An Exploratory Study in Gambling Recovery Communities: A Comparison Between "Pure" and Substance-Abusing Gamblers

Alessandro Quaglieri,[1] Emanuela Mari,[1] Pierluigi Cordellieri,[1] Elena Paoli,[2] Francesca Dimarco,[3] Mario Postiglione,[3] Giampaolo Nicolasi,[4] Tania Fontanella,[4] Umberto Guidoni,[5] Sandro Vedovi,[5] & Anna Maria Giannini[1]

[1] Department of Psychology, Sapienza University of Rome, Rome, Italy
[2] Department of Dynamic and Clinical Psychology and Health Studies, Sapienza University of Rome, Rome, Italy
[3] San Patrignano, Coriano, Italy
[4] Comunità Incontro, Amelia, Italy
[5] Fondazione ANIA, Roma, Italy

Abstract

Most of the available literature has shown that gambling disorder (GD) is often associated with several psychiatric conditions. Comorbidities with mood disorders, impulsiveness, personality traits, and impairments in cognitive function have also been frequently investigated. However, it is currently uncommon to study this disorder in individuals without comorbid substance abuse; therefore, the primary aim of our study was to compare the psychological profile of individuals with GD with and without substance use disorder. A total of 60 participants (100% male), including 20 individuals with GD, 20 substance-dependent gamblers (SDGs), and 20 healthy controls (HCs), were assessed with several clinical measures to investigate impulsivity, hostility, mood, and personality traits, as well as with cognitive tasks (i.e., decision-making tasks). Our results showed differences in both experimental groups compared with the HC group in mood disorders, impulsivity, and hostility traits. The "pure" GD group differed from the SDG group only in characteristics related to mood disorders (e.g., State-Trait Anxiety Inventory-Y2, Beck Depression Inventory-II, and assault dimension), whereas greater impairment in decision-making processes related to risky choices was shown in the SDG group. This study suggests the importance of studying pure GD to clarify the underlying mechanisms without the neurotoxic effects of the substances. This could provide an important contribution to the treatment and understanding of this complex disorder.

Keywords: gambling disorder, substance use disorder, comorbidity, behavioural addiction, pathological gambling, personality traits, poly-substance abuser, substance abuse

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Introduction

Several studies have reported a high comorbidity between gambling disorder (GD) and a wide range of psychiatric disorders, such as depression, anxiety, and personality disorders (APA, 2014; Lorains et al., 2011), as well as with substance use disorders (SUDs; Petry, 2005; Rash et al., 2016). The risk of developing comorbid disorders seems to be linked with the severity of gambling behaviour (Parhami et al., 2014; Rash et al., 2016). Taken together, these results suggest a two-way relationship by identifying comorbidity as a risk factor with respect to both the onset and maintenance of GD development (Chou & Afifi, 2011; Kessler et al., 2008). Many studies have suggested that several trait-specific behaviours are linked to GD (Edgerton et al., 2015; Sanscartier et al., 2019), such as sensation seeking, depression and anxiety, substance abuse, delinquency, impulsivity, and lack of effective coping strategies, which also seem to be related to biological, psychosocial, and demographic factors (Blaszczynski & Nower, 2002; Chinneck et al., 2016; Sanscartier et al., 2019). Consistent with many epidemiological studies, the prevalence of both GD and SUD appears to be higher in males (Blanco et al., 2006; Edgerton et al., 2015; LaBrie et al., 2003), in young people, and in those with a low socioeconomic and single marital status (Kessler et al. 2008; Rash et al., 2016; Welte et al. 2001). In addition, GD and SUD seem to share many main symptoms, such as craving (Tavares et al., 2005), tolerance (Griffiths, 1993), frequent relapses (Ledgerwood & Petry, 2006), withdrawal symptoms, and genetic and neurobiological mechanisms involving the dopamine system (Verdejo-García et al., 2008). The co-occurrence of GD with other behavioural and psychological disorders may exacerbate or be exacerbated by GD (Griffiths et al., 2010), increasing the likelihood of drug use to 4 times that of individuals who do not gamble (for a review, see Heinz et al., 2019). GD has been shown to have a high prevalence of comorbidity with alcohol use disorder (73.2%), other SUDs (38.1%), and nicotine dependence and/or abuse (60.4%; Petry et al., 2005). Individuals with GD may use drugs when they stop gambling; more often, drugs may serve as a gambling surrogate to sustain the feeling of gambling euphoria or ameliorate the dysphoria developed during gambling withdrawal (Heinz et al., 2019).

Several studies have suggested that state and trait impulsivity is higher in those with GD than in healthy controls (HCs; Dannon et al., 2010; Glicksohn & Zilberman, 2010; Rogier, Colombi, & Velotti, 2020); however, the heterogeneity within GD samples and the available assessment instruments are highly controversial

(Conversano et al., 2012; Dannon et al., 2010). Furthermore, it seems that impulsivity is largely implicated in the development and maintenance of both GD and SUD, resulting from impaired inhibitory control and self-regulation (Goldstein & Volkow, 2002; Marazziti et al., 2014; Petry, 2001) and suggesting difficulty in inhibiting stimulus-induced automatic responses and a tendency to choose riskier activities (Clark et al., 2013).

Individuals with GD have been observed to perform worse than HCs under both risky and ambiguous decision-making conditions; however, ambiguous gambling conditions seem to simulate more life-like gambling activities, resulting in a greater sensitivity in predicting gambling severity (Brevers et al., 2012). Furthermore, it is well-known that GD is related to personality characteristics (Sáez-Abad & Bertolín-Guillén, 2008; Rogier, Beomonte Zobel, & Velotti, 2020) and mood disorders (Kessler et al., 2008; Petry et al., 2005). Studies have suggested a high prevalence of mood disorders (37.9%), anxiety disorders (37.4%; Parhami et al., 2014), and both verbal and physical aggression-hostility behaviours (Roberts et al., 2016), especially towards objects (e.g., slot machines; Parke & Griffiths, 2004).

High levels of risk taking, depression, anxiety, sensation seeking, and hostility seem to be in accordance with the pathway model, which describes a subtype of gambler as the "emotionally vulnerable problem gambler" (Blaszczynski & Nower, 2002). However, it would be necessary to clarify these comorbidities from both a clinical and a scientific perspective and to investigate them as either a transient state in response to a particular event or as a trait that refers to a stable personality trait. The current literature should be clarified as to whether these comorbidities were present premorbidly or whether they represent downstream phenotypic effects of psychological changes due to addictive behaviours (Rash et al., 2016). Most of the currently available literature has analysed different clinical variables in GD, often in samples with at least one other comorbid psychiatric disorder; nevertheless, to our knowledge, few studies have compared these variables in GD with and without SUD (Mann et al. 2017; Suomi et al., 2014; Zois et al. 2014).

Because of the paucity of the currently available literature, the first aim of our study was to investigate the presence of factors exclusively found in individuals with "pure" GD by investigating different clinical variables (e.g., impulsivity, hostility-aggression, anxiety, depression, personality traits, and performance in cognitive tasks), with a focus on whether these differences play a role in specific vulnerabilities to GD by configuring a specific subtype of gambler. The second aim was to investigate whether SUD comorbidity can only exacerbate a pre-existing condition or whether it can underlie specific motivational and precipitating factors. This analysis could provide important information about the development of the cycle of dependence from cognitive, clinical, and treatment perspectives that are independent of any changes induced by the harmful biochemical effects caused by neurotoxic substances.

Method

Participants

Individuals with GD and SUD were recruited from two different recovery communities. Those with GD were recruited from the San Patrignano residential recovery community in Coriano (Italy), which focuses on the treatment of individuals with pure GD (i.e., without comorbid substance abuse), whereas substance-dependent gamblers (SDGs) were recruited from the Incontro residential recovery community in Amelia (Italy), which includes individuals with GD and SUD. Both communities offer a residential treatment program that consists of 24/7 monitoring. Convenience sampling was used to recruit HCs by matching them to the other groups with respect to demographic characteristics. HCs were selected by using the official site of the University of Rome "Sapienza." No control participant met the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; APA, 2013) criteria for current GD or any drug dependence. The diagnoses of GD and SUD in the SDGs were certified both by the Italian National Health Service and by a psychiatrist in the residential community according to *DSM-5* criteria.

Our recruitment of the GD and SDG groups was based on specific exclusion criteria, including the presence of psychotic spectrum disorders, progressive neurodegenerative disorders, and neurological diseases, as well as the inability to provide informed consent or complete the required assessment procedures. In addition, to be eligible for our study, participants in both groups (i.e., GD and SDG) had to report a score equal to or higher than 5 on the South Oaks Gambling Screen (SOGS; Guerreschi & Gander, 2000; Lesieur & Blume, 1987), and those in the SDG group had to have a score equal to or higher than 3 on the Drug Abuse Screening Test-10 (DAST-10; Skinner, 1982; Figure 1) or a score equal to or higher than 8 on the Alcohol Use Disorder Identification Test (AUDIT; Piccinelli et al., 1997; Saunders et al., 1987). Both experimental groups received psychoeducational and psychotherapeutic interventions for gambling addiction. Based on the above inclusion and exclusion criteria, the final sample consisted of 60 participants, including 20 individuals with GD, 20 SDGs, and 20 HCs. All participants were male, and the age in the total sample ranged from 19 to 58 years, with a mean of 35.8 years (see Table 1).

Procedure

During the first meeting, the study was briefly presented and, following the individuals' expression of willingness to participate, the aims, objectives, and anonymity of the procedure were clarified. There was no compensation for participating in the study. After providing informed consent, all participants were assessed for addiction characteristics and addictive behaviours, impulsivity, hostility-aggression, mood disorders, personality traits, and cognitive functions (i.e., decision making).

Figure 1

Summary of past substance use patterns in substance dependent gamblers (SDG).
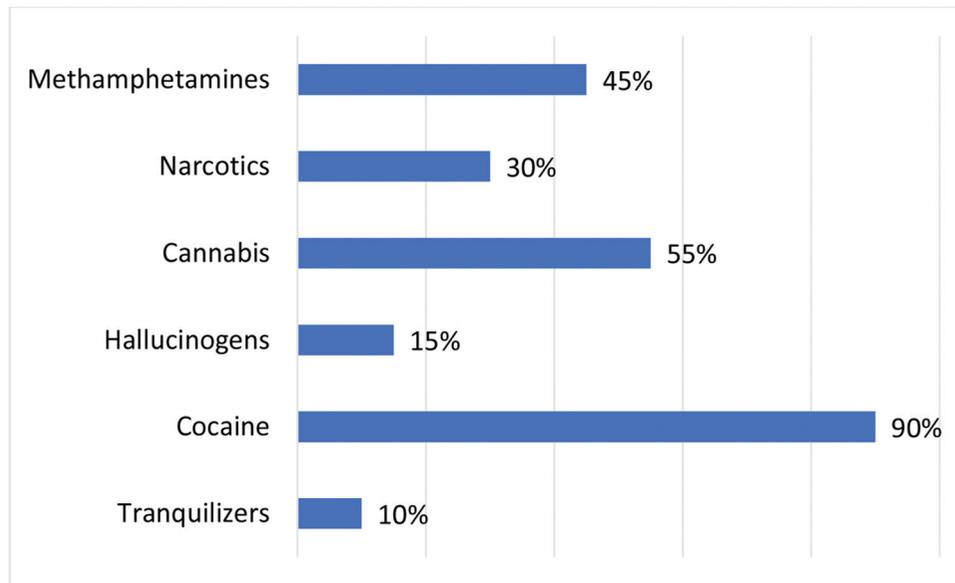
Table 1

Descriptive Statistics of Study (N = 60, All Male)

Group	n	M	SD	Min	Max
Age					
HC	20	34.95	12.80	19	53
GD	20	37.50	12.03	22	58
SDG	20	35.10	11.88	21	58
Age of education					
HC	20	12.55	2.16	8	16
GD	20	11.40	2.64	8	16
SDG	20	10.65	2.80	8	16
SOGS score					
HC	20	0.35	0.59	0	2
GD	20	13.80	3.65	6	20
SDG	20	10.95	3.97	5	16
DAST-10 score					
SDG	20	6.85	1.87	3	10
AUDIT score					
SDG	20	13.7	12.91	0	36

Note. Min = minimum; Max = maximum; HC = healthy control; GD = "pure" gambling disorder; SDG = substance-dependent gambler; SOGS = South Oaks Gambling Screen; DAST-10 = Drug Abuse Screening Test-10; AUDIT = Alcohol Use Disorder Identification Test.

All study procedures were carried out in accordance with the Declaration of Helsinki. The Institutional Review Board of the University of Rome "Sapienza" (protocol number 221/2020) approved the procedures and accompanying consent forms.

Measures

South Oaks Gambling Screen

The SOGS (Leisure & Blume, 1987), a self-reported 20-item questionnaire, is one of the most widely used measures to investigate gambling behaviour. It was developed on the basis of the diagnostic criteria of the third edition of the *DSM* for pathological gambling. Individuals with a score of 5 or higher are probable pathological gamblers (5 was the cut-off score adopted in the current study). The Italian version of the SOGS (Guerreschi & Gander, 2000) was reported to have a Cronbach's alpha of .94.

Drug Abuse Screening Test

The DAST (Skinner, 1982) is a screening questionnaire developed to identify drug-related problems. A summary score reflects the number of drug abuses endorsed. In the present study, we used the DAST-10, a short-form version of the DAST-28 original version. It is based on 10 questions concerning information about involvement with drugs, excluding alcohol and tobacco. It has demonstrated a good internal consistency with a Cronbach's alpha of .86.

Alcohol Use Disorder Identification Test

The AUDIT (Saunders et al., 1993) is a quick screening test developed by the World Health Organization to identify at-risk drinkers and related alcohol problems. In Italy, it has been validated by Piccinelli et al. (1997). A cut-off score of 5 was associated with sensitivity of 0.84, a specificity of 0.90, and a predictive value of 0.60 (Piccinelli et al., 1997).

State-Trait Anxiety Inventory

The State-Trait Anxiety Inventory-Y (STAI-Y; Spielberg et al., 1983) is a 40-item self-reported questionnaire designed to assess and differentiate anxiety as a state (i.e., transient emotional state) and anxiety as a trait (i.e., stable tendency to respond in an anxious way), divided into two 20-item subscales. The STAI-Y is widely used in research and clinical practice and has been validated in the Italian context by Pedrabissi and Santinello (1989). The reliability coefficients have been reported to range from .91 to .95 for the state anxiety subscale and from .85 to .90 for the trait anxiety subscale.

Beck Depression Inventory

The Beck Depression Inventory-II (BDI-II; Beck et al., 1996) is one of the most widely used questionnaires to measure the severity of depressive symptoms: sadness, pessimism, past failure, loss of pleasure, guilty feelings, punishment feelings, self-dislike, self-criticalness, suicidal ideation or wishes, crying, agitation, loss of interest, indecisiveness, feelings of worthlessness, loss of energy, change in sleeping patterns, irritability, change in appetite, concentration difficulty, tiredness or fatigue, and loss

of interest in sex. The questionnaire is composed of 21 items with a scale from 0 to 3 points and a score that reflects the patient's feelings in the previous 2 weeks. Higher scores reflect higher levels of depression. The Italian validation of the scale used in this study, by Sica and Ghisi (2007), showed excellent psychometric properties with an internal consistency of .87 in community patients.

Barratt Impulsiveness Scale-11

The Barratt Impulsiveness Scale-11 (BIS-11; Patton et al., 1995) is a questionnaire developed to assess the personality and behavioural construct of impulsiveness. The BIS-11 is composed of 30 items describing common impulsive or non-impulsive behaviours. The factor structure revealed three second-order factors and six oblique first-order factors. The Italian validation of the scale used in this study, by Fossati et al. (2001), showed a good fit with the original factor structure and concurrent validity with a Cronbach's alpha of .79.

Buss Durkee Hostility Inventory

The Buss Durkee Hostility Inventory (BDHI; Buss & Durkee, 1957) is a self-administered questionnaire containing 75 dichotomous items. It was developed to measure different aspects of hostility and guilt. The dimensions are assault, indirect hostility, verbal hostility, irritability, negativism, suspicious, resentment, and guilt. The revised and validated Italian version by Castrogiovanni et al. (1993) was used in this study. The reliability coefficients have been reported to range from .64 to .78 for the subscales and .82 for the total score.

Temperament and Character Inventory Revised

The Temperament and Character Inventory Revised (Cloninger et al., 1993) is a 240-item inventory scored on a 5-point Likert scale that was developed to investigate seven dimensions of personality: four dimensions of temperament, including novelty seeking (NS), harm avoidance (HA), reward dependence (RD), and persistence (PS), and three dimensions for character traits, including self-directedness (SD), cooperativeness (C), and self-transcendence (ST). The Italian validation by Fossati et al. (2007) that was used in this study showed adequate Cronbach's alpha values ranging from .79 to .91 and acceptable test-retest reliability coefficients.

Iowa Gambling Task

The Iowa Gambling Task (IGT; Bechara et al., 1997) is a psychological task used to measure decision-making processes in ambiguous conditions. The IGT was developed to investigate cognitive symptoms that occur after prefrontal lesions (e.g., ventromedial and orbitofrontal cortex); patients with those lesions showed more risky choice patterns (Bechara et al., 1994). The task consists of a card game in which participants select a card from one of four available decks for 100 trials. Each deck is associated with a gain, and some decks are associated with a penalty.

For example, selecting a card from deck A or B yields 100€, and selecting a card from deck C or D yields 50€. The penalty is higher in card decks A or B and lower in decks C or D. Therefore, decks A and B are "disadvantageous," with the highest risk and loss in the long term. Decks C and D are "advantageous/safe" and return a gain or no loss in the long term. Participants start with 2,000€ virtual money and are instructed to maximize their profit. The quantitative outcome consists of the net score computed for the four blocks of 25 cards each (1–25, 26–50, and so on). This outcome was computed to quantify the progressive change in selection across the task. An IGT net score of < 0 indicates more frequent selection from disadvantageous decks.

Game of Dice Task

The Game of Dice Task (GDT; Brand et al., 2005) is a psychological task used to measure decision-making processes and risk taking. The GDT is similar to the IGT and differs by its explicit probability of gaining or losing. Participants start with 1,000€ and are instructed to maximize their winnings. The probability of winning or losing is associated with each of 18 trials throughout the GDT. Participants are instructed to choose between one dice or two-, three-, and four-dice combinations. The options with a single number yield a 1,000€ gain or loss (probability of winning is 1:6), two-dice combinations yield a 500€ gain or loss (probability is 2:6), three-dice combinations yield a 200€ gain or loss (probability is 3:6), and four-dice combinations yield a 100€ gain or loss (probability is 4:6). The choices of one dice or two-dice combinations can be considered risky decisions, whereas the choices of three- or four-dice combinations are relatively safe decisions.

Data Analysis

The participants were divided into three groups and compared across clinical and cognitive measures. First, we tested the internal consistency of the instruments by means of Cronbach's alphas, the results showing high internal consistency with an alpha ranging from .842 to .946. Differences between groups were examined by using one-way analysis of variance (ANOVA). We performed post hoc analyses by using the Bonferroni correction for alpha inflation due to multiple testing. Group differences in cognitive tasks were examined with a repeated-measures general linear model procedure with outcomes from the IGT and a one-way ANOVA with outcomes from the GDT. Statistical significance was defined as $p < .05$. The distributions of all data were verified for normality. Statistical tests were conducted with IBM SPSS software (Version 25).

Results

Comparing All Groups on Clinical Variables

To explore differences between groups in relation to demographic variables, we performed a one-way ANOVA. Statistical analyses showed that the groups did not differ in relation to education levels and age (see Table 2). A one-way ANOVA was

Table 2
One-Way ANOVA and Post Hoc Comparisons in Clinical Variables

Clinical variables	N	df	F	p	η_p^2	Multiple comparisons	Mean difference	p
Age	60	2, 59	.273	.762	-	-	-	-
Education	60	2, 59	2.81	.068	-	-	-	-
SOGS score	60	2, 59	102.49	.000	.776	HC vs. GD	-13.45	.000***
						HC vs. SDG	-10.60	.000***
						GD vs. SDG	2.85	.017*
BIS-11 Overall	60	2, 59	17.73	.000	.375	HC vs. GD	-17.65	.000***
						HC vs. SDG	-15.65	.000***
BIS-11 ATT	60	2, 59	2.70	.075	-	-	-	-
BIS-11 Attention	60	2, 59	2.96	.060	-	-	-	-
BIS-11 Cognitive instability	60	2, 59	.642	.053	-	-	-	-
BIS-11 MOT	60	2, 59	14.03	.000	.322	HC vs. GD	-7.45	.000***
						HC vs. SDG	-6.75	.000***
BIS-11 Motor	60	2, 59	15.06	.000	.337	HC vs. GD	-6.50	.000***
						HC vs. SDG	-6.40	.000***
BIS-11 Perseverance	60	2, 59	1.14	.032	-	-	-	-
BIS-11 NPL	60	2, 59	19.71	.000	.400	HC vs. GD	-8.10	.000***
						HC vs. SDG	-6.90	.000***
BIS-11 Self-control	60	2, 59	10.43	.000	.261	HC vs. GD	-4.60	.000***
						HC vs. SDG	-3.85	.002**
BIS-11 Cognitive complexity	60	2, 59	17.72	.000	.375	HC vs. GD	-3.50	.000***
						HC vs. SDG	-3.05	.000***
BDHI-ASS	60	2, 59	5.00	.010	.144	HC vs. SDG	-1.55	.019*
						GD vs. SDG	-1.45	.032*
BDHI-IHO	60	2, 59	1.20	.307	-	-	-	-
BDHI-IRR	60	2, 59	4.72	.013	.039	HC vs. GD	-1.85	.027*
						HC vs. SDG	-1.80	.033*
BDHI-NEG	60	2, 59	1.19	.311	-	-	-	-

Table 2 Continued.

Clinical variables	N	df	F	p	η_p^2	Multiple comparisons	Mean difference	p
BDHI-RES	60	2, 59	7.01	.002	.192	HC vs. GD	-1.60	.005**
						HC vs. SDG	-1.55	.007**
BDHI-SUS	60	2, 59	.278	.758	-	-	-	-
BDHI-VHO	60	2, 59	1.69	.193	-	-	-	-
BDHI-GUI	60	2, 59	13.54	.000	.314	HC vs. GD	-2.65	.000***
						HC vs. SDG	-2.85	.000***
BDHI-AGG	60	2, 59	6.77	.002	.186	HC vs. GD	-4.10	.007**
						HC vs. SDG	-4.10	.007**
BDHI-HOS	60	2, 59	3.68	.031	.110	HC vs. SDG	-5.11	.040*
STAI-Y1	60	2, 59	4.31	.018	.127	HC vs. GD	-18.90	.019*
STAI-Y2	60	2, 59	8.97	.000	.233	HC vs. GD	-26.25	.000***
						GD vs. SDG	16.00	.039*
BDI-II	60	2, 59	7.22	.002	.196	HC vs. GD	-11.15	.001**

Note. ANOVA = analysis of variance; HC = healthy control; GD = "pure" gambling disorder; SDG = substance-dependent gambler; SOGS = South Oaks Gambling Screen; BIS-11 ATT = Barratt Impulsiveness Scale-11 - Attentional Impulsivity; BIS-11 MOT = Barratt Impulsiveness Scale-11 Motor Impulsivity; BIS-11 NPL = Barratt Impulsiveness Scale-11 - Non-Planning Impulsivity; BDHI-ASS = Buss-Durkee Hostility Inventory - Assault; BDHI-IHO = Buss-Durkee Hostility Inventory - Indirect Hostility; BDHI-IRR = Buss-Durkee Hostility Inventory - Irritability; BDHI-NEG = Buss-Durkee Hostility Inventory - Negativism; BDHI-RES = Buss-Durkee Hostility Inventory - Resentment; BDHI-SUS = Buss-Durkee Hostility Inventory - Suspicion; BDHI-VHO = Buss-Durkee Hostility Inventory - Verbal Hostility; BDHI-GUI = Buss-Durkee Hostility Inventory - Guilty; BDHI-AGG = Buss-Durkee Hostility Inventory - Aggression index; BDHI-HOS = Buss-Durkee Hostility Inventory - Hostility index; STAI-Y1 = State Anxiety Inventory-Y1; STAI-Y2 = Trait Anxiety Inventory-Y2; BDI-II = Beck Depression Inventory-II.

*p < .05. **p < .01. ***p < .001.

conducted to compare the three groups regarding clinical variables (see Table 2). Statistically significant results emerged on the SOGS, in which both experimental groups differed from the HC group, $F(2, 59) = 102.49$, $p < .001$, $\eta_p^2 = .776$; however, the post hoc comparisons with Bonferroni correction revealed a statistically significant difference between experimental groups, with the GD group scoring higher than the SDG group on the SOGS. Regarding the BIS-11, we analysed both first- and second-order factors and found statistically significant differences between groups on the overall BIS-11, $F(2, 59) = 17.73$, $p < .001$, $\eta_p^2 = .375$, and on the second-order factors motor impulsivity, $F(2, 59) = 14.03$, $p < .001$, $\eta_p^2 = .322$, and non-planning impulsivity, $F(2, 59) = 19.71$, $p < .001$, $\eta_p^2 = .400$. Post hoc comparisons of both first- and second-order factors are reported in Table 2. The results showed statistically significant differences between the HC and both experimental groups, in which the HCs reported lower scores on each subscale of the BIS-11.

There were statistically significant differences in the four subscales of the Buss Durkee Hostility Inventory: assault, $F(2, 59) = 5.00$, $p < .05$, $\eta_p^2 = .144$; irritability, $F(2, 59) = 4.72$, $p < .05$, $\eta_p^2 = .039$; resentment, $F(2, 59) = 7.01$, $p < .05$, $\eta_p^2 = .192$; and guilty, $F(2, 59) = 13.54$, $p < .001$, $\eta_p^2 = .314$. The SDG group had higher scores than did the HC and GD groups on direct aggression, and the HC group reported significantly lower scores than did the GD and SDG groups on the irritability, resentment, and guilty subscales; however, no differences were found between the experimental groups (see Table 2). Regarding the measures used to assess mood disorders, the STAI-Y1, $F(2, 59) = 4.31$, $p < .05$, $\eta_p^2 = .127$; STAI-Y2, $F(2, 59) = 8.97$, $p < .001$, $\eta_p^2 = .233$; and BDI-II, $F(2, 59) = 7.22$, $p < .05$, $\eta_p^2 = .196$, scores were significantly different. Regarding the STAI-Y1, the GD group had higher scores than did the HC group but no difference with respect to the SDG group; however, on the STAI-Y2, the GD group showed statistically significant differences compared with the HC and SDG groups. Finally, there was a statistically significant difference in BDI-II scores between the GD and HC groups (see Table 2).

Personality Traits

A one-way between-participant ANOVA was conducted to investigate group differences in personality traits, including temperaments and character traits, and scores on each subscale were calculated for each of the seven dimensions. Concerning temperaments, there were statistically significant differences in the NS dimension, $F(2, 59) = 3.92$, $p < .05$, $\eta_p^2 = .117$; the NS2 subscale, $F(2, 59) = 7.32$, $p < .001$, $\eta_p^2 = .198$; the HA1 subscale, $F(2, 59) = 8.11$, $p < .001$, $\eta_p^2 = .215$; the RD2 subscale, $F(2, 59) = 3.62$, $p < .05$, $\eta_p^2 = .109$; and the PS4 subscale, $F(2, 59) = 4.05$, $p < .05$, $\eta_p^2 = .120$. Post hoc comparisons with Bonferroni correction (see Table 3) revealed that the GD group had higher scores on the NS dimension than did the HC group; the GD group also had higher scores on the NS2 subscale than did the HC and SDG groups. Regarding the HA1 subscale, the GD group had higher scores than did the HC group, whereas no differences were reported between the experimental groups. Lastly, the HC group had higher scores than did the SDG

Table 3

One-Way ANOVA and Post Hoc Comparisons in Personality Variables

Personality variables	N	df	F	p	η_p^2	Multiple comparisons	Mean difference	p
NS	60	2, 59	3.92	.025	.117	HC vs. GD	-11.45	.027*
NS1	60	2, 59	2.12	.128		-	-	-
NS2	60	2, 59	7.32	.001	.198	HC vs. GD	-6.35	.004**
						HC vs. SDG	-6.20	.005**
NS3	60	2, 59	2.30	.109		-	-	-
NS4	60	2, 59	1.28	.284		-	-	-
HA	60	2, 59	2.53	.088		-	-	-
HA1	60	2, 59	8.11	.001	.215	HC vs. GD	-8.15	.001**
						HC vs. SDG	-6.00	.018*
HA2	60	2, 59	.559	.575		-	-	-
HA3	60	2, 59	.211	.810		-	-	-
HA4	60	2, 59	2.63	.080		-	-	-
RD	60	2, 59	1.91	.156		-	-	-
RD1	60	2, 59	.228	.797		-	-	-
RD2	60	2, 59	3.62	.033	.109	HC vs. SDG	6.15	.029*
RD3	60	2, 59	.502	.608		-	-	-
RD4	60	2, 59	1.05	.355		-	-	-
PS	60	2, 59	2.62	.081		-	-	-
PS1	60	2, 59	.669	.051		-	-	-
PS2	60	2, 59	2.58	.084		-	-	-
PS3	60	2, 59	1.79	.176		-	-	-
PS4	60	2, 59	4.05	.023	.120	HC vs. GD	5.40	.049*
SD	60	2, 59	10.76	.000	.267	HC vs. GD	29.60	.000***
						HC vs. SDG	25.25	.002**
SD1	60	2, 59	5.16	.009	.148	HC vs. GD	6.35	.008**
SD2	60	2, 59	5.05	.010	.146	HC vs. SDG	4.60	.012*
SD3	60	2, 59	7.23	.002	.196	HC vs. GD	4.40	.005**
						HC vs. SDG	4.30	.006**
SD4	60	2, 59	.164	.849		-	-	-
SD5	60	2, 59	18.44	.000	.384	HC vs. GD	13.95	.000***
						HC vs. SDG	10.70	.000***
C	60	2, 59	3.09	.053		-	-	-
C1	60	2, 59	1.01	.369		-	-	-
C2	60	2, 59	4.95	.010	.143	HC vs. GD	3.00	.023*
						HC vs. SDG	2.90	.029*
C3	60	2, 59	3.71	.030	.111	HC vs. GD	3.75	.026*
C4	60	2, 59	.481	.621		-	-	-
C5	60	2, 59	1.93	.153		-	-	-
ST	60	2, 59	.001	.999		-	-	-
ST1	60	2, 59	.716	.493		-	-	-

Table 3 Continued.

Personality variables	N	df	F	p	η_p^2	Multiple comparisons	Mean difference	p
ST2	60	2, 59	.436	.649		-	-	-
ST3	60	2, 59	5.78	.005	.163	HC vs. SDG	-6.25	.004**

Note. ANOVA = analysis of variance; NS = novelty seeking; NS1 = exploratory excitability; NS2 = impulsiveness; NS3 = extravagance; NS4 = disorderliness; HA = harm avoidance; HA1 = anticipatory worry; HA2 = fear of uncertainty; HA3 = shyness; HA4 = fatigability; RD = reward dependence; RD1 = sentimentality; RD2 = openness to warm communication; RD3 = attachment; RD4 = dependence; PS = persistence; PS1 = eagerness of effort; PS2 = work hardened; PS3 = ambitious; PS4 = perfectionist; SD = self-directedness; SD1 = responsibility; SD2 = purposeful; SD3 = resourcefulness; SD4 = self-acceptance; SD5 = enlightened second nature; C = cooperativeness; C1 = social acceptance; C2 = empathy; C3 = helpfulness; C4 = compassion; C5 = pure-hearted conscience; ST = self-transcendence; ST1 = self-forgetful; ST2 = transpersonal identification; ST3 = spiritual acceptance; HC = healthy control; GD = "pure" gambling disorder; SDG = substance-dependent gambler.
*$p < .05$. **$p < .01$. ***$p < .001$.

group on the RD2 subscale and higher scores than did the GD group on the PS4 subscale (see Table 3).

The results regarding character traits showed statistically significant differences in the overall SD dimension, $F(2, 59) = 10.76$, $p < .001$, $\eta_p^2 = .267$, and the subscales SD1, $F(2, 59) = 5.16$, $p < .05$, $\eta_p^2 = .148$; SD2, $F(2, 59) = 5.05$, $p < .05$, $\eta_p^2 = .146$; SD3, $F(2, 59) = 7.23$, $p < .05$, $\eta_p^2 = .196$; SD5, $F(2, 59) = 18.44$, $p < .001$, $\eta_p^2 = .384$; C2, $F(2, 59) = 4.95$, $p < .05$, $\eta_p^2 = .143$; C3, $F(2, 59) = 3.71$, $p < .05$, $\eta_p^2 = .111$; and ST3, $F(2, 59) = 5.78$, $p < .05$, $\eta_p^2 = .163$. Post hoc comparisons revealed that the HC group had higher scores on each of these subscales than did the experimental groups, with the exception of the ST3 subscale, on which the SDG group had higher scores than did the HC group (see Table 3).

Decision-Making Performance on the IGT and GDT

All variables were examined for missing data and distribution normality. In the groups and in the whole sample, we found no association with age or education as a covariate in the analysis of the IGT and GDT variables. There was no statistically significant main effect of the IGT net score, $F(2, 138) = .869$, $p = .458$ (shown in Figure 2). Regarding the GDT, which we examined by using one-way ANOVA, there were statistically significant differences in the GDT total score, $F(2, 59) = 5.07$, $p < .05$, $\eta_p^2 = .146$, and in the scores for risky choices, $F(2, 59) = 4.22$, $p < .05$, $\eta_p^2 = .125$; risky choices after loss, $F(2, 39) = 7.19$, $p < .05$, $\eta_p^2 = .269$; and safe choices after loss, $F(2, 59) = 7.17$, $p < .05$, $\eta_p^2 = .195$. Post hoc comparisons revealed statistically significant differences (see Table 4) between groups on the GDT total score, in which both the HC ($M = 2245.00$, $SE = 806.77$, $p < .05$) and the GD ($M = 2205.00$, $SE = 806.77$, $p < .05$) groups obtained a greater amount of total virtual money than did the SDG group. Regarding the risky choices after loss score, the SDG group had a higher score ($M = 3.93$, $SE = 1.04$, $p < .05$) than did the HC group. Last, post hoc tests revealed a significant difference between the SDG ($M = 3.80$, $SE = 1.36$, $p < .05$) and the HC group on the risky choices score.

Figure 2

IGT block scores in healthy controls (HC; N = 20), "pure" gamblers (GD; N = 20) and substance dependent gamblers (SDG; N = 20).
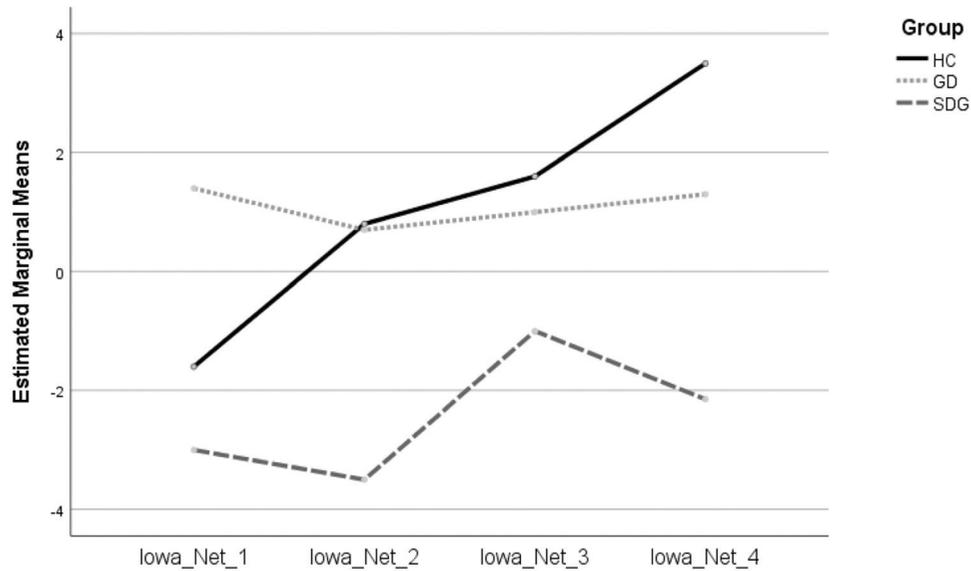
Table 4

One-Way ANOVA and Post Hoc Comparisons in Game of Dice Task (GDT)

Task Variables	N	df	F	p	η_p^2	Multiple comparisons	Mean difference	p
GDT_TS	60	2, 59	5.07	.009	.146	HC vs. SDG	2245.00	.022*
						GD vs. SDG	2205.00	.025*
GDT_NW	60	2, 59	1.10	.337		-	-	-
GDT_NL	60	2, 59	1.10	.337		-	-	-
W_Risky	60	2, 24	1.14	.336		-	-	-
L_Risky	60	2, 39	7.19	.002	.269	HC vs. SDG	-3.93	.002**
W_Safe	60	2, 58	.931	.400		-	-	-
L_Safe	60	2, 59	7.17	.002	.195	HC vs. SDG	2.00	.001**
N_R	60	2, 59	4.22	.019	.125	HC vs. SDG	-3.80	.022*

Note. ANOVA = analysis of variance; GDT_TS = total score; GDT_NW = number of wins; GDT_NL = number of losses; W_Risky = number of risky choices after a win; L_Risky = number of risky choices after a loss; W_Safe = number of safe choices after a win; L_Safe = number of safe choices after a loss; N_R = total number of risky choices; HC = healthy control; GD = "pure" gambling disorder; SDG = substance-Dependent gambler.
*$p < .05$. **$p < .01$.

Discussion

Our findings highlight significant differences in several clinical variables across all three groups, in line with both the primary aim of this study and the specific literature currently available about GD. Compared with those for the HC group,

higher scores were detected for both experimental groups on the dimensions of impulsivity (for a meta-analysis, see Ioannidis et al., 2019; Marazziti et al., 2014) and hostility-aggression (Suomi et al., 2014), as well as for mood disorders (APA, 2013; Kim et al., 2006).

An interesting result was found regarding the severity of GD (evaluated by the SOGS); in contrast to what was expected, the pure gamblers showed higher mean scores than did those with GD and SUD, probably because the gamblers with SUD experience GD as a disorder that is secondary to drug addiction. However, there were no conclusive results on the effects of prolonged drug abstinence in individuals with GD and SUD, and further studies should clarify the impact of both prolonged abstinence and the type of treatment received on the severity of GD.

On the other hand, the higher scores provided from the trait-anxiety measure only in the pure gamblers were in accordance with the literature, which shows a high prevalence of mood disorders in GD (Kim et al., 2006). Relief of negative affective states has been considered a common motivation for gambling, and the importance of emotional vulnerability suggests that gambling could regulate "negative mood states or physiological states of hyper-hypo-arousal," as specified in the integrated model of problem gambling (Blaszczynski & Nower, 2002).

Hostility inventory dimensions were significantly different between the experimental groups and the HC group, and the same result was reported by Suomi et al. (2014) in a study of low comorbid gamblers and by McCormick and Smith (1995) in a study of substance abusers, among whom hostile and aggressive individuals were more likely to use substances. Substance use can in turn maintain an underlying mechanism, especially in situations involving unpleasant internal states such as resentment, irritability, anger, and guilt, resulting in an inability to inhibit aggressive responses and behaviour.

With regard to personality traits, we found differences between the experimental groups compared with the HC group. Significant differences emerged for personality traits such as impulsivity (NS2), anticipatory worry (HA1), and self-directedness (SD), and in particular for resourcefulness (SD3), enlightened second nature (SD5), and empathy (C2). These personality variables are classically considered to be different between the population with GD and HCs (Álvarez-Moya et al., 2010). In contrast, we found no clear differences between pure gamblers and those with both GD and SUD with respect to personality aspects.

However, the self-directedness dimension showed statistically significant results between the experimental groups and the HC group in all subscales except self-acceptance; HCs reported higher mean differences than did GDs with and without SUDs. This finding seems to be consistent with Cloninger's model, which highlighted low self-directedness as a common feature of personality disorders in general (Cloninger et al., 1993). The self-directedness dimension also appeared to be highly and negatively correlated with neuroticism and positively with conscientiousness and

extraversion dimensions (De Fruyt et al., 2000). This finding seems to confirm the results of previous studies that have investigated the relationship between personality traits and GD, often reporting high neuroticism and lower rates of conscientiousness in those with GD (Bagby et al., 2007; Brunborg et al., 2016; Myrseth et al., 2009).

With respect to the NS overall dimension, including impulsiveness, our results showed higher scores in pure GDs, suggesting that these specific personality traits may represent a core trait in GD (Mann et al., 2017). Furthermore, the literature shows that impulsivity is predictive of high severity of GD and linked to borderline, antisocial, and narcissistic personality disorder (Rogier, Beomonte Zobel, & Velotti, 2020; Rogier & Velotti, 2018; Sacco et al., 2008; Vaddiparti & Cottler, 2017).

The concurrent presence of high NS and harm avoidance appears to support Cloninger's hypothesis of the relationship between temperament factors and motivated behaviour and their implications for both the onset (i.e., novelty seeking) and maintenance (i.e., harm avoidance) of GD (Mann et al., 2017). In addition, high levels of avoidance appear to represent a specific strategy for both narcissistic vulnerable personality disorder (Lamkin et al., 2014) and GD (Di Trani et al., 2017; Riley, 2012; Rogier & Velotti, 2018).

One study suggested that the lack of adaptive emotion regulation strategies modulates the relationship between specific personality traits (e.g., impulsivity, lack of perseverance, suspiciousness) and gambling severity (Rogier, Beomonte Zobel, & Velotti, 2020). Indeed, those with GD may find gambling to be a way to suppress intolerable emotional states (e.g., shame) but also to escape personal needs that they are unable to express in intimate relationships (Rogier & Velotti, 2018). Our findings point towards characteristic personality traits in GD, which can be observed independently from comorbid disorders, including substance use; these findings could be particularly useful in providing effective clinical interventions tailored to individual characteristics.

However, we hypothesize that these differences may be mainly the result of the different addictions experienced and different psychological and pharmacological treatments. Our results seem to agree with the recent changes made in the *DSM-5* (APA, 2013); in fact, GD was reclassified from an "impulse-control disorder not elsewhere classified" to one of the "substance-related and addictive disorders" in an effort to clarify diagnosis and treatment (Petry et al., 2013). This change also reflects the recognition of similarities between pathological gambling behaviour and addiction to substances (J. E. Grant et al., 2010). Several studies support the correctness of this orientation on the basis of findings from neuroimaging studies, which have demonstrated the overlap in many neural circuits in the two disorders (Conversano et al., 2012, Quaglieri et al., 2020; van Holst et al., 2010).

The reason for using two gambling tasks was justified by the fact that, although these tasks share some common risk-taking mechanisms, the different conditions (i.e., risky and ambiguous conditions) involve executive function processes in

different ways; in fact, the ambiguous condition seems to involve executive functions in a less engaged way. Indeed, tasks in which explicit rules are provided seem to recruit more cognitive processes (e.g., working memory and executive control) for risk evaluation. The lack of performance on the IGT was reported as a measure of compromised decision making in several neurological and psychiatric conditions (Bechara, 2004; 2005; Bechara et al., 1994; Goudriaan et al., 2005; S. Grant et al., 2000; Lemenager et al., 2011; Whitlow et al., 2004). Findings have shown several similarities between GD and SUD; indeed, worse performances were reported in those with GD and SUD than in HCs on the IGT, suggesting a common impairment in risky-reward decision making, as well as in response impulsivity and cognitive flexibility (Leeman & Potenza, 2012; Rash et al., 2016). Our study did not replicate the results reported in the growing literature on decision-making impairments (e.g., Cavedini et al., 2002; Ciccarelli et al., 2017; Goudriaan et al., 2005; for a review, see Brevers et al., 2013), in which those with GD performed more disadvantageously than did HCs.

No differences were detected concerning performances on the IGT; moreover, selecting a sample of pure gamblers without comorbid substance abuse and other psychiatric disorders should have avoided confounding effects on IGT performance. This result seems to be in line with other studies that have not reported differences in IGT performance between those with GD and HCs (De Wilde et al., 2013; Linnet et al., 2011a, 2011b; Tanabe et al., 2007); a possible reason could be the recruitment of a modest sample size or the selection of high-functioning individuals with GD (Álvarez-Moya et al., 2010), who showed less severe decision-making impairments. Indeed, regarding performance on the GDT, the pure GD group performed similarly to the control group; however, the SDG group showed poor performance. This evidence means that SDGs preferred risky choices, whereby they have a low probability of winning but potentially higher gains, resulting in a worsening overall score based on both the total number of risky choices and the risky choices after a loss trial (i.e., long-term negative balance). GDT performance is highly correlated with specific executive functions (e.g., cognitive flexibility and set shifting), which play a key role in risky decision making. Negative feedback (i.e., risky choices after loss) is often poorly attended to by GD subjects (Brand et al., 2005; Cavedini et al., 2002) and those with SUDs (Brand et al., 2005, 2008), suggesting dysfunctional frontal activity (e.g., orbitofrontal cortex; Cavedini et al., 2002) that is probably more dysfunctional in individuals with GD and SUD due to the permanent neurotoxic effects of substances (Martin et al., 2014; Silveri et al., 2016).

The primary aim of our study was to investigate the presence of exclusive characteristics in pure GD that could differentiate this condition from GD with SUD. A growing body of literature, especially from neuroimaging studies, has reported both similarities and differences with SUD, creating the premises for moving GD to the addictions section of the *DSM-5*; however, few studies have investigated the pure GD condition from a behavioural and personological perspective. The importance of detecting differences in pure GD lies in understanding the characteristics resulting from behavioural dependence without the effect of neurotoxic substances.

Our results showed differences in both experimental groups compared with the HC group that were consistent with the available literature; on the other hand, few differences resulted from comparisons between pure GD and GD with SUD. It seems that pure GD differs only in characteristics related to mood disorders (e.g., STAI-Y2, BDI-II, and assault dimension), whereas GD with SUD seems to be reported as involving greater impairment in decision-making processes related to risky choices. Furthermore, our results showed comparable personality characteristics. The finding that individuals with pure GD reported a greater impairment in emotion-related aspects seems to be in line with the "emotionally vulnerable" gambler subtype reported by Blaszczynski and Nower (2002).

Limitations

Our results need to be replicated in a future study that specifically investigates emotional dimensions (e.g., emotion regulation and alexithymia). Nevertheless, these results cannot be generalized because of several limitations of our study. First, convenience sampling did not allow us to perform an a priori power analysis, resulting in a small final sample size, which could have affected the power of the study. The most notable limitation of our study is the selection bias associated with the use of convenience sampling, which requires results to be interpreted with caution; therefore, further research with systematic sampling methods is needed to replicate the present findings in representative samples of GD with and without SUD. However, this was due to the difficulty in finding individuals with GD without SUD; future studies should include a larger sample and would also benefit from including women in the sample. Despite its small size, our sample yielded good levels of reliability and usability of the measures administered; however, the measures examined (self-report and behavioural tasks) may be sensitive to contextual factors, irrational aspects, and the residential time of the individual, affecting the ecological validity of the study, which would require further investigation.

The limited availability of previous or current diagnoses of comorbidity may limit the generalizability of these findings to perhaps more representative samples of individuals with GD because comorbidity is a common factor of both clinical populations. Indeed, even the presence of any residual symptoms of disorders (e.g., anxiety and depression) could have influenced self-report measures. It is also possible that the sample used in this study is not representative of the types and level of comorbidity in the general population of gamblers, leading to incorrect inferences about the relationship between GD, comorbidity, and clinical variables. In addition, the present study did not measure or control for the IQ scores of each participant.

Despite these limitations, our study suggests the need to further investigate the comparison of gamblers with pure GD with gamblers with SUD; focusing on pure GD could provide a better understanding of the underlying factors involved in maintaining pathological behaviour without the confounding effects of substances. Pure GD may therefore represent a less complicated group of behaviourally dependent individuals. Neurobiological studies have shown alterations that were

independent of substance intake (Zois et al., 2014), and our study attempts to provide new insights in relation to the similarities and differences at the behavioural level. Our findings may also have implications for therapy and personalized approaches in the treatment of GD and addiction in general.

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For correspondence: Alessandro Quaglieri, Department of Psychology, "Sapienza" University of Rome, Via dei Marsi 78, 00185 Rome, Italy, ＋39 0649917534. E-mail: alessandro.quaglieri@uniroma1.it