evaluados inicialmente en impulsividad rasgo y en los covariados mencionados. Dicha evaluación se realizó durante los seis primeros meses desde el inicio de su tratamiento. En el seguimiento realizado a los 6 meses, 24 pacientes habían abandonado (grupo ABD) y 42 continuaban el tratamiento (grupo NABD). Los análisis multivariados con las subescalas de impulsividad mostraron diferencias prospectivas entre ambos grupos. Aparentemente, estas diferencias son atribuibles a las dimensiones afectivas de impulsividad (urgencias positiva y negativa). Entre ambas dimensiones, solo la urgencia positiva fue un predictor independiente de un ligero incremento en la probabilidad de abandono. Dentro del grupo NABD, un mayor grado de adherencia terapéutica vino predicho, de manera independiente, tanto por una baja búsqueda de sensaciones como por una mayor conciencia de los problemas vinculados al juego. Estos resultados sugieren que los rasgos de impulsividad de origen afectivo son predictores de abandono del tratamiento en pacientes con trastorno por juego. La conciencia de problemas asociados al juego de azar y una baja búsqueda de sensaciones predisponen a una mayor adherencia a las prescripciones terapéuticas.

Palabras clave: Trastorno de juego de azar; Tratamiento; Impulsividad; Urgencia positiva; Búsqueda de sensaciones; Conciencia.

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Gambling disorder (GD) is characterized by the inability to reduce or eliminate excessive participation in games of chance involving monetary stakes, in spite of severe negative consequences (American Psychiatric Association, 2013). Its prevalence in adolescent and adult populations ranges from 0.4% to 7.6%, (including both land-based and online gambling modalities, and depending on the sample age, variability of tools and methods, and the stringency of clinical significance thresholds), with an average worldwide prevalence of 2.2% (Jiménez-Murcia, Fernández-Aranda, Granero & Menchón, 2014). The currently recommended therapeutic approaches present a premature dropout rate around 30% (Aragay et al., 2015; Melville, Casey & Kavanagh, 2007).

At present, there is an almost unanimous agreement on considering GD a behavioral addiction (Leeman & Potenza, 2012; Petry, 2010); a consensus not yet reached for other putative behavioral addictions (Chacón-Cuberos et al., 2018; Martín-Fernández et al., 2017). Nonetheless, there is also evidence of a high level of individual variability among patients with GD (Albein-Urios, Martinez-González, Lozano, Clark & Verdejo-García, 2012; Blaszczynski & Nower, 2002; Steward et al., 2017), which is likely to determine differential responses to treatment (Aragay et al., 2015; Chu & Clark, 2015; Melville et al., 2007).

Impulsivity and course of gambling disorder treatment

A number of studies have tried to identify contextual or individual measures that can predict treatment outcomes. For example, Weinstock et al. (2011) concluded that sociodemographic factors, gambling severity, indebtedness, and the level of coercion exerted by legal and social networks predict treatment acceptance/reluctance. Gambling patterns (Pickering, Keen, Entwistle & Blaszczynski, 2018), comorbidities (Maniaci et al., 2017), and interpersonal support (Jiménez-Murcia et al., 2017) have also emerged as valuable indices of treatment course and outcomes.

Here we focus on impulsive personality –the proneness to carry out rash, non-premeditated acts– and its potential value for predicting dropout and compliance with the therapist's advice during treatment. Related evidence converges in showing that: (1) impulsive people are more likely to develop future gambling problems (Secades-Villa, Martínez-Loredo, Grande-Gosende, y Fernández-Hermida, 2016; van Holst, van den Brink, Veltman & Goudriaan, 2010; Vitaro, Brendgen, Ladouceur & Tremblay, 2001); (2) patients with GD with high levels of impulsivity are more likely to prematurely terminate treatment (Leblond, Ladouceur & Blaszczynski, 2003; Maccallum, Blaszczynski, Ladouceur & Nower, 2007); (3) impulsivity is linked to increased psychopathological comorbidity, including other addictions (Grall-Bronnec et al., 2012; Petry, 2010); and (4) impulsivity correlates with GD severity (Billieux et al., 2012).

Impulsivity is however better understood as a multidimensional construct (Cyders & Smith, 2007; Evenden, 1999). Recent factorial models distinguish between a *conscientiousness-planning* factor, reflecting the integrity of top-down executive mechanisms, a *reward seeking* factor, characterized by the subjective overvaluing of reinforcement (despite possible negative consequences), and a *negative emotionality dysregulation* factor (Knezevic-Budisin, Pedden, White, Miller & Hoaken, 2015; Sharma, Markon & Clark, 2014).

Customary psychometric tools rely on factorial analyses of responses to self-report items to idendify the components of impulsive behavior. In this regard, the UPPS-P model of impulsive behavior (Cyders et al., 2007; Whiteside, Lynam, Miller & Reynolds, 2001) has been shown to be advantageous over other impulsivity assessments, based on its discriminative capacity and correspondence with dissociable psychobiological systems (Rochat, Billieux, Gagnon & Van der Linden, 2017). In spite of their undeniable theoretical value, alternative assessment methods, based on neuropsychological or decision-making tasks (see, for example, Torres et al., 2013a, 2013b), have yielded very modest associations with self-report tools even in very large samples (Cyders et al., 2011; MacKillop et al., 2016), and, to date, there is not a battery of tasks of this sort that can be considered as an overarching and time-efficient alternative to assess impulsivity as a multidimensional construct (Stahl et al., 2014).

According to the UPPS-P model, impulsivity is composed of (1) *positive* and (2) *negative urgency*, representing the tendencies to lose control under positive and negative emotions, respectively; (3) *lack of premeditation*, the tendency to make decisions without taking consequences into consideration; (4) *lack of perseverance*, the inability to remain focused on a demanding task; and (5) *sensation seeking*, the predisposition to try new and exciting activities. Convergent validity analyses suggest that urgencies respond to a combination of emotional reactivity and executive dysregulation; lack of premeditation and perseverance mostly overlap with the conscientiousness/planning factor; and sensation seeking reveals a tendency for seeking reward in novel and exciting activities (Cyders & Smith, 2007; Sharma et al., 2014).

Among UPPS-P dimensions, negative urgency emerges as the clearest marker of severity in clinical levels (Billieux et al., 2012), although positive urgency and sensation seeking have also been observed to predict severity in treatment-seeking gamblers (Savvidou et al., 2017). Here, however, our interest is focused on the relationship between UPPS-P dimensions and treatment outcomes. To our knowledge, no previous studies have investigated the putative relationship between impulsivity, assessed in

a multidimensional manner, and adherence/dropout during treatment.

Still, some related evidence allows us to make substantive predictions. On the one hand, at least two studies have focused on the possible link between constructs largely overlapping with sensation seeking and treatment dropout (Aragay et al., 2015; Jiménez-Murcia et al., 2012). These studies did not directly investigate impulsivity, but personality as assessed by the TCI questionnaire (*Temperament and Character Inventory*, Cloninger, Svrakic & Przybeck, 1993). Both of them reported one of these dimensions (*novelty seeking*) to predict dropout. Relatedly, a recent study (Mestre-Bach et al., 2016) has showed high scores in a trait also related to impulsivity and sensation seeking (reward sensitivity) to be associated with an increased probability of treatment dropout, but not disorder severity, occurrence of relapses, or treatment compliance. In view of this evidence, UPPS-P sensation seeking arises as a candidate to predict dropout.

On the other hand, given the connection of negative urgency with addictive behaviors via altered emotion regulation and dysfunctional coping skills (Adams, Kaiser, Lynam, Charnigo & Milich, 2012), a significant contribution of negative urgency to poor adherence and treatment dropout seems highly plausible.

Aims and clinical implications

To date, most studies either have failed to consider other measures of adherence beyond permanence in treatment, or have not explicitly distinguished between dropout and compliance (Melville et al., 2007). In Aragay et al. (2015), therapeutic compliance was not explicitly assessed. In Mestre-Bach et al. (2016), dropout was not considered when computing the number of relapses (making relapse and dropout somewhat confounded), and compliance was analyzed dichotomously (good vs. poor). To our knowledge, only Jiménez-Murcia et al. (2012) have assessed compliance (in 3-point good/fair/poor scale) separately from dropout. As noted earlier, in this study, an association was found between novelty seeking and dropout, but no significant predictors were identified for therapy compliance.

The aims of the present study are as follows: (1) to estimate the degree to which UPPS-P dimensions predict dropout from psychological treatment (in the six months following the initial assessment), taking into account several potential confounders; and (2) to test if these variables further predict the degree of compliance with therapeutic tasks and recommendations, specifically in those patients who remain in treatment.

Results potentially have direct clinical relevance. Changes in the gambling market associated with the emergence of new gambling modalities are posing a serious challenge for clinicians and rehabilitation services. As we have shown elsewhere (Navas et al., 2017, 2018), new gamblers also present distinct psychological traits, and clarifying the prognostic value of such traits is a necessary step for tailoring treatment (Raylu & Oei, 2016).

Method

Participants

Sixty-six patients in treatment for GD [2 females, recruited from the Asociación Granadina de Jugadores de Azar en Rehabilitación (AGRAJER), a mutual help association based in Granada, Spain] participated in this study. As part of their admission protocol, all patients underwent a semi-structured interview based on DSM-IV for axis I and II disorders with their therapist, comprising all the necessary information to check for exclusion criteria. GD diagnosis was established by the therapist on the basis of such an interview, and was confirmed by a score equal to or above 5 on the South Oaks Gambling Screen (SOGS, Spanish version; Echeburúa, Báez, Fernández-Montalvo & Páez, 1994).

Inclusion criteria were: (1) a GD diagnosis; (2) having been in treatment for less than 6 complete months. Exclusion criteria were: (1) suffering any comorbid DSM-IV psychiatric disorder; and (2) any history of neurological disease or brain damage (as reported by the participant). Participants potentially suffering comorbid disorders or with a history of neurological damage were not invited to participate in the study. Signs of problematic alcohol or drug use were further assessed using the MultiCAGE CAD-4 clinical screening questionnaire (Pedrero Pérez et al., 2007).

Procedure

Initial assessment. The initial assessment session lasted approximately three hours. It comprised several self-report questionnaires and neuropsychological tests, some of which are not directly relevant to the aims of this study, as were part of a larger protocol (G-Brain research project, PSI2013-45055-P), and have been described elsewhere (see, for example, Navas et al., 2017; Navas, Verdejo-García, López-Gómez, Maldonado & Perales, 2016; Perales, Navas, Ruiz de Lara, Maldonado & Catena, 2017).

Importantly, given the characteristics of the treatment center, and the restricted availability of patients, it was not always possible to complete the initial assessment immediately after admission. In all cases, the initial assessment took place in the six first months of treatment. More specifically, this assessment took place in the first month of treatment for twenty-two patients, in the second month for twenty, in the third month for eight, in the fourth month for three, in the fifth month for seven, and in the sixth month for six (see average time in treatment in Table 1).

Follow-up. Six months after the initial assessment (and thus in all cases still within the first year of treatment), the

patients' therapist was contacted again in order to collect information on the occurrence or non-occurrence of dropout and/or treatment compliance (see treatment compliance in the instruments section). Based on that information, the original sample was divided into two groups: 24 patients who dropped out from treatment (DO), and 42 patients who did not drop out from treatment (NDO). Descriptive statistics for the two groups are displayed in Table 1 (upper panel).

Instruments

Severity of gambling and other problematic behaviors.

South Oaks Gambling Screen (SOGS, Lesieur & Blume, 1987; Spanish version, Echeburúa et al., 1994). This 20-item questionnaire is aimed to assess gambling severity, indebtedness, and dependence. It has adequate psychometric properties, and is the most widely used tool in GD research. Only the global severity score was used in the present study.

MultiCAGE CAD-4 (Pedrero Pérez et al., 2007). This screening tool consists of a series of dichotomous items checking for the current self-perceived presence of problems associated with poor impulse control in several domains (including gambling and alcohol and illegal drug use). In the present study we used only the gambling, alcohol, and drug subscales, all of which have been reported to have good psychometric properties. The remaining subscales (excessive internet and videogame use, disordered eating, hypersexuality, and compulsive buying) are not relevant for the aims of the present study.

Estimated non-verbal intelligence. A non-verbal Intelligence Quotient (IQ) was estimated using the matrix reasoning task from the Wechsler Adult Intelligence Scale (WAIS-IV; Wechsler, 2008).

Impulsivity. The *UPPS-P* brief impulsivity scale (Spanish version, Cándido, Orduña, Perales, Verdejo-García & Billieux, 2012) comprises 20 Likert-type items aimed at assessing negative and positive urgency, sensation seeking, lack of premeditation and lack of perseverance.

Dysphoric mood. Subclinical signs of poor mood were assessed by using the *Beck Depression Inventory–II* (BDI-II; Spanish version, Sanz, Perdigón & Vázquez, 2005). The BDI questionnaire was included in the protocol when some participants had been already assessed. That said, BDI data are missing for a total of 4 patients, all of whom were in the NDO group.

Treatment compliance. Treatment compliance in NDO patients was defined considering (1) attendance to therapeutic activities (e.g., group sessions); and (2) task completion and fulfillment of the therapist's guidelines for daily life functioning (e.g., keeping diaries up to date, not drinking alcohol). The therapist's records were used to assess all patients on a five-point scale, on which 5 meant full attendance and fulfillment, 4 meant attendance and fulfillment above 50%; 3 meant attendance above 50%, but a fulfillment of task and recommendations below 50%; 2 meant attendance and fulfillment of task and recommendations below 50%; and 1 attendance below 50% and nearly complete disregard of tasks and recommendations. Compliance level was assessed independently by two judges (second and fourth authors), with a concordance of r = 0.952. In the cases in which the judges' assessments did not match, the discordance was resolved by mutual agreement. Among the 42 patients who did not drop out from treatment, 6 scored five points, 13 four points, 14 three points, 7 two points, and 2 one point.

Treatment characteristics

All participants followed the same treatment protocol, with the same therapist, and in the same facilities. This treatment is similar to the treatment implemented in other facilities belonging to the same Regional Federation as AGRAJER [*Federación Andaluza de Asociaciones de Jugadores de Azar en Rehabilitación (FAJER)*]. Treatment is mostly based on groups of mutual help –complemented with professional supervision and individual cognitive-behavioral therapy– and lasts for approximately two years. Features and stages of treatment are described in supplementary materials S1.

Ethical standards

Procedure of this study complies with the ethical standards of the Helsinki Declaration of 1975, as revised in 2008, and was approved by Ethics Committee for Human Research of the University of Granada (Spain), as part of the PSI2013-45055-R research project. All participants were informed about study's objectives and signed informed consent.

Statistical analyses

Dropout analyses. In order to describe differences between the NDO and DO groups, we first ran between group t-tests on sociodemographic and control variables. This analysis was carried out to identify possible confounders before analyzing between-group differences on impulsivity measures.

Secondly, we ran a multivariate analysis of variance/covariance (MANOVA-MANCOVA) on the five UPPS-P subscales. In case potential confounders were identified, these were intended to be included in the MANCOVA as covariates. A significant between-group multivariate effect was planned to be followed by variable-by-variable t-tests, in order to identify where the global multivariate effect originated. For all t-tests, p-values and Bayes factors are reported.

Third, variable-by-variable analyses were complemented with a stepwise logistic regression analysis, with group membership as the dependent variable (NDO vs DO) and

impulsivity dimensions as predictors. This analysis was carried to test whether any of the impulsivity variables differing between the two groups predicted group membership independently of the others.

Compliance analyses in the NDO group. Fourth, for the NDO group only, we ran bivariate correlation analyses to estimate relationships between sociodemographic/control variables and the compliance measure. Again, these analyses were carried out to identify potential confounders to be considered in subsequent steps.

And lastly, impulsivity measures, along with potential confounders, were entered into a stepwise regression analysis of compliance. This was complemented with a Bayesian Regression analysis, to identify the most predictive combination of factors (including impulsivity measures and potential confounders), and the individual contribution of each of those factors therein.

Bayesian analyses and simple t-tests were carried out with JASP statistical software (http://jasp-stats.org). Bayesian analyses were performed with default software settings. MANOVA/MANCOVA and logistic regression analyses were run on SPSS 20.0 (IBM Corp, 2011).

As there were only 2 female participants in our sample, all analyses were run with and without them. Results were virtually identical in all cases, so we found no reason to exclude them. Reported results correspond to the whole sample.

Results

Group comparability checks

No significant differences were observed between DO and NDO groups in sociodemographic and control variables (Table 1, upper panel). Of particular importance is the corroboration that the two groups were well matched in duration of treatment at the moment of the initial assessment. Given that assessment was more delayed for some participants than for others, differential attrition prior to the first assessment could have unbalanced this variable in favor of one of the two groups. Matching thus ensures between-group comparability despite inter-individual differences in the moment of the initial assessment. Additionally, Bayes factors are consistently below 1 for all potential confounders, and below 1/3 in some cases, which indicates a good general matching between the two groups.

Due to slight changes in the form used to collect sociodemographic information during the study, age of gambling onset was available for only 49 participants. Of these, 17 were in the DO group and 32 in the NDO group. These two subgroups were far from substantially differing in onset age [mean (SD) 21.61 (7.69) and 19.47 (5.72), for NDO and DO subgroups, respectively, $t(47)=1.01$, $p=0.32$, $BF_{10}=0.45$]. Complementarily, we had data on gambling modality preference (type I vs type II games, as defined in Navas et al., 2017) for 65 participants. A Chi-squared test on the relationship between preferences and dropout was also non-significant [$\chi^2(1)=1.475$, $p=0.225$].

Dropout

In view of the absence of potential confounders among the variables under consideration, no covariates were included in the subsequent multivariate analysis of impulsivity measures. The corresponding MANOVA yielded a main multivariate effect of group [Wilks' $\lambda=0.823$, $p=0.035$, $\eta^2_p=0.177$]. Variable-by-variable t-tests (Table 1, lower panel) yielded significant differences in positive and negative urgency between the two groups. The logistic regression model correctly classified 62.10% of participants (see Table 2), with positive urgency as the only predictor in the final model.

It is important to take into account, however, that according to Bayes factors, t-tests on specific impulsivity dimensions portray only anecdotal evidence in favor of the alternative hypothesis. Significant p-values should thus be interpreted cautiously, as they are merely suggestive of the specific location of effects on general impulsivity, in the case that there are any.

Compliance

In the correlation analysis in the NDO group, compliance positively correlated with WAIS matrix reasoning score, the gambling subscale on the MultiCAGE CAD-4 questionnaire (MC-gambling), and BDI (Table 3). Gambling preferences (type I vs type II) did not significantly influence compliance [$t(63)=-0.63$, $p= 0.532$]. In other words, compliant patients had better reasoning abilities, presented a worse mood state, and regarded their gambling as more troublesome.

The stepwise linear regression analysis with these three factors and UPPS-P scores yielded significant effects for UPPS-P sensation seeking and MC-gambling score, with the former inversely predicting compliance and the latter positively predicting it (Table 4). As noted above, due to BDI data loss, there were 4 participants missing from this analysis. So, we re-ran it without BDI scores. Results from this analysis were qualitatively identical but notably neater [Adjusted $R^2=0.308$, $p<0.001$; MC-gambling: $\beta=0.470$, $p<0.001$; Sensation seeking: $\beta = -0.330$, $p=0.015$].

These regression analyses were complemented with Bayesian regression modeling. As reported in Table 5, the model with the highest Bayes factor (31.73 relative to the null model), and thus best accounting for data, included UPPS-P negative urgency and sensation seeking, and MC-gambling. However, the three factors contributed differently to the model's predictive fit. The Bayes factor of the best model, relative to the equivalent ones without each of the three of factors, was 1.22, 4.65, and 49.57, when removing negative urgency, sensation seeking, and MC-gambling, respectively. In accordance with the standard regres-

Table 1. *Independent Sample t-tests and Bayesian t-tests on sociodemographic, control variables and impulsivity (UPPS-P) variables.*

	NDO	DO			
	Mean (SD)	***Mean (SD)***	**t**	***p***	***BF_{10}***
Sociodemographic and control variables					
Age	37.67 (11.33)	33.92 (10.46)	1.330	0.188	0.546
Years of education	12.86 (4.55)	12.42 (2.38)	0.440	0.661	0.283
Months in treatment	2.85 (1.72)	2.36 (1.34)	1.193	0.237	0.473
Matrix reasoning (WAIS-IV)	96.31 (14.86)	99.17 (14.42)	-0.759	0.450	0.332
BDI Dysphoric mood	9.92 (8.62)	12.13 (8.48)	-0.987	0.328	0.398
SOGS Severity	10.43 (3.26)	10.38 (3.54)	0.062	0.950	0.261
MC Gambling	3.07 (0.89)	2.75 (0.94)	1.377	0.173	0.576
MC Alcohol	1.14 (1.37)	0.79 (1.22)	1.042	0.301	0.411
MC Drugs	0.52 (1.04)	0.42 (0.93)	0.418	0.678	0.280
UPPS-P					
Negative Urgency	2.73 (0.72)	3.10 (0.69)	-2.047	**0.045**	1.481
Positive Urgency	2.48 (0.59)	2.78 (0.53)	-2.061	**0.043**	1.516
Sensation Seeking	2.14 (0.66)	2.46 (0.91)	-1.647	0.104	0.808
(Lack of) Premeditation	2.19 (0.73)	2.28 (0.64)	-0.508	0.614	0.290
(Lack of) Perseverance	1.97 (0.68)	1.81 (0.64)	0.929	0.356	0.374

Note. Abbreviations: NDO = No dropout group; DO = dropout group; MC = MultiCAGE CAD-4. Significant tests are marked in bold.

Table 2. *Results from the forward logistic regression analysis for group membership (no dropout [NDO] vs dropout [DO]).*

Dependent variable	Variables included	Variables excluded	$-2\Delta LL$	*Wald*	*p*	*N-R^2*
NDO vs DO	*Positive urgency*		4.285	3.882	**0.049**	0.086
		Negative urgency *Sensation seeking* *Lack of premeditation* *Lack of perseverance*				

Note. p values for significant tests are indicated in bold. $-2\Delta LL$: -: -2 log-likelihood change for positive urgency inclusion in the model; *N-R^2*: Nagelkerke's R^2.

Table 3. *Therapy compliance correlations with sociodemographic and control variables in the no-dropout group.*

	Therapy compliance	
	r	***p***
Age	0.053	0.737
Years of education	0.175	0.269
Gambling onset age	0.058	0.752
Months in treatment	0.190	0.228
Matrix reasoning (WAIS-IV)	0.392	**0.010**
Dysphoric mood (BDI)	0.366	**0.024**
Gambling severity (SOGS)	-0.042	0.792
MC Gambling	0.482	**0.001**
MC Alcohol	-0.132	0.403
MC Drugs	-0.007	0.964

Note. p values for significant tests are indicated in bold. Abbreviations: MC = MultiCAGE CAD-4. For instruments details, see text. The correlation between gambling onset age and therapy compliance was performed on the 32 participants of the NDO group for whom these data were available.

Table 4. *Results from the stepwise linear regression analysis for therapy compliance scores in the no dropout group.*

Variables included	Variables excluded	β	*t*	*p*	*Adj. R²*
MC Gambling		*0.465*	*3.311*	*0.002*	*0.272*
Sensation seeking		*-0.319*	*-2.274*	*0.029*	
	Matrix reasoning				
	Dysphoric mood				
	Negative Urgency				
	Positive Urgency				
	Lack of Premeditation				
	Lack of Perseverance				

Note. p values for significant tests are indicated in bold. MC: MultiCAGE CAD-4. See text for details of the measures.

Table 5. *Results from the Bayesian linear regression analysis regarding therapy compliance in the no dropout group.*

Models	P(M)	P(M|data)	BF_M	BF10
Null	0.004	$9.095 \cdot 10^{-4}$	0.232	1
MC Gambling +Negative Urgency + Sensation Seeking	0.004	0.029	7.576	31.725
MC Gambling +Sensation Seeking	0.004	0.024	6.172	25.982
MC Gambling	0.004	0.009	2.442	10.429
MC Gambling +Negative Urgency	0.004	0.006	1.591	6.817
Negative Urgency + Sensation Seeking	0.004	0.000582	0.148	0.64

Note. P(M): prior probability of the models. P(M|data): posterior probability of the models given data. BF_M: model Bayes factors. BF10: model Bayes factors, relative to the null. The model performing best is marked in bold.

sion analysis described above, whereas the models with and without negative urgency performed almost equally well (so negative urgency contributed very modestly to model predictive fit), the contributions of sensation seeking and MC-gambling were substantial and strong (as indicated by Bayes factors above 3 and 10, respectively).

Discussion

Existing research has identified a number of individual variables that influence the risk of discontinuing therapy before completion (e.g., Ramos-Grille, Gomà-i-Freixanet, Aragay, Valero & Vallès, 2013), as well as some therapy features that increase or decrease clinical efficacy (e.g., Cowlishaw et al., 2012; Jiménez-Murcia et al., 2015). However, to our knowledge, none of these studies performed a detailed assessment of the different dimensions of impulsivity as predictors of dropout and therapy compliance, while controlling for potential confounders. Our results add upon the evidence that individual features determine patients' reaction to therapy (Billieux et al., 2012; Blaszczynski & Nower, 2002; Ledgerwood & Petry, 2006).

First, our results suggest that affect-driven dimensions of impulsivity discriminate between patients continuing and discontinuing therapy (DO and NDO). However, on the basis of theoretical relationships between negative urgency and key emotion regulation processes (see Billieux et al., 2012; Clark et al., 2012; Michalczuk, Bowden-Jones, Verdejo-Garcia & Clark, 2011), we had predicted this dimension to strongly and independently predict dropout. Although we found some evidence suggesting that negative urgency was higher in the DO group, that effect was explained away by positive urgency.

Aragay et al. (2015) and Jiménez-Murcia et al. (2012) had reported novelty seeking to predict dropout. The partially corresponding measure in the present study, sensation seeking, failed to discriminate between DO and NDO patients. However, sensation seeking and novelty seeking are not fully overlapping constructs (Cloninger, 1991; Cyders & Coskunpinar, 2011), and, most importantly, novelty seeking and positive urgency encompass similar appetitive motivational processes. This is consistent with the link between dropout and reward dependence we have observed in treatment for other addictions (López-Torrecillas, Perales, Nieto-Ruiz & Verdejo-García, 2014)

If confirmed, a potential predictive superiority of positive urgency relative to other reward-related dimensions of impulsivity could arise from the fact that urgency is more heavily weighted by control-related and executive processes (Billieux, Gay, Rochat & Van der Linden, 2010; Cyders & Smith, 2008; Dir, Karyadi & Cyders, 2013; Grall-Bronnec et al., 2012). Indeed, recent studies have identified two different pathways in which impulsivity might have an impact on potentially addictive behaviors. The first would involve the weakness of self-regulatory systems, and the second, an overreaction of automatic-affective systems (Lannoy, Billieux & Maurage, 2014). Our results suggest that these same two paths might also be involved in the risk of early therapy dropout in GD. Both motivation to continue gambling (driven by the rewarding properties of gambling activities), and inability to regulate behavior under the influence of emotions generated by such appetitive

motivators, might interfere with motivation to stay in treatment. Nonetheless, it is important to keep in mind that the difference between groups in positive urgency, although significant, portrayed little evidence of an actual effect. As noted earlier, any interpretation of this effect must be made cautiously.

With regard to therapeutic compliance in patients who did not abandon therapy during the follow-up period, results are more straightforward. Considered together, higher intelligence, depressive mood, more severe self-perceived gambling status, and lower sensation seeking scores positively correlated with compliance with the therapist's advice and instructions. In other words, not only do appetitive motives seem to increase the probability of discontinuing therapy, but also some degree of dysphoria seems to facilitate adherence in patients who do not abandon treatment.

Sensation seeking was the only impulsivity dimension predicting non-compliance, and, somewhat unexpectedly, higher scores on the MultiCAGE CAD-4 independently enhanced compliance. Tentatively, this relationship can be accounted for by awareness of the negative consequences of excessive gambling. In fact, the four MultiCAGE CAD-4 gambling-related items assess the presence of craving, feelings of guilt, recognition of having deceived others, and acknowledgement of family, financial or work problems. At least three of these items can contribute to a heightened perception of gambling disutility (and therapy utility), especially if we take into account that the MultiCAGE CAD-4-compliance link was found only in the less complicated cases of patients who had remained in therapy. This interpretation is compatible with previous reports that drug and alcohol users with higher scores in the CAGE questionnaire for alcohol abuse (the antecessor of MultiCAGE CAD-4: Mayfield, McLeod & Hall, 1974), and more severe perceived drug-related problems, as assessed by CAGE-inspired measures, are more likely to seek treatment (Ferri, Gossop, Rabe-Hesketh & Laranjeira, 2002).

Clinical implications

The present study identifies two possible targets that therapists should take into consideration when treating patients with GD. First, the inability to manage emotions seems to block early therapeutic efforts, which implies that emotion regulation should be addressed in the initial phases of treatment (Jiménez-Murcia et al., 2015). And second, sensation seeking could interfere with therapists' efforts to make negative consequences of gambling evident to patients. In fact, motivational factors have been proposed to bias gambling-related cognitions, as predicted by motivated reasoning models (Navas et al., 2016). In consequence, problem awareness could be sensitive to metacognitive training strategies (Mansueto et al., 2016).

Relatedly, the emergence of new types of gamblers is posing a serious challenge for treatment providers. Aspects of impulsivity related to reward and positive affect (positive urgency and sensation seeking) seem prevalent in at-risk and pathological users of new gambling devices and venues (Barrault & Varescon, 2016; Goldstein et al., 2016). Our results suggest that current prevalent treatments are probably more likely to fail with these patients, and the cause of such an increased risk of failure is more readily attributable to patients' psychological characteristics than to their gambling preferences *per se*.

Finally, the present study is also a call for caution for therapists treating GD patients. Early dropout precludes availability of feedback on the efficacy of therapy in complicated cases, namely those with the poorest emotion regulation abilities. There is some risk that the feedback the therapist receives on the efficacy of treatment is inflated by early information loss (Einhorn & Hogarth, 1978), as pre-post changes attributed to therapy tend not to take early dropout into consideration.

Limitations and strengths

The present study presents some limitations that should be taken into account. First, the initial assessment was not always carried out as soon as the patient was admitted to therapy. As noted above, some patients had been in treatment for up to six months before assessment. This delay in the assessment of some of the patients opens the possibility that some early dropouts were never detected, and thus were not included in this study. Although this fact could somewhat limit generalizability, DO and NDO groups did not differ in their treatment duration when they were initially assessed. It also is important to address that the follow-up assessment only included dropouts occurring during the first year of a two-year treatment protocol. This could imply that the variables identified could be predictive of relatively early outcomes, but not later ones. Results regarding later treatment stages (currently in progress) will be released in future works.

The second limitation relates to the fact that participants received a specific therapy protocol, so results do not necessarily generalize to patients receiving other forms of therapy. In the present case, the fact that therapy was provided by a mutual help association introduces a number of characteristics (for example, the presence of non-professional co-therapists, or the possible occurrence of confrontations between members of the association) that are not present in more standard forms of cognitive-behavioral therapy.

And finally, the study sample size is limited by the inflow of new patients in the treatment center where the study was carried out during a reasonable window of time. Underpowered samples could be liable for some potential

predictors not reaching significance, particularly in the regression analysis in the NDO group.

Still, the main strengths of this study are, first, the effort to control for sociodemographic and intellectual prowess variables, quite often disregarded in prospective studies; and second, the assessment of compliance, in a careful, quasi-quantitative way, and independently of dropout; and third, its potential clinical relevance.

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Conflict of interest

All the authors declare that they have no conflict of interest.

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S1. Supplementary materials
Treatment Characteristics

All participants followed the same treatment protocol, with the same therapist, and in the same facilities (AGRAJER). This treatment is similar to the one offered by other associations that make up the Regional Federation *Federación Andaluza de Asociaciones de Jugadores de Azar en Rehabilitación* (*FAJER*). The mean duration of the complete treatment program is approximately two years. The specific techniques used in the program are based on the cognitive-behavioral model.

The treatment protocol comprises 4 phases. In the first (1 session, *Pre-welcome*) the prospective patient has his/her first contact with the institution and a welcome session is scheduled. In the second phase (1 session, *Welcome*), two co-therapists (a rehabilitated gambler and a relative) welcome and encourage the patient to accept treatment. Sessions in the third phase (*self-help* and *mutual help*) are group-based, and comprise preliminary, start, and actual rehabilitation stages. Sessions in this stage are programmed on a weekly basis, hosted by rehabilitated gamblers and supervised by a professional therapist. Partially in parallel, a fourth stage (*individual psychotherapy*), is held by the AGRAJER clinical psychologist. Individual intervention has a psychoeducational theme, and is designed to assess the evolution of the patient in therapy in order to allow him/her to become more aware of the addictive process and its symptoms, to teach strategies to prevent relapse, to examine cognitive distortions in gambling, to strengthen self-esteem, social abilities, and assertiveness, to train him/her in anger management, self-control and problem-solving, and to promote rewarding activities. It generally takes one year for the patients to advance through these three stages, in dependence of goals fulfillment.

After this stage, abstinent patients who had not abandoned the group are discharged and start a final, follow-up stage. Patients in this stage meet once a month for an hour and a half. Patients can attend these meetings as long as they like to, as their objective is reinforcing abstinence and providing tools to manage risky situations that could lead to relapse.

In the present study, recruitment and the first assessment were carried out while patients were in the welcome phase or during the initial part of the self-help and mutual-help phase.