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Building a Brief Multidomain Questionnaire for Gambling Dual Disorder: Psychometric Validation and RDoC-Based Dimensional Structure

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ABSTRACT

Objectives: Gambling Disorder (GD) frequently co-occurs with other mental disorders, a clinical condition termed Gambling Dual Disorder (GDD) that is often overlooked. We aimed to develop and validate a brief multidomain questionnaire to assess GDD severity within a dimensional, transdiagnostic framework.

Methods: A 55-item questionnaire was developed and tested across three phases (feasibility, reliability, validity) in 30, 57, and 223 treatment-seeking adults with DSM-5-TR GD. We assessed internal consistency, test–retest reliability, convergent validity against reference instruments (STAI, BDI-II, ISI, BIS, CAARS, SPIN, MULTICAGE-CAD-4, TCI-R, SDI), ROC-derived cutoffs, and the latent dimensional structure via exploratory and confirmatory factor analyses, mapped onto the NIMH Research Domain Criteria (RDoC).

Results: Internal consistency was excellent ($\alpha = 0.93$); test–retest reliability was moderate (ICC = 0.29–0.62). Convergent validity was strong ($r \approx 0.51$–0.72). ROC-based cutoffs prioritized sensitivity, with negative predictive values generally above 0.80. A global severity threshold near 1.44 enabled clinical stratification. A four-factor structure emerged: emotional distress and gambling impairment, impulsivity and behavioral activation, social anxiety and interpersonal suspiciousness, and executive dysfunction with negative self-perception.

Conclusion: The instrument is a reliable, valid, RDoC-aligned tool for stratifying GDD severity and tailoring integrated interventions.

1 | Introduction

The concept of addiction has traditionally been employed to describe substance use disorders. However, growing scientific evidence has made it necessary to expand this concept to include addictions without substances. The term behavioral addiction accurately describes the nature of symptoms associated with compulsive participation in activities that do not involve an addictive substance (Petry et al. 2018). Such

addictions involve compulsive behavior related to gambling, shopping, eating, or sex (Yau and Potenza 2015). Currently, only gambling disorder, as defined in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision (DSM-5-TR), and gaming disorder, as defined in the International Classification of Diseases, 11th Revision (ICD-11), have been formally included in this category.

The publication of the DSM-5 introduced a significant change in the chapter on addictive disorders (American Psychiatric Association 2013, 2022). In the DSM-5, and later the revised DSM-5-TR, Gambling Disorder (GD) is included as the first non-substance addiction, aligning with the new classification proposed by the World Health Organization in the ICD-11 (Grant and Chamberlain 2016). This classification integrates disorders due to substance use and those due to other addictive behaviors (WHO 2019). Within the latter category, GD (6C50), gaming disorder (6C51), other specified addictive behaviors (6C5Y), and unspecified addictive behaviors (6C5Z) are included. GD is defined as a maladaptive gambling behavior characterized by persistent or recurrent gambling activity that leads to clinically significant and progressive impairment across functional domains (Potenza et al. 2019).

A systematic review has estimated the prevalence of GD to range from 0.1% to 5.8% worldwide and from 0.1% to 3.4% in Europe (Calado and Griffiths 2016). The DSM-5-TR indicates a 12-month prevalence of 0.2%–0.3% and a lifetime prevalence of 0.4%–1%, though estimates vary significantly across studies (Potenza et al. 2019). In Spain, a report from the Ministry of Health estimated a GD prevalence of 0.6% among individuals aged 15–64 years, based on DSM-5-TR criteria (de Sanidad 2020). Prevalence rates are notably higher in specific subpopulations. For example, among psychiatric inpatients or individuals treated for substance use disorders, prevalence rates of GD are 6.9% and 4.3%, respectively (Grant et al. 2005; Cowlishaw and Hakes 2015). An epidemiological study conducted in the United States revealed that 96% of people with GD had at least one other psychiatric disorder, excluding psychotic disorders and personality disorders, and that 64% had three or more other mental disorders (Kessler et al. 2008).

According to recent cross-sectional studies, the most frequent other mental disorders include substance use, attention-deficit/hyperactivity disorder (ADHD), mood, impulse-control, anxiety, and other neurodevelopmental disorders (Szerman et al. 2020; Sharman et al. 2019). A systematic review of online GD showed significant associations with anxiety (92%), depression (89%), ADHD symptoms (85%), and social phobia or obsessive-compulsive symptoms (75%) (González-Bueso et al. 2018). From the dual disorder perspective, the presence of these other mental health conditions highlights the importance of designing integrative diagnostic and treatment models that address both behavioral addictions and other mental disorders (Szerman et al. 2020, 2023).

This clinical condition in which other mental disorders manifest alongside GD has been termed gambling dual disorder (GDD) (Szerman et al. 2020). This contextualizes GD in a dual disorder framework, which refers to a broader clinical phenotype characterized by the presence and severity of multiple overlapping psychopathological domains within GD. This perspective aligns with recent calls for a standardized, transdiagnostic conceptualization of dual disorders (Szerman et al. 2022, 2023), as well as with evidence that addictive and other mental disorders involve interconnected or overlapping brain processes rather than being disorders primarily defined by a single behavior (e.g., uncontrollable gambling) (Volkow 2020). Vulnerability to GB as a dual disorder has been linked to genetic, neurobiological, and environmental factors, emphasizing the relevance of clinical neuroscience and precision psychiatry approaches (Szerman and Peris 2018; Mora-Maltas et al. 2024; Huggett et al. 2019).

Certain endophenotypes, such as personality traits such as sensation-seeking and impulsivity, are commonly observed among individuals with GD (Szerman et al. 2020; Ioannidis et al. 2019; Freinhofer et al. 2020). A recent meta-analysis demonstrated increased impulsivity across cognitive domains including motor inhibition, attentional inhibition, delay discounting, and decision-making tasks (Ioannidis et al. 2019). Another study confirmed higher impulsivity in nearly all dimensions when comparing individuals with GD to healthy controls (Freinhofer et al. 2020). Given its complex and multifaceted nature, impulsivity in GD requires robust measures; the motor impulsivity subscale of the Barratt Impulsiveness Scale (BIS) has been proposed as the most clinically useful for predicting severity (Leppink et al. 2016).

Impulsivity is also a core symptomatic dimension of ADHD. In a study by Retz et al. (2016), 28.8% of individuals with GD reported childhood ADHD symptoms, while 25.2% met diagnostic criteria for ADHD in adulthood. Those with both disorders engaged in gambling for longer hours, developed GD more quickly, and experienced more severe outcomes. Similarly, a French study found that 20.7% of individuals with GD had ADHD, which was associated with greater disorder severity (Fatseas et al. 2016). Recent cross-sectional evidence shows that up to 50% of people with GD meet full ADHD criteria, and nearly 80% exhibit elevated impulsivity regardless of other diagnoses (Szerman et al. 2023).

A systematic review of treatment-seeking gamblers found high rates of other psychiatric disorders both current (74.8%) and lifetime (75.5%) (Dowling et al. 2015). The DSM-5-TR specifies nine diagnostic criteria for GD, alongside three severity levels: mild (4–5 criteria), moderate (6–7 criteria), and severe (8–9 criteria) American Psychiatric Association (2022). Screening and assessment tools such as the South Oaks Gambling Screen (SOGS), validated in Spanish (Odriozola et al. 1994), remain widely used despite being based on DSM-3 criteria and not DSM-5 definitions. The MULTICAGE questionnaire, adapted from the CAGE for alcohol abuse, includes scales for gambling, substance use, eating disorders, internet addiction, gaming, compulsive spending, and sex addiction (Ewing 1984; Castillo et al. 2010).

The existing clinical and epidemiological evidence suggests that GD is best conceptualized as a dual disorder (Szerman et al. 2020). Recent observational studies have corroborated the concurrence of ADHD, substance use disorders, mood disorders, and higher impulsivity in patients with GD, leading to the

identification of distinct clinical profiles of varying severity (Szerman et al. 2023). This classification may be particularly useful for optimizing clinical management according to the severity of other psychopathologies. However, there is currently no reliable tool for identifying individuals with GDD who present with more severe clinical phenotypes.

GDD describes the clinically recurrent condition in which GD emerges within a broader range of dysregulations (affective, impulsive-compulsive, cognitive, and interpersonal) that reflect a shared neurobiological and behavioral liability. Rather than proposing a new nosological category, GDD is understood as a clinical phenotype within GD characterized by the co-expression of multiple vulnerability dimensions that interact dynamically with gambling behavior. In this framework, the emphasis is on capturing variability in the type and severity of co-occurring psychopathological domains across individuals, instead of the definition of discrete categories or subtypes, like the Pathways Model (Blaszczynski and Nower 2002).

This perspective aligns with contemporary transdiagnostic models, such as the Research Domain Criteria (RDoC) (Insel et al. 2010; Cuthbert 2014). Developed by the National Institute of Mental Health, RDoC conceptualizes psychiatric conditions as disturbances in core functional domains such as negative valence, positive valence, cognitive systems, and social processes, which map onto underlying neurobiological systems (Cuthbert and Insel 2013; Kozak and Cuthbert 2016). These domains broadly capture responses to threat and loss, reward sensitivity and motivation, executive control processes, and interpersonal functioning. In this sense, GDD reflects how GD manifests within these broader dimensions of dysregulation, emphasizing their clinical relevance without defining a separate diagnostic entity or contradicting evidence on shared variance across disorders.

The instrument we propose adds value by offering a multidomain clinical assessment specifically calibrated for individuals with GD, capturing the pattern and intensity of the functional dimensions that define the GDD phenotype. Existing tools measure anxiety, impulsivity, sleep disturbance, or executive dysfunction independently, and frameworkds such as the Pathways Model and related instruments (e.g., the Gambling Pathways Questionnaire) provide clinically meaningful subtype classifications based on underlying vulnerabilities. However, these approaches are primarily designed to classify individuals into categories or to assess domains separately. None delineate how these domains cluster, interact and co-manifest uniquely within GD, where their combined expression has direct implications for severity, chronicity, and treatment response. By integrating these domains into a single structure (empirically derived and tested using modern psychometric and dimensionality-reduction methods) our instrument enables clinicians and researchers to identify GDD profiles, stratify patients by multidimensional burden, and anticipate differential clinical trajectories that remain invisible when measures are used in isolation. Thus, the scale does not replace existing instruments; it synthesizes their key domains into a clinically meaningful map of GD-related multidomain vulnerability.

The present study aims to develop and validate a brief multidomain instrument for assessing Gambling Dual Disorder (GDD) within a dimensional framework. Specifically, the objectives are threefold: (1) to develop a clinically informed set of items capturing key psychopathological domains associated with GDD; (2) to evaluate the psychometric properties of the instrument, including its reliability and validity; and (3) to examine its underlying dimensional structure using data-driven methods.

2 | Experimental Procedures

This section outlines the study design and measurement framework. *Procedure* subsection details the three-stage approach (feasibility, reliability, validity) and the reference instruments used. *Participants* subsection describes eligibility criteria, recruitment, and data collection sites. *Ethical Considerations* subsection summarizes approvals, informed consent, and data-protection standards. *Scale Development* subsection explains how items were selected from established measures. *Scale Dimensions* subsection specifies scoring (Likert 0–3, reverse-scored items), domain composition, and cutoffs. *Other Measures* subsection lists the sociodemographic, clinical, and gambling-history variables collected to contextualize results.

2.1 | Procedure

The study was carried out in three stages: feasibility, reliability, and validity of the questionnaire.

In the first stage (feasibility), a pilot study was conducted with 30 patients to assess whether the questionnaire was appropriate for its intended purpose. Feasibility was evaluated based on the time required to complete the questionnaire, the clarity and brevity of the questions, ease of reading and format, and the simplicity of scoring and interpretation. Additional measures included the percentage of missing responses, completion time, and the perceptions of both patients and professionals regarding the usability and clinical utility of the instrument. If substantial modifications had been necessary, the feasibility stage would have been repeated with a new group of 30 patients. Once feasibility was established, the same 30 patients also completed the gold-standard tests specified for the validity stage to help define cutoff points.

In the second stage (reliability), the stability and internal consistency of the questionnaire were evaluated. Internal consistency was measured using Cronbach's alpha with a sample size equivalent to five participants per item ($n = 5 \times 55$). Items were reviewed for potential elimination or modification in the event of low coefficients. Test–retest reliability was assessed by administering the questionnaire to the same patients again after one to 3 weeks, with reliability estimated through Pearson's correlation coefficient or the intraclass correlation coefficient.

In the third stage (validity), the results of the new questionnaire were compared against established gold-standard instruments for each relevant domain. Table 1 presents the dimensions evaluated and their corresponding reference instruments. After classification using the new tool, differences between groups

TABLE 1 | Dimensions and gold-standard instruments.

Dimension	Gold-standard instrument
Anxiety severity index	STAI questionnaires
ADHD severity index	CAARS questionnaire
Impulsivity severity index	BIS questionnaire
Addiction severity index	MULTICAGE-CAD-4 questionnaire
Insomnia severity index	ISI questionnaire
Social phobia severity index	SPIN questionnaires
Depression severity index	BDI-II questionnaires
Personality trait severity index	Cloninger's TCI-R questionnaire
Global severity index	All questionnaires
Self-perceived quality of life	Sheehan disability inventory

were compared to determine whether the expected distinctions were maintained across the validated measures.

2.2 | Participants

The study included patients with a clinical diagnosis of GD. In the first phase (tool feasibility), 30 patients were recruited. For the second phase (tool reliability), 223 participants were enrolled, following the calculation of five participants per item for the 55-item questionnaire ($n = 5 \times 55$). The same cohort of 223 patients was used in the third phase (tool validity). In total, 223 patients participated in the study. To be included, participants had to provide informed consent, be over 18 years of age, and meet DSM-5-TR diagnostic criteria for GD. Patients were excluded if they presented concomitant medical conditions that could interfere with the evaluation of study parameters (e.g., organic brain injury, intellectual disability, dementia, or other significant disorders).

Data collection was carried out by trained professionals at specialized centers in Spain dedicated to the treatment of individuals with GD, as specified in Section 1.5 of the protocol. All data were recorded in a purpose-designed digital platform (eCRD).

2.3 | Ethical Considerations

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki, the Oviedo Convention, and current Spanish regulatory requirements, including Law 29/2006 on the rational use of medicines and Royal Decree 957/2020 governing observational studies. Because no invasive procedures or biological samples were involved, the Biomedical Research Law 14/2007 did not apply. Approval was obtained from the Research Ethics Committee with Medicines (CEIm) of the Hospital General Universitario Gregorio Marañón in Madrid, Spain before the start of the study. All participants, or their legal representatives, were fully informed about the objectives, potential risks, and relevant aspects of the study. Written informed consent was obtained after providing participants with an information sheet and sufficient time for review. No financial compensation was offered for participation, and patient rights, safety, and well-being were prioritized over the interests of science and society.

All data were handled in compliance with the EU General Data Protection Regulation (Regulation [EU] 2016/679) and Spanish data protection laws (Organic Law 3/2018 and Law 41/2002). Patients were identified only by coded numbers, and the key linking codes to personal information was securely stored at study centers under the responsibility of the principal investigators. Only the research team and authorized regulatory bodies had access to the data, ensuring strict confidentiality. As the study was observational and descriptive, no experimental interventions were performed, no clinical prescriptions were altered, and participants did not face additional risks beyond routine clinical care.

2.4 | Scale Development

Building on an observational descriptive study conducted by (Szerman et al. 2023), we developed a questionnaire to discriminate among patients with GD according to the degree of associated psychopathology and, consequently, the severity of dual disorders. In that earlier work, patients with GD were assessed across multiple domains, including attention-deficit/hyperactivity disorder (ADHD), mood disorders, anxiety disorders, other addictive behaviors, sleep disturbances, and personality-related dysfunction such as impulsivity, using validated instruments. These data allowed for the identification of two clinical profiles with differing levels of associated psychopathology, defined as "severe" dual GD (Cluster 1) and "mild to moderate" dual GD (Cluster 2).

The instrument was designed to assess psychopathological domains associated with Gambling Disorder rather than the core diagnostic criteria of GD itself. Accordingly, GD diagnosis was established through standard clinical evaluation based on DSM-5-TR criteria, and item development focused on capturing co-occurring affective, impulsive, cognitive, and related dimensions.

Patients in the severe group showed higher levels of psychopathology across key domains. ADHD was assessed using the Adult ADHD Self-Report Scale (ASRS) and the Conners' Adult ADHD Rating Scales (CAARS). Mood and anxiety symptoms were measured using the Beck Depression Inventory-II (BDI-II) and the State-Trait Anxiety Inventory (STAI), along with social phobia using the Social Phobia Inventory (SPIN). Impulsivity was evaluated with the Barratt Impulsiveness Scale (BIS) and

the abbreviated Cloninger Temperament and Character Inventory (TCI-R-67). Sleep disturbance was measured using the Insomnia Severity Index (ISI), and general psychopathology using the Brief Symptom Inventory (BSI) and the Sheehan Disability Inventory (SDI).

Based on these results, we constructed a new questionnaire by selecting items from the validated instruments used in the previous study. Item inclusion was guided by both empirical and theoretical considerations. Items were drawn from validated measures covering the main psychopathological domains associated with GDD and prioritized based on their discriminative capacity between the identified severity groups, using Fisher's exact test, Chi-square test, and effect size estimates. Selection was further guided by a multidomain conceptual model of dual disorder to ensure coverage of clinically relevant domains, and refined through clinical judgment and stakeholder input to improve clarity and feasibility.

The final instrument comprised 55 items rated on a 4-point Likert scale ranging from 0 ("never or rarely") to 3 ("almost always or always"), with eight items reverse scored.

2.5 | Scale Dimensions

Once the questionnaire was completed, responses were scored on a Likert scale from 0 to 3, with 0 indicating no pathology and 3 indicating the most severe pathology. Specifically, 0 points were assigned to the category "never or rarely," 1 point to "occasionally," 2 points to "often," and 3 points to "almost always or always," except for items 3, 4, 7, 8, 35, 51, 52, and 53, which were reverse scored.

After each item was scored, the questionnaire dimensions were calculated using the arithmetic mean of the relevant items. Table 2 summarizes the composition of each dimension, together with the corresponding cutoff values, the mean score at the severity cutoff, the global severity score, and the perceived quality of life score. In addition, two cutoff points were established to classify patients as severe or less severe. These cutoffs were first evaluated in Phase 1 of the study, and the selected cutoff was then validated alongside the tool in Phases 2 and 3.

2.6 | Other Measures

Sociodemographic and clinical data were also collected for all participants. These included sex, age, marital status, educational attainment, and employment status. Clinical history variables encompassed the number of hospitalizations, current psychopharmacological treatment (including type of medication), and receipt of non-pharmacological therapies.

Patients were diagnosed with GD according to DSM-5-TR criteria. Further variables recorded included gambling history (online and/or offline), age of onset, history of the current disorder, the most recent gambling episode, and severity of gambling behavior as assessed by the Severity of Dependence Scale and DSM-5-TR criteria.

To validate the new tool, participants also completed a battery of established instruments. These included the MULTICAGE-CAD4 and the South Oaks Gambling Screen (SOGS) for gambling and other addictions; the Conners' Adult ADHD Rating Scales (CAARS) for ADHD; the Beck Depression Inventory-II (BDI-II) for depression; the State-Trait Anxiety Inventory (STAI) for anxiety; the Social Phobia Inventory (SPIN) for social phobia; the Barratt Impulsiveness Scale (BIS) for impulsivity; the Insomnia Severity Index (ISI) for sleep disturbance; the Brief Symptom Inventory (BSI) and the Sheehan Disability Inventory (SDI) for general psychopathology and disability; and Cloninger's Temperament and Character Inventory (TCI-R) for personality traits.

2.7 | Factorial Structure and RDoC-Based Dimensional Framework

To examine the latent structure of the questionnaire, we conducted an exploratory factor analysis (EFA) followed by a confirmatory factor analysis (CFA) in the full sample of GD patients. Both analyses were conducted on the same sample due

TABLE 2 | Questionnaire dimensions and cutoff points.

Dimension (items)	Cutoff	Mean at severity cutoff
Anxiety severity index (Q1, Q2, Q3†, Q4†, Q5, Q6, Q10, Q43)	1.60	2.18
ADHD severity index (Q4†, Q17, Q18, Q19, Q21, Q23, Q24, Q25, Q26, Q27, Q28, Q29, Q30, Q41, Q47)	1.20	1.82
Impulsivity severity index (Q4†, Q14, Q15, Q17, Q19, Q20, Q21, Q22, Q23, Q24, Q26, Q27, Q37, Q38, Q47, Q48, Q50, Q54)	1.50	2.42
Addiction severity index (Q5, Q6, Q7†, Q11, Q12, Q13, Q14)	1.20	1.93
Insomnia severity index (Q8†)	2.00	2.00
Social phobia severity index (Q1, Q5, Q9, Q10)	0.80	1.43
Depression severity index (Q2, Q3†, Q6, Q16, Q31, Q32, Q33, Q34, Q35†, Q36, Q37)	0.90	1.68
Personality traits severity index (Q6, Q7†, Q9, Q29–Q53)[a]	1.80	2.32
Global severity index (all items)	1.40	2.00
Perceived quality of life (Q7†, Q12, Q13, Q14, Q15, Q54, Q55)	1.88	2.52

Note: Item mapping: Q*k* refers to item *k* in Table A1. Daggered items (†) are reverse scored. Scores range 0–3.
[a]includes reverse-scored items Q51†, Q52†, Q53†.

to sample size constraints, given the substantial sample requirements of factor analytic methods (Kyriazos 2018).[1] The EFA was performed using principal axis factoring (PAF), a robust extraction method suitable for non-normal data distributions. As expected, neither univariate nor multivariate normality assumptions were met (Mardia's test: skewness and kurtosis $p < 0.001$). However, factorability of the correlation matrix was excellent: the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was 0.919 (item MSA values all > 0.70), and Bartlett's test of sphericity was highly significant ($p < 0.001$), confirming that the inter-item correlations were appropriate for factor analysis.:contentReference [oaicite:1] index = 1.

The number of factors was determined using multiple convergent criteria: the eigenvalue-greater-than-one rule (Kaiser's criterion), Cattell's scree test, parallel analysis, and the minimum average partial (MAP) test. All methods converged on a four-factor solution as the most adequate representation of the data. Factors were extracted using principal axis factoring and rotated with an oblique rotation (Oblimin) to allow for correlated dimensions, consistent with the expectation that different domains of dual psychopathology are interrelated rather than orthogonal.

The initial EFA including all 55 items suggested that several items contributed poorly to the latent structure. Items were iteratively removed based on standard psychometric criteria: low factor loading (< 0.30), low communality ($h^2 < 0.25$), and/or excessive cross-loading (high complexity). Following this procedure, eight items (Q7, Q13, Q14, Q31, Q41, Q49, Q51, Q55) were removed, yielding a final 4-factor model with satisfactory item properties (all retained items with loadings > 0.30 and communalities > 0.25). The four factors together explained 41.8% of the total variance (PA1: 13.5%; PA2: 10.8%; PA3: 9.7%; PA4: 7.8%), which is acceptable for a multidimensional clinical questionnaire. Global fit indices for the final EFA model indicated good to excellent fit (RMSEA = 0.052, 90% CI [0.048, 0.056]; SRMR = 0.043; TLI = 0.848), taking into account the large number of items and sample size.

Internal consistency of the four factors was good to excellent. Cronbach's alpha coefficients ranged from 0.83 (PA2) to 0.89 (PA1), and McDonald's Omega coefficients ranged from 0.87 (PA2) to 0.92 (PA1). Item–total corrected correlations were > 0.50 across factors, and removing any single item would have reduced the reliability indices, which supports the internal coherence of each dimension. Inter-factor correlations were moderate (range $r = 0.22$–0.54), all below 0.85, indicating that the dimensions are related but not redundant.

The four-factor structure identified in the EFA was subsequently tested using CFA. The CFA model with four correlated factors showed excellent global fit: comparative fit index (CFI) = 0.978, Tucker–Lewis index (TLI) = 0.977, root mean square error of approximation (RMSEA) = 0.064 (90% CI [0.060, 0.067]), standardized root mean square residual (SRMR) = 0.078, and goodness-of-fit index (GFI) = 0.97. These indices meet or closely approximate commonly accepted thresholds for good fit, supporting the stability and robustness of the proposed structure.

To provide a transdiagnostic and dimensional framework for interpreting the latent dimensions, we mapped the four factors onto the RDoC model as a post hoc theoretical interpretation rather than a data-driven procedure. The factor structure itself was derived empirically, whereas the RDoC alignment is intended to aid interpretation within a transdiagnostic framework. Rather than aligning with categorical DSM-5-TR or ICD-11 diagnoses, RDoC conceptualizes psychopathology in terms of underlying neurobiopsychological systems (e.g., negative valence, cognitive systems, positive valence, social processes, arousal/regulatory systems). Given that individuals with GD frequently exhibit complex dual patterns involving emotional dysregulation, impulsivity, executive dysfunction, and social vulnerability, the RDoC matrix offers a suitable structure for linking the questionnaire's factors to functional domains. Accordingly, the four latent dimensions derived from the EFA and CFA were interpreted within relevant RDoC domains and constructs, thereby supporting a dimensional and transdiagnostic approach to “dual” functioning in GD.

3 | Results

This section reports empirical findings in three parts. *Phase I: Feasibility* subsection describes pilot acceptability and usability of the questionnaire and presents descriptive subscale scores used to refine wording and initial thresholds. *Phase II: Reliability* subsection summarizes internal consistency and test–retest performance across domains, including stability metrics and change analyses. *Phase III: Validity* subsection presents interim cutoff calibration using ROC analyses and, in the full sample, convergent correlations with gold-standard instruments and classification accuracy (sensitivity, specificity, predictive values).

3.1 | Phase I: Feasibility

A total of 30 patients participated in the Phase I pilot (93.3% male; mean age: 39 years old). All participants completed the questionnaire in full, with no missing item responses. Although completion time was not recorded in this phase, clinicians reported no concerns regarding the questionnaire's length. Patient feedback indicated a high level of acceptability, with a mean satisfaction rating of 8.2 out of 10.

The initial version of the questionnaire (v1) was generated during the scale development phase based on the prior observational study and item selection process described above. A second version (v2) incorporated minor preliminary revisions in wording and format before pilot testing. The feasibility phase then led to additional small refinements, resulting in the third version (v3), which was used in the subsequent analyses.

Minor refinements were made to the questionnaire based on qualitative feedback from both patients and administering clinicians. Several wording adjustments were implemented to improve clarity and inclusivity: the text was updated to address both genders and use more formal tones, one lengthy question was shortened for conciseness, and a negatively phrased item was reworded to a positive form (with its scoring accordingly recoded). These changes resulted in the final pilot version (v3)

of the questionnaire, which was deemed viable without need for further pilot testing. Subscale results for the v3 pilot are summarized in Table 3.

Descriptive results from the Phase I administration suggested that the initial cutoff criteria might be set too stringently, as relatively few patients were classified as having severe levels of pathology on most subscales. For example, no patients scored in the "severe problem" range on the anxiety, ADHD, impulsivity, personality trait, global severity, or quality of life indices. In contrast, a subset of patients was flagged as severe on the addiction (16.7%), insomnia (20.0%), social phobia (20.0%), and depression (13.3%) subscales. This pattern suggested a potential underestimation of psychopathology severity with the original cutoffs. It was therefore decided to proceed to an intermediate validity analysis in Phase III (using approximately 20% of the target sample) to recalibrate the questionnaire cutoff points against external "gold standard" criteria before final validation.

3.2 | Phase II: Reliability

Phase II evaluated the instrument's reliability in a sample of 57 patients (91.2% male; mean age 36.7 ± 10.5 years). The average time to complete the questionnaire was 9.1 min (SD = 3.8) for the first administration, and 6.4 min (SD = 3.9) for the second administration, indicating that the instrument can be completed rapidly and may even be filled out more quickly upon re-test (perhaps due to familiarity). The questionnaire demonstrated excellent internal consistency: Cronbach's alpha was $\alpha = 0.93$, well above the acceptable threshold of 0.70, with no improvement in alpha achieved by deleting any of the 55 items or by removing any entire dimension.

Test–retest reliability over an average interval of 21.5 days (SD = 10 days) is presented in Table 4. The intraclass correlation coefficients (ICCs) for the subscale scores ranged from 0.29 to 0.62. The highest stability was observed for the ADHD and personality trait indices (ICC = 0.62 each), while the addiction severity index showed the lowest stability (ICC = 0.29).

The agreement in categorical classification (i.e., grouping patients as having a "problem" or "severe problem" on each domain) between the test and retest was only fair in most cases. Cohen's kappa values ranged from $\kappa = 0.07$ for insomnia (indicating poor agreement) to $\kappa = 0.51$ for ADHD (indicating moderate agreement). Other domains showed low to moderate agreement (e.g., $\kappa = 0.30$ for depression; $\kappa = 0.33$ for anxiety). Based on these results, it was recommended to shorten the retest interval (to 7–15 days) in future administrations to minimize the effects of any clinical improvements due to ongoing treatment during the interval.

3.3 | Phase III: Validity

The validity phase was conducted in two parts. First, an interim analysis was performed on the initial 57 patients (about 20% of the planned sample) to refine the questionnaire's cutoff scores using objective criteria. As in Phase I, the interim data revealed a low detection rate of "severe" cases under the original cutoffs for several domains, as shown in Table 5.

Therefore, receiver operating characteristic (ROC) analyses were carried out for each questionnaire dimension to determine the optimal cutoff that maximized sensitivity while maintaining adequate specificity, using established external questionnaires as the gold-standard measures for each domain. This process yielded revised cutoff scores for all 10 severity indices. In particular, the optimal thresholds were determined to be 1.25 for the anxiety index, 1.40 for the ADHD index, 1.0 for impulsivity, 1.42 for addiction, and 1.0 for insomnia. Similarly, the cutoffs were set at 0.50 for social phobia, 1.18 for depression, 0.75 for personality traits, 1.44 for the global severity index, and

TABLE 3 | Subscales and scores (v3).

Subscale (items)	Mean (SD)	Patients with problems	Patients with severe problems
Anxiety severity index (Q1, Q2, Q3†, Q4†, Q5, Q6, Q10, Q43)	1.0 (0.5)	5 (16.7%)	0 (0.0%)
ADHD severity index (Q4†, Q17, Q18, Q19, Q21, Q23, Q24, Q25, Q26, Q27, Q28, Q29, Q30, Q41, Q47)	0.9 (0.4)	7 (23.3%)	0 (0.0%)
Impulsivity severity index (Q4†, Q14, Q15, Q17, Q19, Q20, Q21, Q22, Q23, Q24, Q26, Q27, Q37, Q38, Q47, Q48, Q50, Q54)	1.0 (0.4)	4 (13.3%)	0 (0.0%)
Addiction severity index (Q5, Q6, Q7†, Q11, Q12, Q13, Q14)	1.2 (0.5)	16 (53.3%)	5 (16.7%)
Insomnia severity index (Q8†)	0.8 (0.9)	6 (20.0%)	6 (20.0%)
Social phobia severity index (Q1, Q5, Q9, Q10)	0.7 (0.7)	8 (26.7%)	6 (20.0%)
Depression severity index (Q2, Q3†, Q6, Q16, Q31, Q32, Q33, Q34, Q35†, Q36, Q37)	0.9 (0.5)	13 (43.3%)	4 (13.3%)
Personality trait severity index (Q6, Q7†, Q9, Q29, Q38, Q39, Q40, Q41, Q42, Q43, Q44, Q45, Q46, Q47, Q48, Q49, Q50, Q51†, Q52†, Q53†)	0.8 (0.3)	0 (0.0%)	0 (0.0%)
Global severity index (all items)	0.9 (0.4)	2 (6.7%)	0 (0.0%)
Self-perceived quality of life (Q7†, Q12, Q13, Q14, Q15, Q54, Q55)	0.9 (0.4)	0 (0.0%)	0 (0.0%)

Note: Item mapping: Q*k* refers to item *k* in Table A1. Daggered items (†) are reverse scored. Phase I pilot, $N = 30$.

TABLE 4 | Test-retest reliability of severity indices.

Dimension	Mean (SD) 1st test	Mean (SD) 2nd test	Pearson (95% CI)	ICC (95% CI)	Mean diff. (95% CI)	*p*	Kappa (95% CI)
Anxiety severity index	1.17 (0.70)	1.15 (0.60)	0.51 (0.29–0.68)	0.52 (0.30–0.68)	−0.02 (−0.18, 0.15)	0.829	0.33 (0.06, 0.61)
ADHD severity index	1.17 (0.55)	1.01 (0.54)	0.65 (0.46–0.78)	0.62 (0.43–0.76)	−0.16 (−0.28, −0.03)	0.013	0.51 (0.30, 0.74)
Impulsivity severity index	1.17 (0.53)	1.03 (0.52)	0.60 (0.40–0.75)	0.58 (0.38–0.73)	−0.14 (−0.26, −0.01)	0.032	0.21 (0.00, 0.51)
Addiction severity index	1.44 (0.50)	1.47 (0.53)	0.28 (0.02–0.51)	0.29 (0.04–0.51)	0.03 (−0.14, 0.20)	0.713	0.29 (0.03, 0.56)
Insomnia severity index	1.00 (1.04)	1.13 (0.99)	0.40 (0.15–0.60)	0.41 (0.17–0.60)	0.13 (−0.17, 0.42)	0.404	0.07 (0.00, 0.38)
Social phobia severity index	1.00 (0.68)	0.96 (0.59)	0.48 (0.25–0.66)	0.49 (0.27–0.66)	−0.04 (−0.22, 0.13)	0.607	0.25 (0.00, 0.50)
Depression severity index	1.14 (0.59)	1.00 (0.53)	0.56 (0.35–0.72)	0.55 (0.34–0.71)	−0.14 (−0.28, 0.00)	0.057	0.30 (0.06, 0.54)
Personality trait severity index	0.90 (0.42)	0.88 (0.44)	0.61 (0.41–0.75)	0.62 (0.43–0.76)	−0.02 (−0.13, 0.08)	0.636	—
Global severity index	1.09 (0.40)	1.00 (0.40)	0.60 (0.40–0.74)	0.59 (0.39–0.73)	−0.10 (−0.20, 0.01)	0.068	0.26 (0.00, 0.54)
Self-perceived quality of life	1.03 (0.45)	1.05 (0.43)	0.41 (0.16–0.61)	0.42 (0.18–0.61)	0.02 (−0.11, 0.15)	0.749	—

TABLE 5 | Cut-off points and number of patients with problems ($N = 57$).

Dimension	Cut-off point	Patients with problems	Patients with severe problems
Anxiety severity index	1.62	42	15
ADHD severity index	1.16	32	25
Impulsivity severity index	1.53	44	13
Addiction severity index	1.21	18	39
Insomnia severity index	2.00	50	7
Social phobia severity index	0.81	27	30
Depression severity index	0.92	24	32
Personality trait severity index	1.83	56	1
Global severity index	1.44	43	14
Self-perceived quality of life	1.88	56	1

1.88 for the self-perceived quality of life index. These adjusted cutpoints were then applied in the final validation with the full sample.

In the second phase, a total of 223 patients were assessed with the study questionnaire alongside the gold-standard instruments (86.5% male; mean age 39.6 years). Across the various domains of dual disorders, the questionnaire's severity scores demonstrated significant positive correlations with the corresponding standardized measures, supporting the instrument's convergent validity. For instance, the anxiety severity index correlated moderately with the State–Trait Anxiety Inventory (Pearson's $r = 0.51$ with STAI-State, and $r = 0.52$ with STAI-Trait). The impulsivity index showed a strong correlation with the BIS-11 impulsiveness scale ($r = 0.72$), and the insomnia index correlated moderately with the Insomnia Severity Index ($r = 0.57$). Correlations for other domains were in the low-to-moderate range (e.g., $r = 0.3$–0.5 for the depression index vs. BDI-II and for the social phobia index vs. SPIN) consistent with expectations given the complexity of those constructs.

Using the optimized cutoff scores determined in the interim analysis, we evaluated the questionnaire's ability to classify patients relative to each gold-standard criterion. Full ROC performance metrics, including sensitivity, specificity, predictive values, and Youden's Index (J), are reported in Table 6. ROC analyses were used to select cutoffs that prioritized sensitivity while maintaining acceptable specificity.

In general, the questionnaire achieved high sensitivity across most domains, correctly identifying the majority of patients with clinically relevant conditions. For example, the anxiety index detected approximately 84% of cases with elevated STAI scores, the ADHD index achieved 92% sensitivity relative to CAARS,

TABLE 6 | ROC performance metrics and youden's index (*J*) for each domain.

Dimension	Cutoff	Sensitivity	Specificity	PPV	NPV	Youden (J)
Anxiety (STAI—State)	1.25	0.84	0.52	0.56	0.82	0.36
Anxiety (STAI—Trait)	1.25	0.86	0.50	0.51	0.85	0.36
ADHD (CAARS)	1.40	0.92	0.52	0.19	0.98	0.44
Impulsivity (BIS)	1.00	0.93	0.58	0.81	0.82	0.51
Addiction (MULTICAGE)	1.42	0.72	1.00	1.00	0.11	0.72
Insomnia (ISI)	1.00	0.92	0.36	0.38	0.92	0.28
Social phobia (SPIN)[a]	0.50	0.96	0.32	0.49	0.92	0.28
Depression (BDI-II)[a]	1.18	0.86	0.65	0.44	0.93	0.51
Personality (TCI-R)[a]	0.75	0.85	0.53	0.62	0.80	0.38
Quality of life (SDI)[a]	0.71	0.78	0.36	0.84	0.29	0.14

[a]Values derived from intermediate ROC analysis where final-phase estimates were not available.

and the impulsivity index captured 93% of patients with high BIS scores. Consistent with this design, specificity was more modest (0.32–0.65), reflecting a trade-off toward minimizing false negatives. For instance, the anxiety and insomnia indices showed lower specificity, indicating some over-identification relative to the gold standards. In contrast, the addiction severity index was calibrated differently, achieving perfect specificity (1.00) with lower sensitivity (0.72), prioritizing avoidance of false positives.

Youden's Index, reported in Table 6, provides a summary measure of discrimination and supports these patterns. The highest discrimination was observed for addiction ($J = 0.72$), followed by impulsivity and depression ($J = 0.51$), indicating strong classification performance. Moderate discrimination was observed for ADHD ($J = 0.44$) and anxiety (0.36), while lower values were observed for insomnia and social phobia (0.28) and quality of life (0.14), suggesting reduced separation between severity levels in these domains.

Across domains, PPV varied substantially (e.g., 0.19 for ADHD vs. 0.81 for impulsivity), reflecting differences in prevalence and threshold selection. In contrast, NPV remained consistently high (> 0.80), indicating that individuals classified as not having severe problems were unlikely to meet clinical thresholds on the corresponding instruments.

3.4 | Dimensional Structure: Exploratory and Confirmatory Factor Analyses

The exploratory factor analysis in the full clinical sample yielded a four-factor solution with adequate global fit and strong psychometric properties. As noted above, eight items with low loadings, low communalities, or excessive cross-loadings were removed, resulting in a refined version of the questionnaire with four correlated dimensions explaining 41.8% of the total variance. Factor loadings for all retained items were above 0.30 and communalities exceeded 0.25, indicating that each item contributed meaningfully to its respective latent factor. Factor correlations ranged from 0.22 to 0.54, suggesting related but non-overlapping symptom domains.

The four factors can be summarized as follows:

3.5 | PA1—Emotional Distress and Gambling-Related Impairment

This dimension reflects negative affective states, emotional dysregulation, arousal disturbance, and the functional impact of gambling. High scores indicate marked tension, anxiety, internal restlessness and fatigue, dissatisfaction with sleep, and perceived deterioration in social life and daily activities linked to gambling. Representative items include feeling "stunned, tense, overexcited or agitated," feeling "oppressed, distressed or uneasy," reduced interest in other activities or people, increased fatigue, and perceiving that social and leisure activities are being harmed by gambling behavior. It also encompasses items related to automatized gambling and concealment or minimization of gambling behavior, capturing the reinforcement and progressive centrality of gambling in daily life.

3.6 | PA2—Impulsivity and Reward-Driven Activation

This factor captures a pattern of behavioral disinhibition, reward seeking, and heightened internal activation. Patients with elevated PA2 scores report feeling driven by an "internal motor," acting and speaking without thinking, interrupting others, experiencing difficulty remaining still, and frequently seeking novel or exciting situations. The dimension also includes unpredictable mood changes and a tendency to offend or annoy others unintentionally, which are consistent with impulsive and hyperactive profiles commonly observed in GDD. Clinically, this domain reflects reward sensitivity, approach motivation, and novelty seeking within RDoC positive valence systems, alongside deficits in inhibitory control.

3.7 | PA3—Social Anxiety and Interpersonal Suspiciousness

PA3 reflects alterations in social processes combined with threat sensitivity. It comprises fear of criticism and social avoidance, autonomic anxiety symptoms in interpersonal contexts (e.g., palpitations, trembling, blushing), persistent feelings of loneliness despite being with others, and suicidal ideation associated with isolation. In addition, the factor captures distrust, feelings of being watched or criticized, beliefs that others seek to take advantage of the patient, and a tendency to

blame others for personal problems. High PA3 scores therefore characterize a profile of social threat, suspiciousness, and fragile attachment, which is very common among patients with GD and severe dual psychopathology.

3.8 | PA4—Executive Dysfunction and Negative Self-Perception

The fourth dimension integrates executive deficits, motivational depletion, and negative self-assessment. Patients scoring high on PA4 report difficulties in organizing, planning, concentrating, and completing tasks; forgetfulness of important matters; rapid loss of interest; and low perceived self-efficacy. The factor also includes changes in appetite and eating control, low self-esteem, feelings of guilt or failure, difficulties expressing emotions, and subjective impressions that "something is wrong" with one's mind. In clinical terms, PA4 combines cognitive control and working memory problems with anhedonia, loss-related processes, and negative self-referential processing, a pattern frequently observed in complex dual disorder presentations. Although some overlap exists (e.g., low motivation, poor concentration), this dimension reflects cognitive control deficits, whereas depressive features reflect negative self-perception and loss-related processes.

CFA results confirmed the adequacy of this four-factor model. The model with four correlated latent factors showed excellent fit (CFI = 0.978; TLI = 0.977; RMSEA = 0.064, 90% CI [0.060, 0.067]; SRMR = 0.078; GFI = 0.97), with all standardized factor loadings in the expected direction and statistically significant. These findings support a stable and clinically interpretable dimensional structure that goes beyond categorical diagnoses and is compatible with contemporary transdiagnostic models of psychopathology.

Table 7 summarizes the mapping of each factor onto the main RDoC domains and constructs, illustrating how the instrument captures key neurobiopsychological systems relevant to GDD.

4 | Discussion

This study validates a novel psychometric questionnaire designed to stratify patients with GD by the severity of co-occurring psychopathology (dual disorders). Overall, the findings indicate that the instrument has strong reliability and sound validity, supporting its use as a multidomain assessment tool for clinical stratification and transdiagnostic characterization in patients with GD. In our sample of treatment-seeking individuals with GD, virtually all patients endorsed symptoms in multiple domains, underscoring the high prevalence of other mental health conditions in this population (Kessler et al. 2008; Dowling et al. 2015). This aligns with prior epidemiological and clinical reports that up to 96% of people with GD have at least one additional psychiatric disorder (Kessler et al. 2008) and about 75% of treatment-seeking gamblers present a lifetime comorbidity (Dowling et al. 2015). Such data reinforce the rationale for an integrated assessment approach. Indeed, our results support the clinical utility of conceptualizing gambling disorder within a multidimensional "gambling dual disorder" framework, without defining or validating a new diagnostic entity (Szerman et al. 2020). By capturing a broad range of psychopathological symptoms, the new questionnaire addresses a critical gap left by traditional gambling screens like the South Oaks Gambling Screen (SOGS) of Problem Gambling Severity Index (PGSI), which focus solely on gambling behavior and do not evaluate comorbid conditions (Stinchfield 2002; Holtgraves 2009). The present findings therefore have important implications for both clinical practice and research, providing a means to identify complex cases that might benefit from more intensive, dual-focused interventions (Szerman et al. 2023).

The conceptual framework of the instrument is directly grounded in prior literature on dual disorders and transdiagnostic models of psychopathology. The dual disorder perspective has consistently emphasized that GD co-occurs with multiple interacting psychiatric domains rather than isolated conditions (Szerman et al. 2020, 2023), which informed the multidomain structure of the scale. At the same time, the selection and organization of domains were aligned with RDoC principles (Insel et al. 2010; Cuthbert 2014), which conceptualize mental disorders in terms of functional systems such as negative valence, cognitive control, and reward processing. Empirical findings on impulsivity, affective dysregulation, and executive dysfunction in GD (Ioannidis et al. 2019; Freinhofer et al. 2020; Potenza et al. 2019) further guided item inclusion and domain representation. The final structure of the instrument reflects a synthesis of clinical evidence on comorbidity patterns and established dimensional frameworks.

Consistent with this conceptual framework, the factor-analytic results show that the questionnaire captures four latent dimensions rather than reproducing categorical diagnoses. The first factor aligns with negative valence and arousal systems, reflecting emotional distress, sleep disturbance, and functional impairment associated with gambling. The second factor combines cognitive control and positive valence systems, indexing impulsivity, behavioral activation, and reward-driven approach behavior. The third factor is rooted in Social Processes and Negative Valence, encompassing social anxiety, interpersonal suspicion, and loneliness. Finally, the fourth factor integrates Cognitive Systems with loss-related and self-referential processes, describing executive dysfunction, motivational depletion, and negative self-perception. Together, these dimensions provide a transdiagnostic representation of GDD that is consistent with modern dimensional models of psychopathology and addiction.

From a clinical standpoint, the four RDoC-informed domains complement the domain-specific indices (e.g., anxiety, ADHD, impulsivity, insomnia, depression) and the global severity index previously described. While the original indices allow clinicians to identify specific other categorical mental health conditions, the four-dimensional structure offers a higher-order view of how symptoms cluster into clinically meaningful patterns (e.g., impulsive–hyperactive profiles, socially anxious–suspicious profiles, cognitively impaired–depressed profiles). This combined information enhances the capacity of the instrument to discriminate levels of severity in dual disorder and GD: patients with high scores across multiple dimensions, particularly PA1 (emotional distress and gambling impairment) and PA4 (executive dysfunction and negative self-perception), tend to present more complex clinical pictures,

TABLE 7 | Mapping of the four latent dimensions to RDoC domains and constructs.

Factor	Negative valence systems	Positive valence systems	Cognitive systems	Social/Arousal systems
PA1: Emotional distress and gambling-related impairment	Acute threat (fear), loss (hopelessness, fatigue, loss of interest)	Habit/Reinforcement learning (automatized gambling)	—	Arousal and circadian regulation (sleep disturbance)
PA2: Impulsivity and behavioral activation	—	Approach motivation, reward seeking (novelty and excitement)	Cognitive control—inhibitory control (acting without thinking)	Arousal/activation (internal "motor")
PA3: Social anxiety and interpersonal suspiciousness	Acute threat (social fear), sustained threat, loss (loneliness, suicidal ideation)	—	—	Social processes—perception and understanding of others, affiliation/attachment, interpersonal distrust
PA4: Executive dysfunction and negative self-perception	Loss/Anhedonia (loss of interest, motivational depletion)	—	Cognitive control—working memory, planning, organization, flexibility	Self-referential processing and emotional expression (negative self-evaluation, guilt, difficulty expressing feelings)

higher functional impairment, and potentially poorer prognosis. In contrast, individuals with more restricted elevations (e.g., predominantly impulsive activation on PA2) may benefit from more targeted interventions focusing on behavioral control and relapse prevention. Thus, the dimensional structure derived from the factor analyses not only strengthens the psychometric foundations of the scale, but also refines its utility for stratifying clinical severity and guiding integrated treatment planning in GDD.

The questionnaire showed strong psychometrics and clinical utility. Internal consistency was excellent ($\alpha = 0.93$), with no item or subscale removal improving alpha, and test–retest reliability over about 3 weeks was moderate overall with ICCs roughly 0.30 to 0.60, highest for ADHD and personality traits and lowest for addiction severity. Small decreases at retest for ADHD and impulsivity likely reflected clinical change or familiarity effects, and categorical agreement was only fair with κ around 0.30 to 0.50 and very low for insomnia, which is highly state dependent. Convergent validity was adequate to strong across domains, for example anxiety with STAI r about 0.51–0.52, depression with BDI–II r about 0.30–0.50, insomnia with ISI r about 0.57, and impulsivity with BIS r about 0.72, consistent with the central role of impulsivity in GD (Ioannidis et al. 2019; Freinhofer et al. 2020; Austin et al. 2023). The ADHD index correlated in the moderate range with CAARS, aligning with the high ADHD burden in this population (Fatseas et al. 2016; Retz et al. 2016). Data driven ROC optimization yielded pragmatic cutoffs, for example anxiety 1.25, ADHD 1.40, impulsivity 1.00, which favored sensitivity with variable PPVs by prevalence, notably low for ADHD about 0.19 and high for impulsivity about 0.81, while NPVs were generally above 0.80, appropriate for screening (Castillo et al. 2010). This pattern supports the use of the instrument as a screening-oriented tool, where minimizing false negatives is prioritized in clinical settings. A global severity threshold around 1.44 supported stratification of dual disorder severity with clear treatment implications and complements DSM-5-TR severity staging for GD (American Psychiatric Association 2022).

4.1 | Clinical Implications

The validated questionnaire provides clinicians with a rapid yet comprehensive means of assessing other mental health conditions in patients with GD. Traditional tools such as the SOGS or PGSI focus solely on gambling severity, often overlooking co-occurring conditions that influence outcomes. Furthermore, they are not aligned with DSM-5 criteria. By evaluating 10 domains in one instrument, this tool improves detection of dual disorders, informs treatment planning, and aligns with modern precision psychiatry perspectives on GD. Elevated ADHD scores, for example, can signal attentional and impulsivity issues that worsen relapse risk if untreated (Fatseas et al. 2016; Retz et al. 2016; Vintró-Alcaraz et al. 2024). Similarly, high depression and anxiety scores highlight the need for concurrent mood-focused interventions to enhance gambling recovery. Quantifying severity across domains supports treatment stratification, ensuring that complex cases with high comorbidity receive integrated dual-disorder care (Szerman et al. 2020). The instrument's global severity index enables clinicians to obtain a holistic view of GD as part of a broad, multidimensional psychopathological network, facilitating better understanding of the burden, progress, and treatment of GD.

4.2 | Theoretical Implications

The questionnaire offers a standardized framework for quantifying dual disorder existence and severity in GD, advancing research comparability across samples and designs. It allows stratification according to psychopathological burden, facilitates subgroup analyses in clinical trials, and enables efficient large-scale screening without the need for diagnostic interviews. This tool also supports precision psychiatry efforts by linking specific symptom profiles to neurobiological markers and

refining the concept of the GD spectrum (Freinhofer et al. 2020; Szerman and Peris 2018). Adaptations could extend its use to other behavioral addictions, such as gaming disorder, and its data may help empirically define subtypes—impulsivity-driven versus anxiety–depression profiles—consistent with earlier findings (Szerman et al. 2023). As an outcome measure, it could assess whether integrated dual-disorder treatments outperform gambling-only interventions (Szerman et al. 2020). Ultimately, this instrument provides a clinically grounded yet research-ready platform that operationalizes a multidimensional understanding of GD consistent with modern addiction frameworks (Grant et al., 2005; Petry et al. 2018).

5 | Conclusion, Limitations and Future Research

This study aimed to develop and validate a new psychometric questionnaire to discriminate the severity of dual disorders in patients with GD. Drawing on prior work that identified distinct clinical profiles of gamblers with high versus low comorbid psychopathology, we constructed 55-item instrument encompassing key domains such as mood, anxiety, ADHD symptoms, impulsivity, insomnia, and personality traits. The questionnaire was tested in a sample of 223 adult GD patients across three phases (development, reliability assessment, and validity testing). Our results indicate that the tool has excellent internal consistency and acceptable test–retest reliability. The instrument's domain scores showed significant positive correlations with established standardized measures for each construct (e.g., depression, anxiety, impulsiveness), demonstrating good convergent validity. By performing ROC analysis, we optimized cutoff scores for each domain and for a global severity index, which allowed classification of patients into severity categories. The questionnaire was able to identify GD patients with multiple co-occurring mental health conditions with high sensitivity and yielded high negative predictive values, meaning that a negative screening result effectively ruled out severe comorbidity in that domain. This new instrument can be completed quickly and provides a reliable and valid assessment of both the presence and severity of GD according to the presence of other psychiatric symptoms. It also distinguishes patients with more severe and complex conditions from those with more limited psychopathology. In addition, factor-analytic modeling revealed a stable four-dimensional structure that aligns with key some RDoC domains, integrating emotional distress, impulsive activation, social threat, and executive/self-referential dysfunction into a coherent framework for understanding dual disorder severity in gambling.

5.1 | Limitations

Several limitations should be considered when interpreting these findings. First, the sample consisted primarily of treatment-seeking individuals with Gambling Disorder, approximately 86% of whom were male. Although this demographic pattern is common in clinical studies of gambling, it may limit generalizability to women and to community or non-treatment-seeking populations. Second, all measures were based on self-report, which introduces potential recall and social desirability biases. Third, the 3-week test–retest interval occurred during active treatment, meaning that the reliability estimates obtained here likely underestimate true temporal stability. Fourth, although both the EFA and CFA supported a coherent four-factor structure, future research should test higher-order models (e.g., a potential general dual-disorder factor) and conduct measurement invariance analyses across demographic and clinical subgroups. Finally, because this was a cross-sectional validation study, predictive validity could not be established; longitudinal research is needed to determine whether the questionnaire prospectively predicts relapse, recovery trajectories, or treatment outcomes.

5.2 | Future Directions

Future studies should validate the questionnaire in more diverse and international samples, including a higher proportion of women and non-treatment-seeking gamblers. Longitudinal research could evaluate whether baseline scores predict clinical trajectories such as relapse or improvement, establishing the tool's prognostic utility. The questionnaire may also serve as a multidimensional outcome measure in trials comparing integrated versus gambling-specific treatments, helping capture improvements across comorbid domains. Psychometric refinement through factor analysis or item-response modeling could streamline the scale and enable digital or adaptive versions for routine screening. Cross-cultural measurement invariance and psychometric performance in non-Spanish samples remain to be tested. Lastly, adapting this framework to other behavioral addictions, such as gaming disorder, may broaden its relevance and support early detection of emerging dual disorders.

Author Contributions

Ignacio Basurte-Villamor: conceptualization, validation, writing – original draft, funding acquisition, investigation, formal analysis, project administration, resources, data curation. **Ismael Gomez-Talal:** methodology, visualization, writing – original draft, investigation, software, data curation, conceptualization. **Pablo Vega:** conceptualization, investigation, project administration, validation. **Mana Azizsoltani:** conceptualization, investigation, writing – review and editing, methodology, software. **Javier Gonzalez-Peñas:** conceptualization, investigation, validation, supervision. **Francisco Ferre:** project administration, resources, funding acquisition, investigation, validation. **Nestor Szerman:** conceptualization, investigation, writing – review and editing, validation, project administration, formal analysis, supervision, resources, funding acquisition.

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Ethics Statement

The study was conducted in accordance with the Declaration of Helsinki and applicable national regulations. Ethical approval was obtained from the Research Ethics Committee with Medicines (CEIm) of the Hospital

General Universitario Gregorio Marañón (Madrid, Spain) (Reference: FPD-IPSM-2023-01; approval date: January 23, 2023). All participants, or their legal representatives, were fully informed about the objectives and procedures of the study, and written informed consent was obtained prior to participation.

Conflicts of Interest

During the past 5 years, Dr. Pablo Vega has received honoraria or expense reimbursements from Camurus and Casen Recordati. He has served on advisory boards for Gilead and received funded research support from Exeltis. These activities were academic and non-promotional, and none influenced the design, conduct, or interpretation of the present research. Over the past 3 years, Dr. Mana Azizsoltani and Dr. Ismael Gómez-Talal have either worked on projects funded by or have personally recieved funding, honoraria, travel reimbursement, or consulting fees from AXES. ai, Inspire Entertainment, Walker Digital Table Systems, Melco Resorts, Crown Melbourne, Mohegan, Bally's Resorts, Wynn Resorts, GMA Consulting, the Nevada Council on Problem Gambling, and the Nevada Department of Health and Human Services. During the past 5 years, the International Gaming Institute (IGI) at University of Nevada, Las Vegas, has received research and program funding from DraftKings Inc., the American Gaming Association, ESPN, MGM Resorts International, Wynn Resorts Ltd, Las Vegas Sands Corporation, Entain Foundation, Aristocrat Gaming, San Manuel Band of Mission Indians, Axes. ai, Sports Betting Alliance, Playtech, Sightline Payments, Global Payments, the State of Nevada Knowledge Fund, and the State of Nevada Department of Health and Human Services. IGI runs the triennial research-focused International Conference on Gambling and Risk Taking, whose sponsors include industry, academic, and legal/regulatory stakeholders in gambling. A full list of sponsors for the most recent conference can be found at https://www.unlv.edu/igi/conference/18th/sponsors. IGI maintains a strict research policy (https://www.unlv.edu/igi/research-policy), as well as partnership and transparency framework (https://www.unlv.edu/igi/policies/partnership) to ensure appropriate firewalls exist between funding entities—no matter the entity's classification—and IGI's research and programs. During the past 5 years, Dr. Nestor Szerman has either worked on projects or has received honoraria or consulting fees from Gedeon Richter and Recordatti, Lundbeck, Lilly Inc. He has also served on the advisory board and given talks with Lunbeck/Otsuka and Eli Lilly Inc. None of these entities had any role in the design, analysis, or interpretation of the present study and imposed no constraints on its publication.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Endnotes

[1] Full technical details of the EFA and CFA including item-level parameters and fit indices are provided in the supplementary material.

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APPENDIX A

TABLE A1 | Gambling dual-disorder scale (55 items).

Items (mark one response per item)
1. I feel dazed, tense, overexcited and/or unsettled
2. I feel very constrained, as if oppressed, anxious, uneasy
3†. I feel happy, joyful, calm, secure, satisfied and relaxed
4†. I am a calm, serene and composed person
5. I feel that my social life and leisure activities are being harmed by my problem
6. How much have personal problems and adverse events in different areas of your life (work, family, health, finances...) made things difficult for you?
7†. Do you feel supported by your environment?
8†. Are you satisfied with your current sleep? Do you sleep well?
9. I am afraid of being criticized and avoid social relationships
10. When interacting, I feel fear, palpitations, tremor; I blush
11. Do you like betting with money?
12. Do you deny, hide, or minimize your gambling behavior for fear of criticism?

(Continues)

TABLE A1 | (Continued)

Items (mark one response per item)
13. Have you ever felt guilty about your way or pattern of drinking?
14. Have you unsuccessfully tried to reduce or control unnecessary or excessive spending on gambling?
15. Are you worried that you have lost control over how much you eat?
16. Have you experienced any change in your appetite?
17. I have difficulties organizing, planning, concentrating, and finishing the tasks I start
18. I feel very active and driven to do things, as if I had a motor inside
19. I interrupt other people when they are busy
20. I think I act impulsively
21. I say and do things without thinking
22. I think and/or speak quickly
23. I get distracted or bored easily
24. It is hard for me to stay still for long periods of time
25. I wish I had more confidence in my abilities
26. I regret saying or acting hastily
27. I have unpredictable mood swings; I am irritable, lose my temper, or feel offended easily
28. I lose interest in things very quickly
29. I offend or annoy others unintentionally
30. I forget important things
31. I have little interest in sex
32. I have lost interest in other activities or people
33. I feel like a failure, insecure, and/or guilty
34. I am more tired or fatigued than usual
35†. I show myself optimistic about the future
36. I have had thoughts of harming myself or wanting to commit suicide
37. Do you feel lonely even when you are with other people?
38. Do you blame others for most of your personal problems?
39. I consider myself distrustful
40. I think people intend to take advantage of me
41. I have to check things I do over and over again
42. I feel lonely and/or abandoned
43. I am afraid of places or situations that could cause me panic and make me feel trapped
44. I show myself distant toward people and try not to form bonds with them
45. I have felt observed and/or criticized by others
46. I feel that others do not give me enough credit for my achievements
47. When nothing new happens I tend to look for something exciting or novel
48. I have little willpower to resist strong temptations even though I know I will suffer the consequences
49. I expect someone else to solve my problems
50. I tend to rely on intuition, hunches, or instincts without considering all the details
51†. I like to strive to achieve more and better things each time
52†. I usually respect others' opinions as well as the rules
53†. I have no difficulties expressing my feelings and experiences
54. I think something is wrong with my mind
55. I consider myself a spiritual or religious person

Note: Response options (for all items): 0 = Never/Rarely; 1 = Occasionally; 2 = Often; 3 = Almost always/Always. Items marked with† are reverse scored.