













Common and differential risk factors behind suicidal behavior in patients with impulsivity-related disorders: The case of bulimic spectrum eating disorders and gambling disorder

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FULL-LENGTH REPORT



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ABSTRACT

Background and aims: Mental disorders with high levels of impulsivity such as bulimic spectrum eating disorders (BSED) and gambling disorder (GD) are associated with high risk of suicidal behavior. The aim of the present study was to identify the common and differential vulnerability factors behind suicide attempts in a sample of patients with BSED compared to patients with GD. **Methods:** A total of 6,077 adults who sought treatment and met criteria either for BSED ($n = 2,391$) or GD ($n = 3,686$) were assessed at a specialized hospital unit. Personality traits, psychopathological symptomatology, lifetime history of suicide attempts and socio-demographic variables were evaluated. **Results:** The prevalence of suicide attempts was higher for BSED patients (26.2%) compared to GD patients (7.1%) being anorexia nervosa (Binge/Purge type) and bulimia nervosa the most affected subtypes. In the predictive model, the transdiagnostic vulnerability factors with the highest contribution to the risk of suicidal behavior both in BSED and GD were unemployment, early age of onset of the disorder, worse psychopathological state, and self-transcendence personality trait. However, specific risk factors for suicidal acts were identified in each disorder: longer duration of the disorder, lower education levels and reward dependence were exclusively associated with BSED while female gender, older age, and higher harm avoidance were associated with GD. **Discussion:** Patients with GD and BSED share certain vulnerability factors although certain factors are exclusive to each disorder. **Conclusions:** Interventions need to pay special attention to both common and specific vulnerability factors to mitigate the risk of suicidal acts in these disorders.

KEYWORDS

suicidal behavior, bulimic spectrum eating disorders, gambling disorder, impulsivity, risk factors

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INTRODUCTION

Suicide constitutes a major health concern given that it accounts for 1.4% of all deaths worldwide (World Health Organization, 2019) and in most Western countries it has become one of the first causes of non-natural death (World Health Organization, 2014). Numerous suicides are related to mental disorders (Chesney, Goodwin, & Fazel, 2014; Too et al., 2019) and impulsivity as a personality trait has been identified as a risk factor for suicidal behavior (Costanza et al., 2020; Gvion, Levi-Belz, Hadlaczky, & Apter, 2015). Impulsivity is defined as a predisposition to perform rapid unplanned reactions to internal or external stimuli that often cause adverse consequences (Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001). Therefore, those mental disorders that are characterized by high levels of impulsivity, such as gambling disorder (GD) (Black et al., 2014; Hodgins & Holub, 2015; Ioannidis, Hook, Wickham, Grant, & Chamberlain, 2019; Rømer Thomsen et al., 2018) and bulimic spectrum eating disorders (BSED) (Lavender & Mitchell, 2015; Mallorquí-Bagué et al., 2020; Waxman, 2009), deserve greater attention when studying suicidal behavior. Although from a categorical point of view these disorders are clearly differentiated, from a dimensional approach these disorders are situated in the impulsive pole of the impulsive-compulsive spectrum (Del Pino-Gutiérrez et al., 2017). In fact, this group of disorders share not only high levels of impulsivity but also other transdiagnostic clinical features such as difficulties in emotional regulation and inhibitory control (Dalglish, Black, Johnston, & Bevan, 2020; Munguía et al., 2021; Vintro-Alcaraz et al., 2022). It has also been argued that GD and BSED may have similar risk and maintenance factors. Following this idea, perfectionistic tendencies and overvalued ideas constitute risk and maintaining factors for BSED and may also explain GD (Tabri, Werner, Milyavskaya, & Wohl, 2021). Due to the shared clinical characteristics and high prevalence of these disorders as well as their serious consequences -including suicidal behavior-, it becomes clinically relevant to investigate both groups of disorders from a transdiagnostic approach.

Impulsivity is a multidimensional construct (Sperry, Lynam, Walsh, Horton, & Kwapil, 2016) and previous studies have examined which facets of the construct are more predominant in each disorder (Lavender & Mitchell, 2015; Mestre-Bach et al., 2020). There is a multiplicity of models on impulsivity (Sperry et al., 2016). One of the most studied is the UPPS-P, which proposes five factors of trait impulsivity: (lack of) perseverance, (lack of) premeditation, positive and negative urgency, and sensation-seeking (Whiteside & Lynam, 2001; Whiteside, Lynam, Miller, & Reynolds, 2005). Higher lack of perseverance, and positive and negative urgency are the most distinctive components that distinguish patients with GD compared to healthy controls (Billieux et al., 2012; Michalczuk, Bowden-Jones, Verdejo-Garcia, & Clark, 2011). Regarding BSED, patients with bulimia nervosa (BN) are more prone to report higher levels of urgency and sensation seeking and less

premeditation and perseverance compared to patients with anorexia nervosa (AN) restricting type, while those individuals with AN binge/purge (AN-BP) type have been described to be situated in between (Claes, Vandereycken, & Vertommen, 2005).

GD is characterized by a loss of control over gambling which becomes the individual's only interest, causing serious harmful consequences at social, family and financial levels (American Psychiatric Association, 2013). The lifetime prevalence of the disorder is estimated to be around 0.4–1.0% of the population (American Psychiatric Association, 2013) although wide variations in past-year problem gambling rates across different countries in the world have been described ranging from 0.12 to 5.8% (Calado & Griffiths, 2016). GD is associated with severe consequences including suicidal behavior (Karlsson & Håkansson, 2018). Manning et al. (2015) reported that 11.2% of patients with GD who sought treatment had attempted suicide in their lifetime. Likewise, eating disorders (ED) with a bulimic component are those in which there is presence of binge and/or purging episodes (i.e., “binge/purge type,” including BN, binge-eating disorder (BED), and AN-BP). Lifetime and 12-month prevalence of BSED range from 1.68 to 2.15% and 0.23–1.03% respectively (Micali et al., 2017). These ED subtypes show greater prevalence of impulsive behaviors (Mallorquí-Bagué et al., 2020) as well as higher rates of suicidal behavior compared to the rest of the ED subtypes (Bodell, Joiner, & Keel, 2013; Foulon et al., 2007; Mandelli, Arminio, Atti, & De Ronchi, 2019; Krug et al., 2021). Udo, Bitley, and Grilo (2019) found that the prevalence estimates of suicide attempts in AN-BP, BN and BED were 44.1%, 31.4%, and 22.9% respectively showing that the highest prevalence of suicide attempts were found in patients with BN and AN-BP (Forcano et al., 2009, 2011; Krug et al., 2021).

The fact that both BSED and GD have been classified as disorders in which impulsivity is crucial has led to the proposal that these two types of disorders may show common clinical correlates and a high shared comorbidity (Del Pino-Gutiérrez et al., 2017). In other words, it could indicate that both types of disorders share impulsivity-related vulnerability factors (Davis et al., 2017; Munguía et al., 2021). Not surprisingly, GD and BSED may co-occur (Jiménez-Murcia et al., 2013, 2015; Kim, von Ranson, Hodgins, McGrath, & Tavares, 2018; Mestre-Bach, Fernández-Aranda, Jiménez-Murcia, & Potenza, 2020). In a sample of treatment seeking patients with GD, 11.5% of the individuals met criteria for a BSED. The prevalence of co-occurring GD and BSED was higher in patients with BED and BN, and specifically among women (Kim et al., 2018).

When approaching the phenomenon of suicidal behavior, it is important to differentiate between suicidal ideation (thoughts of engaging in behavior intended to end one's life) and suicide attempts (any non-fatal self-destructive act that includes a certain degree of intention to end one's life) (Gómez-Expósito et al., 2016; Mallorquí-Bagué et al., 2018; Nock et al., 2008).



Suicidal risk in the clinical population has been linked, besides biological vulnerabilities (van Heeringen, Bijttebier, & Godfrin, 2011), to a set of socio-demographic and psychological factors. Socio-demographic factors include unemployment, family history of suicide, social isolation and the occurrence of adverse life events during childhood (especially sexual and physical abuse) (Blakely, Collings, & Atkinson, 2003; Cano-Montalbán & Quevedo-Blasco, 2018), while psychological factors include hopelessness, impulsivity, fearlessness and pain insensitivity, as well as difficulties in problem solving and coping (O'Connor & Nock, 2014). Specifically, in the case of GD, the literature has identified a set of factors associated with suicide attempts, namely psychological distress or depressive symptomatology, female gender, older age, financial debts and problem gambling severity (Carr, Ellis, & Ledgerwood, 2018; Giovanni et al., 2017; Husky, Michel, Richard, Guignard, & Beck, 2015; Ronzitti et al., 2017), as well as high scores in personality traits such as novelty seeking (propensity to be excited in response to novel stimuli) and harm avoidance (tendency to inhibit responses to signals of aversive stimuli that lead to avoidance of punishment) (Guillou-Landreat et al., 2016). Similarly, regarding suicide attempts in patients with BSED, factors such as psychological distress, comorbid psychiatric disorders -including affective, substance use and anxiety disorders-, greater levels of psychopathology and severity of the disorder (Corcos et al., 2002; Gómez-Expósito et al., 2016; Milos, Spindler, Hepp, & Schnyder, 2004) have been identified. In addition, personality traits such as high scores in persistence (propensity to persevere in spite of frustration and difficulties) and self-transcendence (inclination to conceive oneself as an integral part of the universe as a whole) and low scores in self-directedness (lack of a tendency to be goal-oriented and self-confident) (Bulik, Sullivan, & Joyce, 1999; Forcano et al., 2009) have been reported as well.

However, even though BSED and GD share vulnerability factors and clinical manifestations, to the best of the authors' knowledge there are no studies investigating common and differential factors between these two types of disorders regarding suicide attempts. Improved knowledge of demographic, psychological and behavioral risk factors behind suicidal behavior in impulsivity-related disorders can inform appropriate harm reduction efforts and treatment approaches.

The aim of the present study was to identify common and differential risk factors behind suicide attempts in a sample of patients diagnosed with GD and in a sample of patients diagnosed with BSED. It was hypothesized that, considering psychological factors, both BSED and GD patients who attempt suicide share general risk factors such as comorbid depressive symptomatology and unemployment. However, specific factors may differ according to the disorder. Regarding socio-demographic factors, in the case of patients with BSED, being young would be a greater risk for suicide attempts. As regards patients with GD, we hypothesized that it would be vice versa.

METHODS

Participants and procedure

The total sample consisted of 6,077 adults who sought treatment and met criteria either for BSED ($n = 2,391$) or GD ($n = 3,686$). In our sample, patients with BSED included individuals with a formal diagnosis of AN-BP ($n = 326$), BN ($n = 1,440$), BED ($n = 361$) or Other Specified Feeding or Eating Disorders (OSFED) with binge and purge episodes ($n = 264$). All patients were diagnosed according to DSM-5 criteria (American Psychiatric Association, 2013). Patients were recruited via consecutive referrals to the Eating Disorders Unit and Behavioral Addictions Unit at Bellvitge University Hospital, a tertiary care center highly specialized in the diagnosis and treatment of these mental disorders and other psychiatric disorders. All diagnoses were made by experienced clinical psychologists in the assessment and treatment of these two types of disorders. No compensation for being part of the study was given.

Measures

Lifetime suicidal ideation and suicide attempts. The presence of lifetime suicidal ideation and a history of suicide attempts were assessed during a face-to-face structured clinical interview in which participants were asked about past, recent, and present suicidal ideation and suicide attempts.

Diagnostic questionnaire for gambling disorder (according to DSM criteria) (Stinchfield, 2003). This is a self-report questionnaire designed to identify the presence of GD using 19 items based on the DSM criteria [diagnoses are available for the DSM-IV-TR (American Psychiatric Association, 2000) and the DSM-5 versions (American Psychiatric Association, 2013)]. To answer affirmatively to each item, the patient must have experienced the symptom for at least the last year. The psychometrical Spanish adaptation of this tool achieved adequate properties (Cronbach's alpha $\alpha = 0.81$ for a population-based sample and $\alpha = 0.77$ for a clinical sample) (Jiménez-Murcia et al., 2009). The internal consistency achieved in this study was good ($\alpha = 0.70$).

Eating disorders Inventory-2 (EDI-2) (Garner, 1991); Spanish validation (Garner, 1998). This instrument was used to assess different ED-related psychopathological characteristics: drive for thinness, body dissatisfaction, bulimia, ineffectiveness, perfectionism, interpersonal distrust, interoceptive awareness, maturity fears, asceticism, impulse regulation, and social insecurity. The internal consistency in the present study was excellent ($\alpha = 0.94$).

Symptom checklist-revised (SCL-90-R) (Derogatis, 1994). This is a self-report questionnaire used to assess general psychopathology by means of 90 items factorized into nine primary dimensions (somatization, obsessive-compulsive, interpersonal



sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism), and three global indices [global severity index (GSI), positive symptom total (PST), and positive symptom distress index (PSDI)]. Participants are requested to answer each item by considering their symptoms during the last few weeks including the day of the assessment. A Spanish adaptation of this tool is available and obtained adequate properties (the mean Cronbach's alpha was $\alpha = 0.75$) (Derogatis, 1997). In the present study, the internal consistency was also in the adequate to good range ($\alpha = 0.790$, for the paranoid ideation scale, to $\alpha = 0.981$ for the global indices).

Temperament and Character Inventory-Revised (TCI-R) (Cloninger, 1999). This questionnaire is based on Cloninger model of personality and therefore assesses the four dimensions of temperament (harm avoidance, novelty seeking, reward dependence, and persistence) and the three dimensions of character (self-directedness, cooperativeness, and self-transcendence). Participants are requested to answer each item considering how they usually act and feel, not just how they feel or act at the moment of the assessment. A validated Spanish version of the questionnaire is available and obtained adequate properties (the mean Cronbach's alpha was $\alpha = 0.87$) (Gutiérrez-Zotes et al., 2004). The internal consistency in the sample of the study was in the adequate to good range ($\alpha = 0.707$, for reward dependence, to $\alpha = 0.861$ for persistence).

Other relevant sociodemographic and clinical variables: socio-demographic characteristics including gender (female/male), age (years-old), employment status (unemployed or student and employed), socio-economic position index -according to Hollingshead's scale (based on the participants' level of education, the profession and the employment status) (Hollingshead, 2011)- marital status (single, married or stable partner and divorced or separated), education level (primary or less than primary, secondary and university), were collected. Clinical information was also collected concerning age of onset and duration of the disorder (measured in years).

In this study, the severity of the disorder was calculated as the standardized T-score in the EDI-2 total score (for patients with BSED) and in the number of DSM-5 criteria (for patients with GD). The standardized T-scores have been calculated from the normative data published in the Spanish validation studies of each tool. The converted T-scores provide the position of the raw scores relative to the reference-normative groups, and they were used in the study for comparing the symptom severity level between BSED versus GD patients (raw scores were not adequate because the different ranges of the original scales).

Statistical analysis

Statistical analysis was carried out with Stata16 for Windows (Stata-Corp, 2019). The comparisons between the groups for the proportions registered in the categorical variables were based on chi-square tests (χ^2), while analysis of variance (ANOVA) was conducted to compare the means registered among the groups in the quantitative measures. The effect

size for the means and the difference between proportions was estimated with the standardized Cohen's-d coefficient (effect size was considered low-poor $|d| > 0.20$, moderate-medium for $|d| > 0.5$, and large-high for $|d| > 0.8$) (Kelley & Preacher, 2012).

Logistic regression selected the significant predictors of the suicidal behavior in the study. The set of independent variables of these models included the sociodemographic variables (gender, marital status, education, socioeconomic index, employment and age), age of onset and duration of the disorder, severity of the disorder, global psychopathological distress (SCL-90-R GSI) and personality profile (TCI-R scales). The predictive models in the study were performed combining different estimate-procedures: a) a first model entered simultaneously and fixed all the predictors; b) a second model used stepwise method to automatically select the significant predictors (this selection was used due the large set of potential predictors and the exploratory nature of the analysis) (Kleinbaum, Kupper, Nizam, & Rosenberg, 2014); c) the final model was generated selecting all the significant predictors obtained in the previous two steps, and it was only considered the most optimal if the final regression allowed reliable clinical interpretation. A predictive model was adjusted within the total sample, and two additional models were also obtained stratified by the diagnostic subtype (GD and BSED) based on the potential moderator effect of this feature. For the predictive analysis, the whole dataset was randomly split into two groups (regardless of diagnosis) for a cross-validation procedure. The first group (which selected 50% of the participants) was used to obtain the predictive models; next, the resulting regressions were applied to the cross-validation group (the other 50% of the participants), and a prediction was made summarized with the Nagelkerke's pseudo- R^2 coefficient and the area under the curve (AUC) of a receiver operating characteristic (ROC) curve. It was verified that both groups were similar in the diagnostic distribution and the other variables used for obtaining the predictive models. It was verified that both groups were similar in the diagnostic distribution and the other variables used for obtaining the predictive models.

To control the increase in the Type-I error due to the multiple statistical tests, Finner's method was used, a familywise error rate procedure which is more powerful than the classical Bonferroni correction (Finner, 1993). Familywise error rate (FWER) is defined as the probability that statistical systems make at least k false rejections. When using these methods, a fixed number of $k-1$ of erroneous rejections is tolerated, and under the assumption that all the null hypotheses are equal, controlling the FWER at α -level is equivalent to combine the set of P -values to obtain a single testing for H_0 which is at level α . The use of Finner's method consists in adjusting the rejection criteria for each of the individual hypothesis fixing the familywise error rate no higher than a certain prespecified significance alpha-level (like $\alpha = 0.05$). Then, all the p (unadjusted)-values p_1, \dots, p_k obtained in k -independent null-hypothesis tests are ordered lowest-to-highest. The final step of the method consists in applying the next algorithm: p (adjusted) = $(1 - (1-p$ (non-



adjusted))^(total null-hypothesis tests/position of the test within the ordered tests)).

Ethics

The present study was developed in accordance with the Declaration of Helsinki and approved by The Clinical Research Ethics Committee (CEIC) of Bellvitge University Hospital (reference number: 307/06). Signed informed consent was provided by all the patients participating in this study.

RESULTS

Characteristics of the participants

Table A1 includes the descriptive statistics of the sample of GD and BSED patients. Differences between the diagnostic subtypes were obtained for participants' gender, marital status, education, social index and employment status. Among the BSED subsample (compared to GD), the proportion was higher for female gender, single status, higher education levels, lower social positions, and unemployed or student states. Additionally, BSED patients reported lower ages, earlier age of onset and longer duration of the disorder.

Prevalence of suicidal behavior in the study

Figure 1 includes the bar-chart with the prevalence of patients with suicide attempts and suicidal ideation in the study stratified by the diagnostic subtypes. The classification of the gambling preference in this work was based on the individuals' capacity-skills for impacting on the outcomes: a) non-strategic gambling includes games with little deliberation or skill to predict the results (these games are also called total chance-based games, and include slot-machines, bingo and lotteries); b) strategic gambling includes games which allow gamblers to attempt to use some knowledge to predict potential results (these games are also called skill-based games, and includes games such as dice, poker,

sports-betting or the stock market); c) mixed gambling is considered for gamblers who select both gambling types, non-strategic and strategic. The likelihood of both suicide attempts and suicidal ideation was higher for BSED patients compared to GD (suicide attempts: $\chi^2 = 427.5$, $df = 1$, $P < 0.001$; $|d| = 0.54$; suicidal ideation: $\chi^2 = 743.3$, $df = 1$, $P < 0.001$; $|d| = 0.72$). Additional information on the prevalence of suicidal behavior according to the diagnostic subtypes can be found in the Appendix and in Figure A1.

Comparison between patients with and without suicide attempts

Table 1 contains the comparison of the phenotypes (socio-demographic and clinical variables of the study) between the four groups defined by the diagnostic subtype and the suicide attempts (Fig. 2 also includes the graph-lines with the prevalence of patients outside the normative ranges in the SCL-90-R and the TCI-R). The first column with the pairwise comparisons of this table showed that among patients with GD, the presence of suicidal behavior was related to female gender, individuals separated or divorced, lower social position indexes, unemployment, older age, longer duration of the gambling problems, worse psychopathological state, higher scores in harm avoidance and self-transcendence traits and lower scores in self-directedness.

Among the BSED groups, the presence of suicide attempts was related to (see the second column with the pairwise comparisons in Table 1) lower education levels, lower social position indexes, earlier onset and longer duration of the eating problems, higher severity of the eating symptoms, worse psychopathological state, and personality traits characterized by higher scores in harm avoidance and self-transcendence, and lower scores in reward dependence, self-directedness and cooperativeness.

Finally, considering patients with GD and suicidal behavior versus BSED patients also with suicidal behavior, it was observed that BSED registered higher proportion of women, single individuals, higher education levels, lower social indexes, unemployed/student status, younger age, earlier onset and longer duration of the disorder, higher severity level of the disorder, worse psychopathological state and a personality phenotype characterized by lower scores in novelty seeking and self-directedness, and higher scores in harm avoidance.

Predictive models for the presence of suicide attempts

Table 2 contains the results of the predictive analysis in the study (the models obtained among the predictive-test group and the results within the cross-validation group). Among patients with GD (first model of the Table), the features with the significant contribution increasing the risk of suicidal behavior were: female gender, older age, earlier onset of the gambling problems, and higher levels in harm avoidance and self-transcendence. Among patients with BSED, the higher likelihood of suicidal behavior were: lower education levels, unemployment status, older age, earlier age of onset of the eating problems, higher severity of the

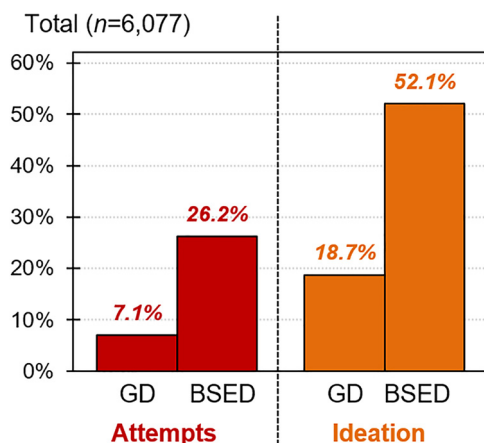


Fig. 1. Presence of suicidal behavior in the study (total sample)

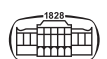


Table 1. Comparison between the groups with and without suicide attempts

		Descriptives								Pairwise comparisons					
		GD-SA		GD+SA		BSED-SA		BSED+SA		GD-SA		BSED-SA		GD+SA	
		<i>(n = 3,426)</i>		<i>(n = 260)</i>		<i>(n = 1,764)</i>		<i>(n = 627)</i>		GD+ SA		BSED+SA		BSED+SA	
		<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>p</i>	<i> d </i>	<i>p</i>	<i> d </i>	<i>p</i>	<i> d </i>
Gender	Women	278	8.1%	53	20.4%	1,655	93.8%	596	95.1%	0.001*	0.36	0.258	0.05	0.001*	1.76[†]
	Men	3,148	91.9%	207	79.6%	109	6.2%	31	4.9%						
Marital	Single	1,433	41.8%	103	39.6%	1,269	71.9%	445	71.0%	0.015*	0.05	0.112	0.02	0.001*	0.64[†]
	Married/Partner	1,548	45.2%	101	38.8%	373	21.1%	123	19.6%		0.13		0.04		0.43
	Divorced/Separated	445	13.0%	56	21.5%	122	6.9%	59	9.4%		0.23		0.09		0.34
Education	Primary	1,970	57.5%	158	60.8%	737	41.8%	331	52.8%	0.094	0.07	0.001*	0.22	0.001*	0.16
	Secondary	1,232	36.0%	93	35.8%	754	42.7%	230	36.7%		0.00		0.12		0.02
	University	224	6.5%	9	3.5%	273	15.5%	66	10.5%		0.14		0.15		0.29
Social index	High	52	1.5%	1	0.4%	10	0.6%	4	0.6%	0.026*	0.12	0.001*	0.01	0.001*	0.04
	Mean-high	162	4.7%	8	3.1%	64	3.6%	11	1.8%		0.09		0.12		0.09
	Mean	375	10.9%	26	10.0%	110	6.2%	18	2.9%		0.03		0.16		0.30
	Mean-low	1,093	31.9%	78	30.0%	732	41.5%	246	39.2%		0.04		0.05		0.19
Laboral	Low	1,744	50.9%	147	56.5%	848	48.1%	348	55.5%		0.11		0.15		0.02
	Unem./student Employed	1,428 1,998	41.7% 58.3%	143 117	55.0% 45.0%	1,247 517	70.7% 29.3%	522 105	83.3% 16.7%	0.001*	0.27	0.001*	0.30	0.001*	0.63[†]
		<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>P</i>	<i> d </i>	<i>P</i>	<i> d </i>	<i>P</i>	<i> d </i>
Age (yrs)		41.50	13.32	44.67	11.71	28.60	9.48	28.17	9.28	0.001*	0.25	0.443	0.05	0.001*	1.56[†]
Onset disorder (yrs)		29.75	11.71	29.95	10.82	20.51	8.26	18.63	8.18	0.758	0.02	0.001*	0.23	0.001*	1.18[†]
Duration disorder (yrs)		6.06	5.87	7.48	6.59	8.14	7.12	9.62	6.95	0.001*	0.23	0.001*	0.21	0.001*	0.32
Severity of disorder		86.28	10.33	87.24	9.92	84.13	12.21	90.78	8.37	0.163	0.09	0.001*	0.64[†]	0.001*	0.39
SCL-90R Somatic		1.00	0.80	1.32	0.94	1.80	0.68	2.25	0.60	0.001*	0.37	0.001*	0.70[†]	0.001*	1.17[†]
SCL-90R Obs-som		1.21	0.81	1.47	0.85	1.90	0.66	2.26	0.56	0.001*	0.32	0.001*	0.59[†]	0.001*	1.09[†]
SCL-90R Int.sens.		1.09	0.82	1.36	0.92	2.06	0.71	2.31	0.59	0.001*	0.30	0.001*	0.38	0.001*	1.23[†]
SCL-90R Depress.		1.58	0.88	2.06	0.95	2.22	0.69	2.69	0.55	0.001*	0.53[†]	0.001*	0.76[†]	0.001*	0.81[†]
SCL-90R Anx		1.07	0.79	1.44	0.91	1.66	0.68	2.13	0.61	0.001*	0.43	0.001*	0.73[†]	0.001*	0.89[†]
SCL-90R Hostility		0.99	0.83	1.17	0.95	1.38	0.77	1.78	0.73	0.001*	0.20	0.001*	0.54[†]	0.001*	0.72[†]
SCL-90R Pho.Anx		0.51	0.67	0.80	0.85	1.01	0.69	1.46	0.66	0.001*	0.38	0.001*	0.66[†]	0.001*	0.86[†]
SCL-90R Paranoia		0.99	0.78	1.17	0.90	1.47	0.67	1.74	0.56	0.001*	0.22	0.001*	0.44	0.001*	0.76[†]
SCL-90R Psychotic		0.97	0.75	1.26	0.84	1.33	0.57	1.63	0.55	0.001*	0.36	0.001*	0.53[†]	0.001*	0.52[†]
SCL-90R GSI		1.12	0.69	1.44	0.77	1.75	0.55	2.13	0.48	0.001*	0.44	0.001*	0.74[†]	0.001*	1.07[†]
SCL-90R PST		48.3	20.8	53.4	21.0	44.8	27.9	39.7	30.7	0.001*	0.24	0.001*	0.17	0.001*	0.52[†]
SCL-90R PSDI		1.93	0.58	2.24	0.66	2.37	0.43	2.62	0.36	0.001*	0.50[†]	0.001*	0.63[†]	0.001*	0.72[†]
TCI-R Novelty seeking		110.6	12.7	111.2	13.7	103.0	12.9	103.9	11.0	0.475	0.04	0.121	0.08	0.001*	0.59[†]
TCI-R Harm avoidance		101.3	16.1	107.1	16.5	117.1	15.6	122.9	13.1	0.001*	0.36	0.001*	0.40	0.001*	1.06[†]
TCI-R Reward depend.		97.9	13.9	97.2	13.7	102.8	12.6	98.9	10.3	0.371	0.06	0.001*	0.34	0.079	0.14
TCI-R Persistence		108.2	18.8	107.3	19.3	107.2	16.5	106.8	15.0	0.439	0.05	0.702	0.02	0.715	0.03
TCI-R Self-directedness		125.7	19.4	118.3	17.4	115.0	15.9	108.0	13.0	0.001*	0.40	0.001*	0.51[†]	0.001*	0.67[†]
TCI-R Cooperativeness		129.3	15.4	128.3	15.2	133.1	12.5	128.9	11.3	0.304	0.06	0.001*	0.35	0.566	0.04
TCI-R Self-transcend.		63.7	14.1	67.8	15.1	64.3	11.8	68.2	10.5	0.001*	0.28	0.001*	0.35	0.699	0.03

Note. GD-SA: gambling disorder without suicide attempts.
 GD+SA: gambling disorder with suicide attempts.
 BSED-SA: bulimic spectrum eating disorder without suicide attempts.
 BSED+SA: bulimic spectrum eating disorder with suicide attempts.
 SD: standard deviation. *Bold: significant comparison (0.05).
[†]Bold: effect size into the ranges mild-moderate ($|d| > 0.50$) to the high-large ($|d| > 0.80$).

eating problems, worse psychopathological distress, and higher level in self-transcendence. According to the model obtained for the whole sample, the diagnostic subtype contributed to the risk of suicidal behavior (patients with BSED achieved higher likelihood). Once the diagnostic type is considered, other contributors to the presence of suicidal behavior were female gender, unemployed status, older age,

earlier onset, higher severity of the disorder, higher psychopathological distress, higher harm avoidance and self-transcendence. The similar results (parameter estimates and the global predictive indexes) obtained in both groups (the predictive-estimation and the cross-validation groups) provided empirical validity to the results of the predictive analyses.



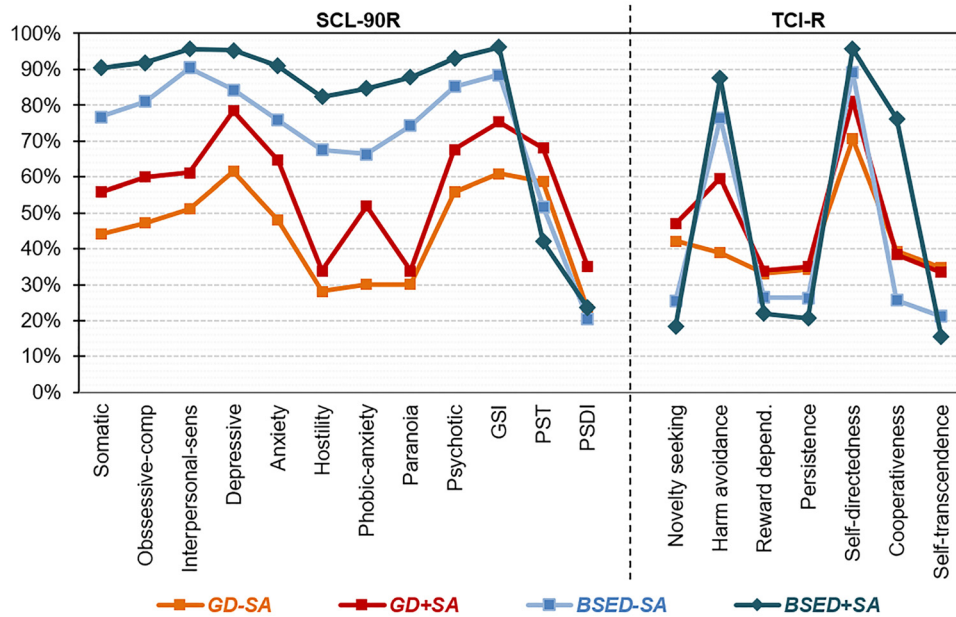


Fig. 2. Percentage of participants within the non-normative range

To sum up the results obtained in the study, Fig. 3 includes the main features related to the presence of suicidal behavior for each condition (in the center of the figure, the factors in common).

DISCUSSION

The present study aimed to identify which risk factors of suicide attempts a sample of patients with GD and a sample of patients with BSED have in common and which risk factors are different. To the best of the authors' knowledge, this is the first study to examine risk factors in these two related disorders following a transdiagnostic approach. In accordance with previous literature, both suicidal ideation and suicide attempts were more prevalent in BSED (particularly in those subtypes with purging episodes) compared to GD (Bodell et al., 2013; Fernández-Aranda et al., 2021; Foulon et al., 2007; Mandelli et al., 2019; Thon et al., 2014). Patients with binge/purge disorders might become less sensitive to pain due to the constant self-harm that purging-related behavior may cause through actions such as vomiting and excessive use of laxatives (Mandelli et al., 2019). This fact has led to the hypothesis that purging behavior might be a critical risk factor for committing a suicidal act but the underlying mechanisms that accounts for this phenomenon remains uncertain (Franko et al., 2004). It is worth noting that prevalence estimates of lifetime suicide attempts both in BSED and GD in the present sample are significantly higher compared to previous epidemiological studies that estimated this behavior to range between 1% and 4.6% in the general population (Kessler, Borges, & Walters, 1999; Lee et al., 2007).

Risk factors for suicide attempts that GD and BSED have in common

The predictive model carried out in the present study indicated that the four factors that are more associated with suicide attempts in both types of disorders were unemployment, early onset of the disorder, high psychological distress and high scores in self-transcendence. Consistent with previous studies and following the first hypothesis of the present study, unemployment has been described as a predictor of suicide attempts in the case of GD (Guillou-Landreat et al., 2016; Komoto, 2014; Newman & Thompson, 2007; Thon et al., 2014), in BN (Forcano et al., 2009; Goldstein & Gvion, 2019; Nickel et al., 2006) and in the general population irrespectively of the presence of a mental disorder (Blakely et al., 2003; Haw, Hawton, Gunnell, & Platt, 2015; Nordt, Warnke, Seifritz, & Kawohl, 2015). The relevance of unemployment may be interpreted by the fact that it is often associated with previous social maladjustment (Sciulli, 2016) as well as great difficulties to overcome financial problems due to a lack of a regular income and low levels of subjective well-being (Paul, Vastamäki, & Moser, 2016). Another interesting finding was that an early onset of the disorder was associated with a greater likelihood of a suicide attempt later in life. Bischof et al. (2015) explained that individuals with gambling problems and suicidal ideation were more likely to report an early onset of maladaptive gambling behavior. In a study carried out in a sample of patients with ED, the authors identified that an early onset of the disorder was related to a higher risk of suicide only in the case of BN and BED (Udo et al., 2019).

Additionally, the results from the present study indicated that greater psychological distress is a key factor that might predict a future suicide attempt. Patients with BSED who



Table 2. Predictive models for the presence of suicidal behavior: stepwise logistic regression

	Group for the obtaining the prediction model							Group for the cross-validation								
	B	SE	p	OR	95% CI	OR	NR ²	AUC	B	SE	p	OR	95% CI	OR	NR ²	AUC
¹ GD; n = 1,841 and 1,845							0.060	0.674							0.074	0.679
Gender (1 = men vs 0 = women)	-0.987	0.239	<0.001	0.373	0.233	0.596			-0.770	0.261	0.003	0.463	0.278	0.772		
Chronological age (yrs-old)	0.030	0.010	0.003	1.030	1.010	1.051			0.038	0.011	<0.001	1.039	1.017	1.061		
Age of onset (yrs-old)	-0.035	0.012	0.003	0.966	0.944	0.988			-0.041	0.012	0.001	0.960	0.937	0.983		
TCI-R: Harm-avoidance	0.017	0.006	0.002	1.018	1.006	1.029			0.022	0.006	<0.001	1.022	1.011	1.034		
TCI-R: Self-transcendence	0.016	0.006	0.013	1.016	1.003	1.029			0.021	0.006	0.001	1.022	1.009	1.034		
¹ BSED; n = 1,214 and 1,177							0.196	0.641							0.216	0.656
Education (higher levels)	-0.098	0.105	0.349	0.907	0.739	1.113			-0.404	0.110	<0.001	0.668	0.538	0.829		
Employment (employed)	-0.993	0.194	<0.001	0.371	0.253	0.542			-0.613	0.188	0.001	0.542	0.374	0.784		
Age (yrs-old)	0.039	0.010	<0.001	1.040	1.020	1.061			0.026	0.011	0.015	1.026	1.005	1.048		
Age of onset (yrs-old)	-0.051	0.012	<0.001	0.950	0.928	0.973			-0.045	0.013	<0.001	0.956	0.932	0.980		
Severity of the BSED	0.033	0.010	0.002	1.033	1.012	1.055			0.040	0.010	<0.001	1.040	1.019	1.062		
SCL-90R: GSI	0.944	0.205	<0.001	2.570	1.721	3.839			0.848	0.187	<0.001	2.335	1.618	3.370		
TCI-R: Self-transcendence	0.014	0.007	0.039	1.014	1.001	1.028			0.028	0.007	<0.001	1.029	1.015	1.043		
¹ Total; n = 3,055 and 3,022							0.216	0.666							0.228	0.685
Disorder (1 = BSED vs 0 = GD)	0.388	0.227	0.087	1.474	0.945	2.300			0.812	0.241	0.001	2.251	1.404	3.609		
Gender (1 = men vs 0 = women)	-0.658	0.205	0.001	0.518	0.346	0.775			-0.345	0.215	0.049	0.708	-0.465	-0.998		
Employment (employed)	-0.575	0.127	<0.001	0.563	0.439	0.722			-0.592	0.129	<0.001	0.553	0.430	0.712		
Age (yrs-old)	0.030	0.007	<0.001	1.031	1.017	1.045			0.028	0.007	<0.001	1.028	1.013	1.043		
Age of onset (yrs-old)	-0.038	0.008	<0.001	0.963	0.947	0.978			-0.036	0.009	<0.001	0.964	0.948	0.981		
Severity of the disorder	0.022	0.007	0.001	1.022	1.009	1.035			0.024	0.007	<0.001	1.024	1.011	1.038		
SCL-90R: GSI	0.543	0.112	<0.001	1.720	1.383	2.141			0.450	0.116	<0.001	1.568	1.248	1.969		
TCI-R: Harm avoidance	0.010	0.004	0.026	1.010	1.001	1.018			0.011	0.004	0.018	1.011	1.002	1.020		
TCI-R: Self-transcendence	0.014	0.005	0.004	1.014	1.004	1.024			0.022	0.005	<0.001	1.022	1.013	1.032		

Note. SE: standard error. OR: odds ratio. NR²: Nagelekerke's pseudo-R². AUC: Area under the receiver operator curve (ROC)

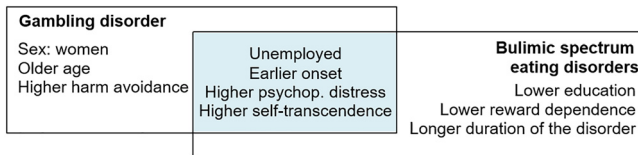


Fig. 3. Main features related to the presence of suicidal behavior in the study

reported higher scores in the SCL-90-R GSI increased the likelihood of suicide attempts. Specifically, depressive symptomatology is especially predominant in patients with suicide attempts, as we found in the present study, as well as it was described in previous studies (Bischof et al., 2016; Corcos et al., 2002; Guillou-Landreat et al., 2016).

Interestingly, in the present study, higher scores in self-transcendence personality trait appeared to be a transdiagnostic risk factor for suicide attempts in GD and BSED. Self-transcendence refers to the experience of spiritual ideas and considering oneself an integral part of the universe and it has been described earlier as a risk factor for suicidal events in BSED (Anderson, Carter, McIntosh, Joyce, & Bulik, 2002; Bulik et al., 1999). Despite the fact that it is the most scientifically controversial character dimension of Cloninger's theory of personality (MacDonald & Holland, 2002), it has been described as a risk factor for suicidal behavior in mood disorders and psychotic disorders (Jakšić & Margetić, 2017; Woo et al., 2014). In that sense, self-transcendence may constitute an important variable to consider when assessing patients with GD and BSED to detect individuals at higher risk for suicidal behavior. Nevertheless, self-transcendence on its own is not enough to predict future suicide attempts as it is the combination of certain temperament and character dimensions which increases the likelihood of suicidal behavior. In a study carried out in a sample of patients with ED, high scores in persistence and self-transcendence and low score in self-directedness were associated with a history of suicide attempts (Bulik et al., 1999). In another study, only self-transcendence and low self-directedness were associated with suicide attempts in individuals with BN (Favaro et al., 2008).

Differential risk factors for suicide attempts in GD and BSED

Regarding specific risk factors for suicide attempts in GD, and consistent with previous research, we found that women constitute a vulnerable group in terms of suicidal behavior (Bischof et al., 2015; Carr et al., 2018; Husky et al., 2015). Gender differences in suicide rate may be explained by differences in emotional and behavioral problems (Kaess et al., 2011).

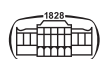
Another relevant finding from the current study was that patients with GD with a history of suicide attempts are older compared to patients with GD but without suicide attempts. This significant difference could not be found in our sample regarding patients with BSED. Even though several studies

did find that younger age was associated with a higher risk for suicidal behavior (Tae & Chae, 2021; Wardle & McManus, 2021), our findings are in line with other studies which have found that older age is a risk factor in addictive behaviors (Guillou-Landreat et al., 2016; Mallorquí-Bagué et al., 2018; Yuodelis-Flores & Ries, 2015). The association between a great suicidal risk and older age may be due to a cumulative effect of several years of financial and familial damages. While younger individuals with gambling problems may foresee possibilities to start a new life free of gambling, this may be seen as more complicated in the case of older individuals who have accumulated several negative consequences and may find more difficulties to find a way out of their current situation. Following this idea, a recent study described that older patients with GD were more likely to present comorbid health problems and greater emotional distress (Granero et al., 2014). The results from the present study led to partially support the hypothesis given that only the association between older age and risk of a suicide attempt was applicable in GD, but the contrary was not applicable in BSED, as it was hypothesized. Therefore, more studies are required to elucidate the role of age in terms of suicide risk.

Finally, the present study indicated that greater levels of harm avoidance are observed in patients with GD with suicide attempts compared to those without suicidal risk. This difference was not detected in patients with BSED. This is in line with a previous study which described that high levels of harm avoidance and novelty seeking were observed in individuals with GD (Guillou-Landreat et al., 2016). Harm avoidance is related to negative emotionality in conjunction with the tendency to inhibit responses to signals of aversive stimuli. It has been described as a personality trait in suicidal individuals (Calati et al., 2008; Perroud, Baud, Mouthon, Courtet, & Malafosse, 2011) and it is common in female patients with GD (Jiménez-Murcia et al., 2020).

Concerning the specific risk factors that appeared to be associated with a greater likelihood of presenting a history of suicide attempt in BSED, the present study's findings indicated that lower education constituted a relevant factor. Low education has previously been identified as a risk factor for suicidal behavior in BN (Forcano et al., 2009) and in other mental disorders (Christiansen, Agerbo, Larsen, Bilenberg, & Stenager, 2015), as well as in the general population (Abel & Kruger, 2005).

Our results also suggested that longer duration of the BSED is more frequent in patients reporting a lifetime history of suicide attempts. Based on the abovementioned finding from our study which indicates that older age constitutes a risk factor in GD, chronicity in BSED may aggravate the individual's perception that nothing can be done to resolve the situation and suicide appears to be a drastic solution to end the suffering. As described in previous studies (Forcano et al., 2009; Fennig & Hadas, 2010; Stein, Lilienfeld, Wildman, & Marcus, 2004), patients with longer duration of the ED are at higher risk to report a history of suicide attempts. Contrary to this association, in a recent study, longer duration and suicide attempts were only



detected in AN while in the case of BN shorter duration was associated with suicide (Udo et al., 2019).

Lastly, our results pointed out the fact that patients with BSED and lower reward dependence scores are at greater risk to commit a suicide act. This feature has also been suggested by previous studies, adding that lower scores self-directedness and cooperation and higher scores in harm avoidance have been described as a profile of personality especially at risk for committing suicide acts (Forcano et al., 2009; Gómez-Expósito et al., 2016). Therefore, both temperament and character seemed to play an important role in determining the risk of suicidal events. Following this idea, lower reward dependence and cooperativeness seem to be associated with a greater suicidal risk which could indicate that a strong social sphere may be a crucial protective factor for suicidal events (Coppersmith, Kleiman, Glenn, Millner, & Nock, 2019; Amitai & Apter, 2012).

A dimensional conceptualization of mental disorders reveals that transdiagnostic clinical features such as impulsivity allow grouping seemingly unrelated disorders from a categorical perspective such as GD and BSED. Grouping disorders under the prism of impulsivity makes it clear that these disorders share clinical features, risk factors and behaviors, and opens the door to transdiagnostic treatments that attempt to address the core elements of these disorders such as difficulties in emotional regulation and inhibitory control as well as repetitive desires to perform an act despite having negative consequences (Hamilton et al., 2015; Kim et al., 2018).

Limitations and strengths

The present findings should be interpreted cautiously due to several limitations. First, this study was based on a cross-sectional study design which did not allow to assess a potential causal link between the abovementioned risk factors and suicide attempts. Second, given that suicidal ideation and suicide attempts were assessed during a semi-structured interview and no specific assessment tool for measuring suicidal behavior was used, complementary information such as suicide severity was not contemplated. Third, the use of a clinical sample of individuals who sought treatment may create a bias as many individuals with BSED and GD do not seek treatment. Following this idea, most of the participants with GD were men while most of the subjects with BSED were women. This gender unbalance in clinical samples -which has been widely described in previous studies- is very frequent (Masheb et al., 2021; Wong, Zane, Saw, & Chan, 2013) and, for this reason, more studies are needed aiming at reducing this gender imbalance in the samples. Beyond the specific disorders with their sociodemographic and clinical manifestations and their differential risk profiles, the perspective of dimensional classification of diseases, from a transdiagnostic point of view, tries to identify shared risk factors in pathologies as apparently different as those under study in this research (BSED and GD), but also others. All these conditions could be included in the impulsive-compulsive spectrum disorders, such as substance use disorders, compulsive shopping

and other behavioral addictions, anorexia nervosa, obsessive-compulsive disorder or body dysmorphic disorder.

This study had the objective to identify common and differential risk factors behind suicidal behavior, taking into account that both disorders (GD and BSED) share two crucial risk factors such as high levels of impulsivity and emotional dysregulation, among others. Therefore, this study is contextualized in this translational perspective. However, it will be essential to expand the samples in the future, in order to obtain groups of men and women that are more similar in number, reducing the potential effect of this variable. Finally, despite the fact that psychopathological symptoms were assessed through SCL-90-R, comorbid mental disorders were not assessed -particularly depression followed by substance use disorders, psychotic disorders and personality disorders which have been described as frequently present in individuals with lifetime suicide attempts (Bachmann, 2018; Probert-Lindström, Berge, Westrin, Öjehagen, & Skogman Pavulans, 2020)- and hence the present findings may show some degree of bias.

Nevertheless, this study also presents relevant strengths. Firstly, the large sample size of patients who sought treatment with either GD or BSED provides robustness to the findings. Secondly, to the authors' knowledge, this is the first study considering transdiagnostic risk factors for suicide attempts in two related disorders.

Conclusions

GD and BSED share risk factors for suicide attempts which constitute more evidence supporting that both disorders share a common impulsivity-related substratum. Some of the risk factors for suicide attempts may be considered as transdiagnostic risk factors of impulsivity-related disorders, and therefore clinicians may consider them when assessing the suicidal risk in this profile of patients. However, specific risk factors in each disorder have been identified and they led us to conclude that, after considering transdiagnostic risk factors, clinicians would need to pay attention to particular risk factors of each disorder to reduce the risk of suicide. The present study may have clear clinical and research implications given that it provides a greater insight into the factors associated with suicidal risk in patients with a particular vulnerability to such a dramatic behavior.

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Appendix

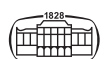
Table A1. Descriptive of the subsamples of GD and BSED patients

		GD (n = 3,686)		BSED (n = 2,391)		p	d
		n	%	n	%		
Gender	Women	331	9.0%	2,251	94.1%	<0.001*	2.04 [†]
	Men	3,355	91.0%	140	5.9%		
Marital status	Single	1,536	41.7%	1714	71.7%	<0.001*	0.62 [†]
	Married/Partner	1,649	44.7%	496	20.7%		
	Divorced/Separated	501	13.6%	181	7.6%		
Education	Primary or less	2,128	57.7%	1,068	44.7%	<0.001*	0.26
	Secondary	1,325	35.9%	984	41.2%		
	University	233	6.3%	339	14.2%		
Social index	High	53	1.4%	14	0.6%	<0.001*	0.09
	Mean-high	170	4.6%	75	3.1%		
	Mean	401	10.9%	128	5.4%		
	Mean-low	1,171	31.8%	978	40.9%		
Employment	Low	1,891	51.3%	1,196	50.0%	<0.001*	0.03
	Unemployed./student	1,571	42.6%	1769	74.0%		
	Employed	2,115	57.4%	622	26.0%		
		<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>P</i>	<i> d </i>
	Chronological age (years-old)	41.72	13.23	28.48	9.42	<0.001*	1.15 [†]
	Age of onset of disorder (years-old)	29.76	11.65	20.02	8.28	<0.001*	0.96 [†]
	Duration of disorder (years)	6.16	5.93	8.53	7.10	<0.001*	0.36

Note. SD: standard deviation.

*Bold: significant comparison (0.05).

[†]Bold: effect size into the mild-moderate ($|d| > 0.50$) to the high-large range ($|d| > 0.80$).



Description of the results regarding the prevalence of suicidal behavioral according to the diagnostic subtypes

Within the GD subsample (first panel of Figure A1), the prevalence of suicide attempts was higher for non-strategic gambling (7.6%), followed by mixed (6.1%) and strategic gambling (4.6%) ($\chi^2 = 6.47$, $df = 2$, $P = 0.039$). No differences were found between the groups defined by the gambling preferences for the prevalence of suicidal ideation

(17.9% for non-strategic, 19.5% for strategic and 21.9% for mixed) ($\chi^2 = 4.45$, $df = 2$, $P = 0.065$).

Within the BSED subsample (second panel of Figure A1), the prevalence of suicide attempts was lower for BED (13.9%) compared to the other diagnostic subtypes (24.2% for OSFED, 28.8% for AN-BP and 29.1% for BN) ($\chi^2 = 36.40$, $df = 3$, $P < 0.001$). In a similar way, the prevalence of suicidal ideation was the lowest for BED (44.3%), followed by AN-BP (46.6%), OSFED (54.2%) and BN (54.9%) ($\chi^2 = 17.52$, $df = 3$, $P = 0.001$).

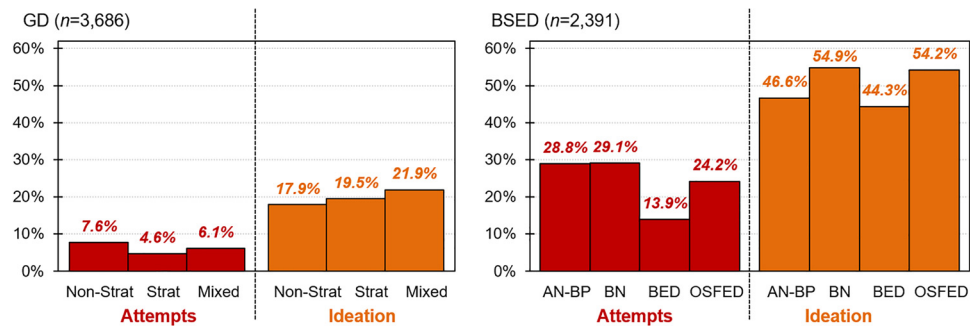


Fig. A1. Presence of suicidal behavior in the study (within the diagnostic subtypes)