



## Short Communication

# Pathological gambling subtypes: A comparison of treatment-seeking and non-treatment-seeking samples from Brazil and Canada



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## ARTICLE INFO

Available online 12 March 2014

## Keywords:

Pathological gambling  
Gambling subtypes  
Personality  
Problem gambling

## ABSTRACT

**Background:** Pathological gambling (PG) is a heterogeneous disorder. The identification and characterization of PG subtypes could lead to tailored treatment approaches, which may, in turn, improve treatment outcomes.

**Objective:** To investigate PG subtypes based on personality traits across two different cultural and clinical settings. Consistent with the Pathways Model, we hypothesized the presence of three subtypes (behaviorally conditioned – BC, emotionally vulnerable – EV, and antisocial impulsivist – AI).

**Methods:** 140 PG adults from São Paulo, Brazil (SP sample) and 352 adults with PG ( $n = 214$ ) or sub-clinical PG ( $n = 138$ ) from Toronto, Canada (TO sample) completed the Temperament and Character Inventory (TCI). Latent-class analysis was used to investigate subtypes.

**Results:** A 2-class solution was the best model for the pooled SP and TO samples. Class 1 presented a normative personality profile and was composed exclusively of participants from Toronto (BC subtype). Class 2 was characterized by high novelty seeking, high harm avoidance, and low self-directedness, and included participants from both SP and TO (EV subtype). When sub-clinical PGs were excluded from the analysis, a single-class solution better characterized the SP and TO samples.

**Conclusions:** Our results suggest that PG severity, rather than community or clinical settings, may have an effect on PG subtypes. The generalizability of the results is limited by the demographic and clinical features of the selected samples. Future neurobiological studies may contribute to the categorization of subjects into PG subtypes based on different underlying biological pathways.

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## 1. Introduction

Several studies have proposed that the identification of pathological gambling (PG) subtypes may be an important factor in the development of more specific treatment strategies (Blaszczynski & Nower, 2002; Ledgerwood & Petry, 2010; Milosevic & Ledgerwood, 2010). Blaszczynski and Nower (2002) proposed “the pathways model” for the development of PG, which has been generally investigated in terms of three PG subtypes: (1) behaviorally conditioned (BC),

(2) emotionally vulnerable (EV), and (3) antisocial impulsivist (sic) (AI). Overall, studies have confirmed the pathways model subtypes; however, questions remain as to whether subtypes that have been identified in community samples can also be identified in clinical samples (Milosevic & Ledgerwood, 2010; Slutske, Caspi, Moffitt, & Poulton, 2005). This is a critically important issue as most individuals who develop PG never seek treatment. Further, studies to date have been performed in English-speaking countries and predominantly Anglo-Saxon cultures (i.e., U.S., Canada, and Australia), such that little information is available regarding PG subtypes in other language groups and cultures.

The Temperament and Character Inventory (TCI) (Cloninger, Svrakic, & Przybeck, 1993) has been extensively used in psychiatry research (Albayrak, Ekinci, & Caykoylu, 2012; Goekoop, De Winter, & Goekoop, 2011; Kampman & Poutanen, 2011; Sarisoy et al., 2012). To date, two published studies have identified four PG subtypes using the TCI, with the first study using a community-based sample (Turner,

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Jain, Spence, & Zangeneh, 2008) and the second study using a clinical sample (Alvarez-Moya et al., 2010).

Our objective was to investigate PG subtypes based on the TCI in two different countries (Brazil and Canada) from two different samples — a treatment-seeking PG sample recruited from a clinical setting and a sample of non-treatment-seeking PGs, recruited from a community setting. We hypothesized that we would identify three PG subtypes consistent with Blaszczynski and Nower (2002) in both settings. We expected the BC subtype to be characterized by normative TCI trait levels, whereas both the EV and AI subtypes would be characterized by high Novelty Seeking and low Self-Directedness which are correlated with impulsivity measures (Piero, 2010; Yoo et al., 2006). We expected that Harm Avoidance would differentiate the EV and AI subtypes because it has been significantly associated with mood and anxiety disorders (Cloninger, Zohar, Hirschmann, & Dahan, 2012). We also hypothesized that the EV and AI subtypes would be found more frequently in the treatment-seeking sample, whereas the BC subtype would be more frequent in the community sample.

## 2. Methods

### 2.1. Sample and assessments

Pathological gamblers seeking treatment at the University of São Paulo (Tavares, Gentil, Oliveira, & Tavares, 1999) (Brazil) between 2001 and 2004 were invited to participate in a PG study (da Silva Lobo et al., 2007). In the São Paulo sample (SP sample) individuals who met  $\geq 5$  DSM-IV diagnostic criteria for PG were included in the study. Psychiatric comorbidities were assessed through the Schedules for Clinical Assessment in Neuropsychiatry (SCAN) (Wing et al., 1990).

Adult gamblers from Toronto (Canada) were recruited from the general population between 2003 and 2006. Both sub-clinical pathological gamblers (1–4 DSM-IV criteria) and individuals meeting full DSM-IV diagnostic criteria for PG ( $\geq 5$  DSM-IV criteria) were included in the TO sample. Psychiatric comorbidities were assessed through the Structured Clinical Interview for DSM-IV-TR Axis I Disorders, non-patient version — SCID-I/NP (First, Spitzer, Gibbon, & Williams, 2002).

In both the SP and TO samples, gambling status was ascertained through a DSM-IV based interview (NODS) (N.O.R.C., 1999) and lifetime history of psychoses, bipolar disorder and neurological diseases were exclusion criteria.

The Temperament and Character Inventory — TCI (Cloninger et al., 1993; Fuentes, Tavares, Camargo, & Gorenstein, 2000) was used to assess personality characteristics in both samples. The TCI is composed of 4 temperament (Novelty Seeking — NS, Harm Avoidance — HA, Reward Dependence — RD, and Persistence — P) and 3 character scales (Self-Directedness — SD, Cooperativeness — C, and Self-Transcendence — ST).

### 2.2. Statistical analyses

Because the TO sample included sub-clinical pathological gamblers, we carried out analyses using all participants as well as only those meeting the DSM-IV criteria for PG (TO PG Only sample,  $n = 214$ ).

Socio-demographic data and TCI scores from the SP, TO and TO PG Only samples were analyzed using chi-squared tests, *t*-tests or ANCOVAs as appropriate. The LCA approach developed by Fraley and Raftery (2002, 2006) was used to investigate the presence of classes in each of the samples. Statistical analyses were performed using MPlus 6.0 (Muthén & Muthén, 1998–2010). The best-fit model was selected based primarily on the lower values of the Bayesian Information Criterion (BIC) statistic while taking into consideration other indices (AIC, adjusted-BIC, Lo–Mendell–Rubin test — LMRT, bootstrap likelihood ratio test — BLRT, and entropy), class sizes and convergence of the model (Nylund, Asparouhov, & Muthén, 2007). Sample origin was included as a covariate to determine whether the class solution differed across samples or whether the probability of membership in a particular

class differed across samples. In the event of more than one class, chi-square tests based on the log-likelihood difference associated with models determined whether classes differed in their mean scores on each TCI scale where a) the group means on a particular scale are assumed to be the same in each class vs. b) the mean scores are allowed to differ across classes.

## 3. Results

### 3.1. Socio-demographic characteristics and TCI scores

#### 3.1.1. SP $\times$ TO samples

Compared with the TO sample, the SP sample presented a higher proportion of females ( $\chi^2(df) = 8.4(1), p < .001$ ); and of individuals who were married or living with a partner ( $\chi^2(df) = 31(1), p < .001$ ), who were employed ( $\chi^2(df) = 17(3), p = .001$ ), and who presented higher PG severity (corrected for gender,  $F(df) = 151.5(1), p < .001, d = 1.3$ ). The TO sample presented a higher proportion of individuals who completed high school ( $\chi^2 = 5, df = 1, p = .02$ ).

The SP sample exhibited higher scores on NS ( $F(df) = 22.7(1), p < .001, d = 0.5$ ) and HA ( $F(df) = 26.8(1), p < .001, d = 0.3$ ), and lower scores on SD ( $F(df) = 19.4(1), p < .001, d = 0.4$ ) after controlling for gender and PG severity.

#### 3.1.2. SP $\times$ TO PG Only samples

Compared with the TO PG Only sample, the SP sample presented a higher proportion of females ( $\chi^2(df) = 19(1), p < .001$ ), and of individuals who were married or living with a partner ( $\chi^2(df) = 41(1), p < .001$ ), and who were employed ( $\chi^2(df) = 23(3), p < .001$ ). PG was also more severe in the SP sample (corrected for gender,  $F(df) = 46.8(1), p < .001, d = .7$ ).

Finally, the SP sample presented higher scores on NS ( $F(df) = 26.8(1), p < .001, d = .6$ ) and HA ( $F(df) = 7.8(1), p = .005, d = .6$ ), and lower scores on SD ( $F(df) = 17.1(1), p < .001, d = .4$ ) after controlling for gender and PG severity.

### 3.2. Psychiatric comorbidity and types of gambling

No psychiatric comorbidity diagnosis data was available for the TO sample but individuals with positive screenings on depression, anxiety and substance abuse as assessed by the SCID N/P were included in the study. No psychotic, bipolar, or neurological disorders were present.

In the SP sample 80% ( $n = 112$ ) of the subjects presented with tobacco dependence, 67% ( $n = 94$ ) presented with major depression, 12.9% ( $n = 18$ ) presented with alcohol dependence, 6.4% ( $n = 9$ ) presented with obsessive-compulsive disorder, and 5.7% ( $n = 8$ ) presented with panic disorder. The elevated rate of psychiatric comorbidity in the SP sample is consistent with rates found in other treatment-seeking (Crockford & el-Guebaly, 1998; Petry, Stinson, & Grant, 2005) and general population samples of PG (Lorains, Cowlshaw, & Thomas, 2011).

### 3.3. Latent class analyses

A series of solutions consisting of 1 to 5 classes were fit within each of the individual samples (SP, TO and TO PG Only). Our results indicate that no subtypes exist in any of the three individual samples (*results available upon request*).

#### 3.3.1. Pooled SP and TO samples

The “best-fitted” model was the 2-class solution (Table 1), according to BIC and LMRT statistics. Class 1 is composed 316 subjects from the TO sample. Class 2 consists of 176 subjects and is composed of the entire SP sample ( $n = 140, 79.5\%$ ) and a proportion of the TO sample ( $n = 36, 20.5\%$ ). Because sample origin and treatment-seeking status are

**Table 1**

Latent class analyses for the pooled São Paulo (SP) and Toronto (TO) samples and for the pooled SP and Toronto Pathological Gambling Only (TO PG Only) samples.

Number of classes	Log likelihood	AIC	BIC	Adjusted BIC	LMRT	BLRT	Class size	Entropy
<i>Pooled SP (n = 140) and TO samples (n = 352)</i>								
1 Class	−10,328	20,726	20,873	20,761.9	n/a	n/a	492	n/a
2 Classes	−10,248.8	20,585.6	20,770.3	20,630.6	$p < 0.001$	$p < 0.0001$	316/176	0.7
3 Classes	−10,231.9	20,569.8	20,792.3	20,624.1	$p = 0.43$	$p = 0.02$	200/118/174	0.6
4 Classes <sup>a</sup>	−10,212.9	20,549.9	20,810.2	29,613.4	$p = 0.33$	$p < 0.0001$	43/148/135/166	0.7
5 Classes <sup>a</sup>	−10,198.9	20,539.9	20,838	20,612.6	$p = 0.09$	$p = 0.17$	1/65/122/128/176	0.7
<i>Pooled SP (n = 140) and TO PG Only samples (n = 214)</i>								
1 Class	−7362.1	14,794.1	14,929.5	14,818.5	n/a	n/a	354	n/a
2 Classes	7313.6	14,715.1	14,885.4	14,745.8	$p = 0.21$	$p < 0.0001$	196/158	0.6
3 Classes <sup>a</sup>	−7295.5	14,697.4	14,902.5	14,734.4	$p < 0.001$	$p = 0.02$	1/197/156	0.8
4 Classes <sup>b</sup>	–	–	–	–	–	–	–	–
5 Classes <sup>b</sup>	–	–	–	–	–	–	–	–

AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion, LMRT = Lo–Mendell–Rubin test, BLRT = bootstrap likelihood ratio test.

<sup>a</sup> Classes presenting convergence and/or estimation problems.<sup>b</sup> Solutions for models with 4 and 5 classes could not be estimated for the pooled SP and TO PG only samples.

confounded in these samples, we cannot determine whether the classes are equally likely to occur in both samples.

As shown in Table 2, Class 1 exhibited lower NS and HA scores, and higher SD scores compared with Class 2. Class 1 exhibited normative mean scores (Cloninger et al., 1993) on all scales, suggesting that this class presents a more adaptive personality profile. Class 2 exhibited SD mean scores that are more than one standard-deviation below, and NS and HA mean scores that are approximately one standard-deviation above the upper limit of normative data (Cloninger et al., 1993). All other TCI scales on Class 2 are within the range of normative data.

Class 2 presents a higher proportion of females ( $\chi^2(df) = 8.2(1)$ ,  $p = .004$ ), and of individuals who were employed ( $\chi^2(df) = 11.3(3)$ ,  $p = .01$ ), who lived with a partner ( $\chi^2(df) = 17.5(1)$ ,  $p < .001$ ), and who did not complete high school ( $\chi^2(df) = 6.4(1)$ ,  $p = .01$ ). Class 1 presents lower PG severity compared to Class 2 (corrected for gender,  $F(df) = 168.1(1)$ ,  $p < .001$ ).

### 3.3.2. Pooled SP and TO PG Only samples

Table 1 presents the results for the LCA in the pooled SP and TO PG Only samples. Convergence problems were observed in solutions with 3–5 classes, which prevent us from using the BIC to interpret the results. Both of the LRTs suggest that the data is best described by a single-class solution.

## 4. Discussion

Consistent with our hypotheses, we found a BC subtype characterized by normative TCI trait levels (Class 1), and an EV subtype characterized by higher NS and HA and lower SD compared to normative TCI trait levels (Class 2). Contrary to our hypotheses, we did not find a class representative of the AI subtype. The fact that we did not find PG

subtypes when sub-clinical PG was excluded suggests that samples with a restricted range of PG symptomatology may not exhibit the same subtypes found in more varied samples. Indeed, a previous investigation supporting personality-based subtypes of PG similarly included participants with both PG as well as diagnostically subthreshold or non-problematic levels of gambling involvement (e.g., Vachon & Bagby, 2009).

Two previous studies have used the TCI for the characterization of PG subtypes (Alvarez-Moya et al., 2010; Turner et al., 2008). Turner et al.'s (2008) emotional vulnerability subtype, characterized by high impulsiveness and HA, and low SD is very similar to our Class 2. Alvarez-Moya et al.'s (2010) "disorganized and emotionally unstable" subtype presents high scores on NS, HA and ST and low scores on SD and C, which partially corresponds to our Class 2; whereas the "high functioning" subtype presents a well-adapted personality profile, similar to our Class 1.

Studies that characterized subtypes of PG using impulsivity scales have found a subtype characterized by emotional dysregulation and low impulsivity levels (Milosevic & Ledgerwood, 2010), while others have found an emotional dysregulation subtype presenting high levels of impulsivity and/or boredom proneness similar to our Class 2 (Alvarez-Moya et al., 2010; Blaszczynski, McConaghy, & Frankova, 1990; Graham & Lowenfeld, 1986; Lesieur, 2001; Turner et al., 2008; Vachon & Bagby, 2009). Together with our TCI data, the psychopathological profile of the SP sample indicates that Class 2 is indeed similar to the PG subtype characterized by high impulsivity and emotional dysregulation described by other studies in both community (Turner et al., 2008; Vachon & Bagby, 2009) and treatment-seeking samples (Blaszczynski et al., 1990; Graham & Lowenfeld, 1986; Lesieur, 2001).

Another commonly identified PG subtype is one characterized by higher levels of impulsivity and low levels of psychopathology (Alvarez-Moya et al., 2010; Bonnaire, Bungener, & Varescon, 2009; Gonzalez-Ibanez et al., 2003; Ledgerwood & Petry, 2006; Steel & Blaszczynski, 1996). Several issues could have contributed to the fact that we did not find this subtype in the samples we studied: a) axis I comorbidity was not available for the TO sample, precluding the ability to evaluate variability in clinical features; and b) subjects in the SP sample were very similar regarding educational level and socio-demographic status (da Silva Lobo et al., 2007) and thus the SP sample might have less variability compared to other treatment samples. These limitations, including the fact that we did not examine the influence of gender (due to insufficient power) in our models should be considered in the interpretation of our results.

Although legalized gambling in Canada and Brazil share important similarities, we cannot rule out the possibility of a confounding effect of culture on our results. Moreover, we cannot rule-out the possible effect of sample origin on inferences regarding the effect of treatment-seeking and non-treatment-seeking samples on PG subtypes. In order to address this issue, it would be necessary for both samples to have

**Table 2**

TCI Personality Scale Scores in the pooled Toronto (TO) and São Paulo (SP) samples according to class obtained through latent class analysis, chi-square tests of the difference in log-likelihood ratios associated with each class. Significant results highlighted in bold.

TCI scales	Class 1 (n = 316) mean ( $\pm SE$ )	Class 2 (n = 176) mean ( $\pm SE$ )	Log-likelihood $\chi^2$	p
<i>Temperament</i>				
Novelty Seeking (NS)	20.3 (0.6)	25.7 (0.8)	<b>99.3</b>	<b>&lt;0.0001</b>
Harm Avoidance (HA)	14.1 (0.6)	18.9(0.6)	<b>8.3</b>	<b>&lt;0.004</b>
Reward Dependence (RD)	14.0 (0.3)	13.6 (0.4)	0.3	0.6
Persistence (P)	4.9 (0.1)	4.3 (0.2)	3.3	0.1
<i>Character</i>				
Self-Directedness (SD)	28.0 (0.8)	19.5 (0.9)	<b>19.5</b>	<b>0.0001</b>
Cooperativeness (C)	28.8 (0.5)	28.5 (0.7)	0.1	0.8
Self-Transcendence (ST)	16.9 (0.4)	17.5 (0.6)	0.4	0.5

the same treatment-seeking status — a challenging issue as very few PG subjects seek treatment.

Nevertheless, the fact that no subtypes were found when only pathological gamblers were analyzed suggests that PG severity, rather than community or clinical setting, may have an effect on PG subtypes, an interpretation partially corroborated by a recent study (Knezevic & Ledgerwood, 2012).

Replication in large samples and additional clinical and community settings can further clarify these issues, and enhance the successful execution of neurobiological and genetic investigations of PG through the identification of more phenotypically homogenous PG subtypes (Lobo & Kennedy, 2009).

#### Role of Funding Sources

Contributors Study concept and design: Daniela Lobo, Hermano Tavares, James Kennedy Acquisition of data: Brazil sample was collected by Drs. Lobo, Martins and Tavares under the supervision of Dr. Vallada. The Toronto sample was collected by Dr. Kennedy.

#### Contributors

Analysis and interpretation of data: Daniela Lobo, Lena Quilty, Michael Bagby Critical revision of the manuscript for important intellectual content: Drs. Daniela Lobo, Lena Quilty, Silvia Martins, Homero Vallada, Hermano Tavares, Michael Bagby and James Kennedy.

#### Conflict of interest

The authors declare that they have no conflicts of interest.

#### Acknowledgments

We would like to thank Prof. Valentim Gentil for revising previous versions of this manuscript and Ms. Tamara Arenovich for reviewing the statistical analyses. We would also like to acknowledge the Fundação de Amparo a Pesquisa do Estado de São Paulo (FAPESP) (02/02653-7 and 02/00009-3) and the Ontario Problem Gambling Research Centre (OPGRC) (2277) for providing the funding for this research.

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