Obsessive-compulsive, harm-avoidance and persistence tendencies in patients with gambling, gaming, compulsive sexual behavior and compulsive buying-shopping disorders/concerns

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ABSTRACT

Background and aims: There is a growing interest in determining the specific role of obsessive-compulsive features in different behavioral addictions. However, more studies comparing sizable clinical populations with different addictions are needed.Therefore, a main aim of the present study was to explore the presence of obsessive-compulsive features among people with different behavioral addictions (gambling disorder, internet gaming disorder, compulsive sexual behavior disorder and compulsive buying-shopping concerns). Through a clustering procedure, the existence of empirical clusters among treatment-seeking patients based on obsessive-compulsive measures was explored. **Materials and methods:** The Symptom Checklist-Revised, and the Temperament and Character Inventory-Revised were obtained from 4,010 treatment-seeking patients. Obsessive-compulsive features were measured with the obsessive-compulsive subscale of the Symptom Checklist-Revised and the harm avoidance and persistence dimensions of the Temperament and Character Inventory-Revised. Cluster analysis was applied to explore the existence of empirical groups based on obsessive-compulsive features. **Results:** Patients with compulsive sexual behavior disorder and compulsive buying-shopping disorder reported the highest scores on the obsessive-compulsive subscale, while patients with gambling disorder showed the lowest scores on harm avoidance, and patients with internet gaming disorder the lowest scores on persistence. Two mutually exclusive clusters were identified. Cluster 1 exhibited a more maladaptive psychopathological and personality profile than cluster 2. **Discussion and Conclusions:** These results provide new evidence regarding obsessive-compulsive features in specific behavioral addictions. Therapeutic approaches should consider that different addictions may present distinct levels of obsessive-compulsive features.

Keywords: obsessive-compulsive behaviors; impulsive behaviors; addictive behaviors; video games; gambling; compulsive sexual behaviors.

INTRODUCTION

Scientific interest exists in better understanding obsessivity, compulsivity, impulsivity, and addictive behaviors given their clinical relevance. There exists overlap and co-occurrence among these constructs, and obsessive-compulsive disorder (OCD) and obsessive-compulsive-related disorders (OCRDs), impulse control disorders (ICDs) and addictions show similarities with respect to phenomenology, pathophysiology and comorbidity (Fontenelle et al., 2011). Given similarities and new data gathered, changes in diagnostic classification, theoretical models and clinical interventions have occurred over time.

On the one hand, of the different disorders currently considered as OCRDs (e.g., body dysmorphic disorder, hoarding disorder, trichotillomania, and excoriation (skin picking) disorder) in the fifth edition of the Diagnostic and Statistical Manual (DSM-5) (APA, 2013), trichotillomania was previously classified as an ICD (APA, 1994). However, it has recently been proposed that these disorders may present with different levels of impulsivity and/or compulsivity (Fineberg et al., 2022; Fontenelle et al., 2021). Some authors have suggested categorizing OCD as an addiction, since individuals with this disorder may present with high levels of impulsivity, biased probabilistic reasoning, and risky decision-making, as occurs in the case of substance and non-substance addictions (Denys et al., 2004; Grassi et al., 2016; Holden, 2001). On the other hand, some consider conditions such as gambling disorder (GD), internet gaming disorder (IGD), compulsive sexual behavior disorder (CSBD), and compulsive buying-shopping concenrs (CBSCs) as behavioral addictions given multiple similarities with substance use disorders (Grant et al., 2006, 2010; Kraus et al., 2016; Vereczkei et al., 2022)[1]. However, international diagnostic manuals such as the DSM and the the International Classification of Diseases (ICD) initially classified them as ICDs (APA, 1994; WHO, 2019), and only GD has subsequently come to be categorized as "Substance Related and Addictive Disorders" in the DSM-5 (APA, 2013). The ICD-11 correlate of IGD has been classified as a “Disorder due to Addictive Behaviors” (WHO, 2020). However, some studies report similarities between Substance Related and Addictive Disorders and OCD (Figee et al., 2016). The multiple theoretical proposals and dialog among researchers and clinicians highlight complexities regarding classification considerations.

Compulsivity, that may be defined as involving “the performance of repetitive and functionally impairing overt or covert behavior without adaptive function, performed in a habitual or stereotyped fashion, either according to rigid rules or as a means of avoiding perceived negative consequences” (Fineberg et al., 2014), is a transdiagnostic factor relevant across these clinical conditions (Figee et al., 2016; Fineberg et al., 2014). It has been hypothesized that these disorders show different levels of compulsivity (Kim et al., 2017), making some of them more phenotypically compulsive (such as IGD), and others, (such as GD, CSBD, and CBD), more phenotypically impulsive (Vats et al., 2021).

Regarding compulsivity, IGD has been associated with cognitive inflexibility (Kim et al., 2017; Klugah-Brown et al., 2021; Morris & Voon, 2016). Obsessive-compulsive (OC) tendencies have been linked to GD, with genetic underpinnings implicated (Bottesi et al., 2015; Scherrer et al., 2015). GD-related deficits have been reported in specific cognitive domains, including cognitive flexibility, attentional set-shifting, and attentional bias (Leeman & Potenza, 2012; van Timmeren et al., 2018). Gender-related differences have been reported in individuals with GD in terms of compulsivity (Mallorquí-Bagué et al., 2021). CBSCs have also been associated with OC tendencies, with individual differences noted. Specifically, some authors have suggested the existence of three profiles: compulsive-impulsive buyers, impulsive excessive buyers, and ordinary buyers (Yi, 2013). Finally, OC tendencies have been identified in individuals with CSBD. Specifically, it has been suggested that they contribute to addiction, especially in individuals who use the internet for the

[1] Throughout this study, these clinical conditions will be referred to as behavioral addictions.

purpose of finding sexual partners (Levi et al., 2020). However, CSBD may be more linked to impulsivity than compulsivity (Bőthe et al., 2019; Raymond et al., 2003).

Although compulsivity may contribute importantly to behavioral addictions, few studies have examined relationships using the same measures across different addictions simultaneously. The clinical groups included in the present study with the exception of CBSCs (GD, IGD, and CSBD) were selected because (with the exception of CBSCs) they are the only three entities accepted by at least one of the international diagnostic manuals (ICD / DSM). Even though CSBD is included in the ICD-11 as an impulse control disorder and CBSCs are not included in the DSM or ICD, both CSBD and CBSCs have been described as being addictions in nature (Brand et al., 2020; Kraus et al., 2016; Stark et al., 2018), with the terminology of "other specified disorder due to addictive behaviors" being a possible ICD-11 term that may be applied. Other entities (e.g., problematic use of social media) were not significant clinical concerns at the time which data collection commenced, and few people have been seen at our clinic to date for such concerns.

The main aims of the present study were: a) to compare OC levels between patients treatment seeking for GD, CBSCs, CSBD and IGD; b) to explore correlations between OC features (OC, harm-avoidance, and persistence tendencies) and clinical features (onset and duration of the behavioral addictions, as well as substance use); c) to explore associations between sociodemographic measures and OC features; and d) to explore through a clustering procedure the existence of empirical clusters among the treatment-seeking patients based on OC features.

Based on the cumulative evidence reported in the scientific literature (Kim et al., 2017), we hypothesized that the different behavioral addictions would show different severity levels related to OC, persistence, and harm-avoidance, and that the existence of differentiated latent empirical clusters would be identified and relate to quantitative and qualitative OC classes (Bottesi et al., 2015; Scherrer et al., 2015).

MATERIAL AND METHODS

Participants and procedure

The sample included n=4,010 treatment-seeking patients consecutively attending the Pathological Gambling and other Behavioral Addictions Unit at the Bellvitge University Hospital (Barcelona) and treated from January 2005 to March 2022. Inclusion criteria were: (1) 18 years or older; and (2) to seek treatment for GD, CBSCs, CSBD, or IGD as a primary health concern. Exclusion criteria were: (1) history of chronic medical illness or neurological condition that might affect cognitive function; and (2) brain trauma, a learning disability, or intellectual disabilities. Given the long period of data collection, the existence of a relationship between the year of recruitment and the means in the basic measures of the study has been explored through one-factor analysis of variance. No significant differences were observed for the measures SCL-90R obsessive-compulsive ($F_{[df=16;3993]}=0.96$, $p=0.498$), TCI-R harm avoidance ($F_{[df=16;3993]}=0.83$, $p=0.658$), and TCI-R persistence ($F_{[df=16;3993]}=1.16$, $p=0.298$).

The assessment was conducted prior to starting treatment and was done in a single session lasting approximately 90 minutes. Data for the semi-structured interview were collected by psychologists and psychiatrists with extensive experience of the treatment of behavioral addictions.

The data were collected in accordance with the Declaration of Helsinki principles, and the study was approved by the Ethics Committee of the University Hospital of Bellvitge. All patients provided signed informed consent to participate in the research. There was no financial or other compensation for being part of the study.

Measures

Symptom Checklist-Revised (SCL-90-R) (Derogatis, 1997)

The SCL-90-R assessed participants' psychological states. The instrument includes 90 items measuring diverse psychological symptom/concerns. The tool is structured into nine primary subscales (somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism) and three global indices [global severity index (GSI), total positive symptoms (PST), and positive symptoms discomfort index (PSDI)]. The Spanish adaptation used in this study obtained adequate properties in psychometric validation studies (mean Cronbach's alpha α=0.75) (Gonzalez De Rivera et al., 2002). The internal consistency in our sample was in the adequate to excellent range (from α=0.79 for paranoid ideation factor to α=0.98 for the second-order global factors). For the present study, the OC subscale was used to assess compulsivity.

Temperament and Character Inventory-Revised (TCI-R) (Cloninger et al., 1994)

This self-report questionnaire was used to assess personality features, based on the Cloninger's multidimensional model. It includes 240 items that structure into 7 factors: 4 dimensions assessing temperament (novelty-seeking, harm-avoidance, reward-dependence, and persistence), and 3 assessing character (self-directedness, cooperation, and self-transcendence). The Spanish version used in this work obtained adequate psychometric indexes in the validation studies (mean Cronbach's alpha α=0.87) (Gutiérrez-Zotes et al., 2004). The internal consistency in the study sample was in the adequate to good range (from α=0.71 for novelty-seeking to α=0.84 for self-transcendence). For the present study, the harm-avoidance and persistence dimensions were used to assess compulsivity. Regarding harm-avoidance, low scores on this dimension would indicate that the individual has a higher tendency to be optimistic, daring, outgoing, and vigorous. However, elevated levels of harm-avoidance have been associated with OCD and anxiety disorders due to individuals with this trait are described as pessimistic, shy, worried about the future, doubtful, anxious, and easy to exhaust. Regarding persistence, individuals with reduced levels of persistence have been described as apathetic, spoiled, underachiever, and pragmatist, whereas those with high persistence have been defined as industrious, determined, ambitious, and especially perfectionist (a trait highly associated with compulsivity).

Other variables

The other sociodemographic and clinical variables analyzed in the study were assessed through a semi-structured clinical interview. Socio-demographic characteristics included age, gender, marital status, education level and employment, with the socio-economic status index calculated according to Hollingshead's scale (based on employment status, level of education and occupational prestige) (Hollingshead, 2011). Clinical variables were also assessed, such as age at onset and duration of the behavioral addiction and use of substances (alcohol, tobacco, and other drugs).

Statistical analysis

Stata17 for Windows (Stata-Corp, 2021) was used for statistical analyses. First, comparisons between the groups defined for the behavioral addiction subtypes was based on chi-square tests for categorical variables (χ^2) and one-way analyses of variance (ANOVAs) for quantitative measures. The comparison of the OC measures was done with analysis of covariance (ANCOVA) adjusted for gender and age.

The association of the OC measures with the onset and duration of the behavioral addictions and with the substances use was calculated with partial correlations, adjusted for gender and age. Due the strong association between the sample sizes and the correlation significance tests (coefficients with low effect sizes achieving high significance levels [very low p-values]), these measures were interpreted as relevant based on the effect size: mild-moderate for |R|>0.24 and high-large for |R|>0.37 (these are the equivalent thresholds for Cohen's-d equal to 0.50 and 0.80) (Cohen, 1988).

The statistical predictive capacity of the sociodemographic measures (independent variables) with the OC measures (dependent variables) was obtained with multiple regression models. The ENTER procedure was used to simultaneously enter and fix the list of predictors and to obtain the specific contribution of each measure.

Finally, cluster analysis was used to identify the latent empirical classes based on the OC measures. The Calinski-Harabasz's index was used to assess the clustering performance, and as a criterion to select the optimal number of clusters (Calinski & Harabasz, 1974). This coefficient provides a measure of the distinctiveness between the groups, and it is calculated comparing the between-cluster dispersion versus the within-cluster dispersion. No bound/range was used to value/interpret the accuracy of the clustering, and higher scores reflect more well-defined clusters.

In this work, the estimation of the effect sizes for the proportion and mean differences was based on the standardized Cohen's coefficients (h-coefficient for proportions and d-coefficient for means), considering the thresholds of 0.50 and 0.80 for mild-moderate and large-high effects, respectively (Kelley & Preacher, 2012). The increase in Type-I errors due to the multiple statistical tests for comparing clusters was controlled with the Finner method (included in the stepwise family-wise error-rate procedures) (Finner, 1993).

RESULTS

Descriptive for the sample

Table 1 shows the descriptive data for study participants, as well as comparisons between the diagnostic groups. Most participants were male (89.9%), married (43.8%) or single (42.9%), with low education levels (53.7% primary), considerable employment (59.7%) and frequent mean-low to low socio-economic status (80.9%). Mean age was 40.8 years (SD=13.2), mean onset of the behavioral addiction 29.1 years (SD=11.5) and mean duration of the addictions 6.9 years (SD=5.9). Prevalence of tobacco use was around 60%, 15% for alcohol and 11% for other substances.

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OC features between groups

Table 2 contains the results of ANCOVA comparing OC features by group, adjusting for gender and age. The highest mean scores for the SCL-90-R OC scale were reported by patients with CBSCs and CSBD. The TCI-R harm-avoidance level was the lowest for patients with GD, and the TCI-R persistence was the lowest for those with IGD.

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Adjusting for gender and age, SCL-90-R OC scores correlated with onset and duration of CSBD, with higher OC scores related to older age of onset and shorter duration of illness. No other relevant correlations were obtained between OC measures with the onset and duration of the addictions, nor with substance-use measures (Table S1, supplementary material).

Table 3 shows associations between socioeconomic and OC measures, obtained via multiple regression analyses. The relationships varied according to disorder and OC measure. Higher SCL-90-R OC scores were associated with being: a) women, non-married, employed and within low education groups among GD patients; b) women and employed, among CBSC patients; and c) older, women, non-married, unemployed and of lower socio-economic status among IGD patients. Higher TCI-R harm avoidance scores were associated with being: a) older, women, non-married, employed, and of low education level and low socio-economic status among GD patients; b) women and employed among CBSC patients; and c) older, women and non-married among IGD patients. Higher TCI-R persistence scores were related to being: a) younger, men, married, unemployed and of higher socio-economic status among GD patients; b) of higher socio-economic status among CBSC patients; c) unemployed among CSBD patients; and d) younger age among IGD patients.

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Clustering procedure

The optimal number of clusters selected in the clustering analysis was two: it achieved the highest distance measure compared with the solution for a higher number of empirical groups (Calinski-Harabasz index: 749.17 for the two groups solution, versus to 435.49 for the three groups solution). The bi-cluster solution also provided adequate clinical interpretation since it achieved discriminative capacity to differentiate sociodemographic and clinical features.

Table 4 contains the results of the comparison between the 2 empirical clusters, for all study variables. Cluster 1 was characterized by including a higher proportion of female patients who were women, non-married, with lower education levels, unemployed and of lower socio-economic status. The behavioral addiction profile was also unequally distributed, with cluster 1 being characterized by the presence of CBSCs and CSBD, older age, and longer duration of the behavioral addiction. Regarding clinical measures, patients within cluster 1 obtained higher likelihoods of illegal drugs, worse psychological states and a more dysfunctional personality profile (higher levels of novelty-seeking, harm-avoidance and self-transcendence, and lower levels of reward-dependence, persistence, self-directedness and cooperativeness).

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DISCUSSION

This study aimed to compare OC levels between patients seeking treatment for GD, CBSCs, CSBD and IGD. Moreover, it aimed to explore correlations between OC features and sociodemographic and clinical features (onset and duration of the behavioral addictions, as well as substance use). Finally, it aimed to explore through a clustering procedure the existence of empirical clusters among the treatment-seeking patients based on OC features.

Most patients were men, employed, of low education levels and mean-low to low socio-economic status, and many reported tobacco use. These findings are consistent with previous studies of behavioral addictions. For example, James et al. (2016) observed that being male and smoking tobacco were linked to GD severity. In addition, lower levels of education, both personal and parental, have also been associated with addictive disorders (Swendsen & Le Moal, 2011).

Specifically, regarding gender, higher prevalences of GD, IGD, and CSBD have been found in males, whereas a higher prevalence of CBSCs have been described in females (Kürbitz & Briken,

2021; Maraz et al., 2016; Mihara & Higuchi, 2017; Subramaniam et al., 2015). These results coincide with those from the present study, resulting in a predominantly male sample.

In the present study, the highest mean scores for the OC (SCL-90-R) subscale were observed in patients with CBSCs and CSBD. In the specific case of CBSCs, it has been debated whether it should be classified along an OC spectrum, considered as an addiction, or categorized as an ICD. The rationale for including it an OC-spectrum category includes several factors. For example, phenomenological similarities between CBSCs and OCD have been described. Both disorders may involve the presence of repetitive behaviors that arise after strong motivations, thoughts or urges. Therefore, in both disorders, behaviors may aim to reduce anxiety/tension and relieve urges (Black et al., 2010). A Delphi study of potential diagnostic criteria for CBSCs recently highlighted the presence of preoccupations and obsessions related to buying/shopping as a characteristic feature. This feature was eventually defined as a "repetitive intrusive thoughts about buying/shopping" criterion (Muller et al., 2021), reflective of a specific diagnostic criterion for OCD (APA, 2013). In addition, it has been suggested that the comorbidity rate between OCD and CBSCs is significantly higher than that reported in the general population (ranging from 4 to 23%), and that greater severity of OC symptoms is associated with greater severity of CBSCs and vice versa (Kim et al., 2018; Lejoyeux et al., 2005; Matsunaga et al., 2005; Mueller et al., 2010).

Regarding CSBD, there has been debate regarding the categorization of this disorder, given that it shows similarities with addictions, ICDs, and OC-spectrum disorders (Fuss et al., 2019). More specifically, individuals with CSBD usually report compulsive behaviors and OC symptoms, substance use, and impulse-control impairments (Derbyshire & Grant, 2015; Levi et al., 2020). One factor that has been considered in measuring levels of compulsivity in CSBD is the presence of intrusive thoughts and urges (Raymond et al., 2003). In addition, many individuals with OCD present with co-occurring CSBD, more so than with addictive behaviors, and thus some authors advocate considering CSBD a compulsive-impulsive disorder (Fuss et al., 2019; Levi et al., 2020). Therefore, both CBSCs and CSBD seem associated with thoughts, actions and impulses that are experienced as unwanted (OC SCL-90-R subscale) and, therefore, with higher levels of compulsivity than the other disorders (GD and IGD) examined in this study.

When exploring compulsivity using the harm-avoidance subscale of the TCI-R, both CBSCs and CSBD showed similar levels, higher than those reported by patients with GD. Harm-avoidance has been associated with compulsivity, and levels of harm avoidance have been linked to impulsivity (Arzeno Ferrão et al., 2006; Kim et al., 2018). Considering that patients with GD reported lower scores on this dimension, as well as on the OC scale of the SCL-90-R, it could be said that this disorder may be less associated with compulsivity (and perhaps more associated with impulsivity) than the other disorders considered in the present study, consistent with previous findings (Blanco et al., 2009; Mestre-Bach et al., 2021), including those observing high levels of impulsivity in people with GD (Leeman & Potenza, 2012; Mestre-Bach et al., 2020). However, research examining compulsivity in GD is less documented (Mestre-Bach et al., 2021). Most published studies on compulsivity in GD have especially emphasized response perseveration, which may reflect persistence (Leeman & Potenza, 2012). Therefore, it may not be surprising that GD patients in the present study showed greater persistence compared with individuals with IGD. Compared to other disorders studied here, GD may therefore present with high persistence and low harm-avoidance and OC features, thus highlighting the importance of considering specific facets of compulsivity in specific behavioral addictions.

IGD was the condition that demonstrated the lowest levels of persistence. These results fit with previous findings that also observed lower levels of persistence in patients with IGD compared to those with GD (Mallorquí-Bagué et al., 2017). However, these results contrast with writings of other authors who have described persistence as one of the most robust features of IGD (Castro-Calvo et al., 2021). This heterogeneity of views and results may be due, as mentioned by the authors, to tendencies to assess persistence with the personality dimension of the TCI-R, whereas other neuropsychological tools may capture different aspects of this construct. Behavioral and self-

report measures of impulsivity may capture different elements and often factor separately and do not correlate (Meda et al., 2009), and the same may hold true for compulsivity (Fineberg et al., 2014). The IGD group also demonstrated relatively lower levels of OC severity on the SCL-90-R, in comparison with other conditions, but elevated levels of harm-avoidance on the TCI-R. These results suggest that IGD is characterized by both impulsive and compulsive components, sharing certain similarities with OCD, as previous studies have shown (Andreassen et al., 2016; Kim et al., 2017; Kim et al., 2017). However, impulsivity and compulsivity have also been linked to substance and behavioral addictions transdiagnostically, complicating classification efforts (Brand et al., 2019; Fineberg et al., 2014).

The OC subscale (SCL-90-R) correlated with the onset and duration of CSBD. More specifically, higher OC levels were related to older age of onset and shorter CSBD duration. Previous theories have suggested that impulsivity and compulsivity in addictions may vary over time. For example, theories have proposed that over time, addictions may shift from being more egosyntonic (more impulsive) to more egodystonic (more compulsive) (Gardner, 2011; Lüscher et al., 2020). Additional research, especially longitudinal, is needed to clarify how specific OC features may relate to onset and progression of CSBD.

When analyzing factors associated with OC features, in the case of the GD, being female, older, unmarried, employed and with low educational levels was associated with both OC and harm avoidance measures. However, the persistence dimension was related to other factors, specifically being male, younger, married, and unemployed, among other factors. Similar results were observed in the case of IGD, given that OC subscale and harm avoidance were linked with older age, while persistence was associated with younger age. These findings suggest that compulsivity is a complex and multifaceted construct and that the entities assessed could be independent, although associated with each other. These findings are similar to previous studies in impulsivity, compulsivity and behavioral addictions, suggesting that not all factors encompassed in these constructs may be associated with the same clinical and sociodemographic factors, nor have the same influences in the development and maintenance of the disorder (Mestre-Bach et al., 2020, 2021). Further studies are needed to explore possible associations between OC features and multiple sociodemographic and clinical factors in specific behavioral addictions.

When identifying possible clusters considering sociodemographic and clinical variables, two differentiated clusters were obtained. Cluster 1 was composed of higher proportions of patients with CBSCs and CSBD, and who were women, older, unmarried, unemployed and of lower socio-economic status, compared with cluster 2. In addition, cluster 1 presented longer duration of the disorder, greater use of illegal drugs , and a more dysfunctional psychopathological and personality profile than that presented by individuals in cluster 2. These findings are in line with previous studies, suggesting that patients with behavioral addictions present with heterogeneous sociodemographic and clinical profiles (Granero et al., 2016; Jiménez-Murcia et al., 2019). Therefore, different approaches to behavioral addictions should consider individual differences in OC features and other characteristics in order to be optimally effective.

Limitations and future research

The present study included limitations. First, part of the sample was collected before the inclusion of CSBD and IGD by the ICD-11, and consequently specific diagnostic criteria for the diagnosis of these disorders were not available. Future studies should consider the diagnostic criteria for CSBD and IGD, which would allow greater comparability with other studies. Second, OC features were explored by means of three subscales of self-report questionnaires, the SCL-90-R, and the TCI-R. On the one hand, these self-report instruments are subject to possible biases. Furthermore, both obsessiveness and compulsivity are complex constructs that should be assessed with other self-report and behavioral measures (Kim et al., 1992; Potenza, 2007). Third, the cross-sectional nature of the present study limits the exploration of changes in OC features in the course of different

behavioral addictions, and it does not allow the interpretation of the results as empirical evidence of causal relationships. Future longitudinal studies are indicated, especially assessing these factors before and after treatment for GD given that compulsivity may change over time with treatment (Blanco et al., 2009; Grant et al., 2010). Such longitudinal data over long periods of time (years) would be helpful. Fourth, the groups studied were imbalanced in terms of sample size. Future studies should explore obsessive, compulsive, and impulsive features in larger and more balanced samples. Similarly, the different groups were also not gender-balanced. While the observed gender distributions may reflect the prevalence of each disorder (higher prevalence of GD, IGD, and CSBD in males, and higher prevalence of CBSCs in females) (Kürbitz & Briken, 2021; Maraz et al., 2016; Mihara & Higuchi, 2017; Subramaniam et al., 2015), more gender-balanced distributions may help best consider sex as a biological variable. Likewise, having balanced samples would allow for an in-depth exploration of sex/gender differences in different addictions in order to design effective prevention and intervention plans for both men and women. Fifth, the present study was composed of patients seeking treatment for different behavioral addictions, so the results cannot be generalized to other populations, such as non-treatment-seeking individuals with behavioral addictions. Future studies could also include these populations in order to obtain a more complete picture of the existing clinical profiles and their associations with OC features. Sixth, the sample was collected between 2005 and 2022. This allowed us to have a large clinical sample. However, this large time period may have influenced to some extent the results obtained. As many factors may have changed over time (e.g. the technological advances and the proliferation of online activities, especially after the pandemic; the development of new improved tools; new evidence on the ethology of these disorders; and updates of diagnostic criteria and dynamic updates in the scientific consensus regarding their diagnosis), a current limitation is the many years over which the data were collected. As the data collected were cross-sectional in nature, they precluded meaningful insights that could be obtained through longitudinal research. Seventh, a priority of the current study was to focus on people seeking treatment for behavioral addictions. As such, we did not focus on online versus offline behavioral addictions. Given the arguable increasing importance of problems people are experiencing with online behaviors (e.g., use of social media) and the online/offline specified for GD and gaming disorder in the ICD-11, future studies should consider online/offline concerns. Eighth, the sample of this study, as described in the participants section, is a clinical sample collected from consecutive patients who have sought treatment in a specialized unit for the diagnosis and treatment of behavioral addictions. Patients who come to our unit did not show one subtype of problematic use of the internet described by Fineberg et al. (2022). Specifically, individuals did not seek treatment for cyberchondria, cyberstalking, or digital hoarding. It is possible that the patients described by Fineberg et al. (2022) seek treatment in OCD units, but in the present study we have included only individuals with behavioral addictions who sought treatment in our unit. Finally, the clinical heterogeneity of behavioral addictions should be considered. Therefore, it may be possible that there are subtypes of individuals with higher or lower levels of OC features, in line with prior studies (Scherrer et al., 2015). Future studies could explore the existence of clusters considering OC features and impulsivity levels from a transdiagnostic point of view, regardless of the specific diagnostic category, as has been done in other studies (Meda et al., 2009).

Conclusions

Overall, our results suggest that the relationships between OC measures and other psychopathology and clinical measures are related to behavioral-addiction subtypes. The 2-cluster solution was optimal, with differences in global functioning between clusters. The results also support heterogeneity across behavioral addictions, which may be reflected in distinct profiles based on OC features.

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Declaration of Competing Interest

FFA and SJM received consultancy honoraria from Novo Nordisk and FFA editorial honoraria as EIC from Wiley. The rest of the authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

Data availability

Data may be available on reasonable request and in consideration of ongoing studies and other matters.

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Table 1. *Descriptive characteristics of the sample*

		Total (n=4,010)		GD (n=3,725)		CBSCs (n=146)		CSBD (n=44)		IGD (n=95)			
Sociodemographics		*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	χ^2	*p*
Gender	Female	408	10.2%	289	7.8%	108	74.0%	1	2.3%	10	10.5%	677.02	<.001
	Male	3,602	89.8%	3436	92.2%	38	26.0%	43	97.7%	85	89.5%		
Marital status	Single	1,721	42.9%	1561	41.9%	61	41.8%	14	31.8%	85	89.5%	89.00	<.001
	Married	1,757	43.8%	1662	44.6%	65	44.5%	21	47.7%	9	9.5%		
	Divorced	532	13.3%	502	13.5%	20	13.7%	9	20.5%	1	1.1%		
Education	Primary	2,154	53.7%	2047	55.0%	49	33.6%	11	25.0%	47	49.5%	112.14	<.001
	Secondary	1,538	38.4%	1418	38.1%	60	41.1%	19	43.2%	41	43.2%		
	University	318	7.9%	260	7.0%	37	25.3%	14	31.8%	7	7.4%		
Employment	Unemployed	1,618	40.3%	1461	39.2%	70	47.9%	12	27.3%	75	78.9%	67.40	<.001
	Employed	2,392	59.7%	2264	60.8%	76	52.1%	32	72.7%	20	21.1%		
Socio-economic status	High	78	1.9%	64	1.7%	9	6.2%	3	6.8%	2	2.1%	83.49	<.001
	Mean-high	229	5.7%	194	5.2%	20	13.7%	11	25.0%	4	4.2%		
	Mean	458	11.4%	423	11.4%	20	13.7%	7	15.9%	8	8.4%		
	Mean-low	1,368	34.1%	1288	34.6%	42	28.8%	13	29.5%	25	26.3%		
	Low	1,877	46.8%	1756	47.1%	55	37.7%	10	22.7%	56	58.9%		
Age, onset, duration		*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*F-stat*	*p*
Age (years)		40.78	13.17	41.11	13.04	43.23	10.60	42.18	10.15	23.37	10.97	60.52	<.001
Onset of BA (years)		29.09	11.50	29.14	11.40	33.43	11.47	31.75	11.27	19.13	9.87	32.19	<.001
Duration of BA (years)		5.92	5.87	5.93	5.92	6.95	6.01	6.16	6.06	3.71	2.43	6.05	<.001
Substances used		*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	χ^2	*p*
Tobacco		2,392	59.7%	2302	61.8%	57	39.0%	12	27.3%	21	22.1%	107.71	<.001
Alcohol		616	15.4%	604	16.2%	9	6.2%	2	4.5%	1	1.1%	30.50	<.001
Other substances		439	10.9%	421	11.3%	7	4.8%	8	18.2%	3	3.2%	14.43	.002

Note. SD: standard deviation. GD: gambling disorder. CBD: compulsive buying-shopping concerns. CSBD: compulsive sexual behavior disorder. IGD: internet gaming disorder. BA: behavioral addictions.

Table 2. *Comparisons between the groups, adjusted by gender and age*

	GD (*n=3,725*)		CBSCs (*n=146*)		CSBD (*n=44*)		IGD (*n=95*)				
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*F-stat*	*p*	*Significant pairwise comparisons*
SCL-90-R Obsessive-compulsive	1.16	0.84	1.66	1.00	1.57	0.97	1.20	0.80	16.57	<.001	(CBSCs = CSBD) > (GD = IGD)
TCI-R Harm avoidance	100.9	17.24	108.5	19.71	103.1	18.10	105.4	20.08	9.71	<.001	(CBSCs = CSBD = IGD) > GD
TCI-R Persistence	108.4	19.90	106.9	19.07	103.6	22.13	89.9	19.81	26.87	<.001	(GD = CBSCs = CSBD) > IGD

Note. GD: gambling disorder. CBSCs: compulsive buying-shopping concerns. CSBD: compulsive sexual behavior disorder. IGD: internet gaming disorder. SCL-90-R: Symptom Checklist-Revised. TCI-R: Temperament and Character Inventory-Revised.

Table 3. *Variables associated with compulsivity measures: multiple regression*

	SCL-90-R obsessive-compulsive						TCI-R harm avoidance						TCI-R persistence					
	B	*SE*	*Beta*	*p*	*95%CI B*		*B*	*SE*	*Beta*	*p*	*95%CI B*		*B*	*SE*	*Beta*	*p*	*95%CI B*	
Gambling disorder (n=3,725)																		
Age (years)	-0.001	0.001	-0.014	.423	0.00	0.00	0.133	0.023	0.101	**.001***	0.09	0.18	-0.173	0.027	-0.113	**.001***	-0.23	-0.12
Gender (0=female, 1=male)	-0.380	0.052	-0.121	**.001***	-0.48	-0.28	-7.545	1.044	-0.117	**.001***	-9.59	-5.50	2.811	1.222	0.038	**.021***	0.42	5.21
Marital status (0=married, 1=non-married)	0.156	0.029	0.092	**.001***	0.10	0.21	3.364	0.581	0.097	**.001***	2.22	4.50	-3.338	0.681	-0.083	**.001***	-4.67	-2.00
Education (low levels)	0.087	0.032	0.052	**.006***	0.03	0.15	2.109	0.644	0.061	**.001***	0.85	3.37	0.096	0.753	0.002	.899	-1.38	1.57
Employment (0=unemployed, 1=employed)	0.182	0.031	0.106	**.001***	0.12	0.24	2.887	0.627	0.082	**.001***	1.66	4.12	-2.998	0.734	-0.074	**.001***	-4.44	-1.56
Socio-economic status (low levels)	-0.013	0.018	-0.015	.451	-0.05	0.02	0.754	0.357	0.042	**.035***	0.05	1.45	-0.896	0.418	-0.043	**.032***	-1.72	-0.08
Compulsive buying-shopping concerns (n=146)																		
Age (years)	-0.002	0.008	-0.026	.754	-0.02	0.01	-0.256	0.153	-0.138	.096	-0.56	0.05	-0.134	0.148	-0.075	.365	-0.43	0.16
Gender (0=female, 1=male)	-0.409	0.185	-0.180	**.029***	-0.78	-0.04	-8.091	3.656	-0.181	**.029***	-15.32	-0.86	4.503	3.539	0.104	.205	-2.49	11.50
Marital (0=married, 1=non-married)	-0.178	0.168	-0.089	.291	-0.51	0.15	-4.153	3.313	-0.105	.212	-10.70	2.40	-0.950	3.207	-0.025	.767	-7.29	5.39
Education (low levels)	-0.086	0.213	-0.041	.685	-0.51	0.33	3.008	4.191	0.072	.474	-5.28	11.30	-1.265	4.057	-0.031	.756	-9.29	6.76
Employment (0=unemployed, 1=employed)	0.510	0.187	0.256	**.007***	0.14	0.88	9.934	3.692	0.253	**.008***	2.63	17.23	-0.204	3.574	-0.005	.955	-7.27	6.86
Socio-economic status (low levels)	0.026	0.089	0.033	.767	-0.15	0.20	-1.020	1.749	-0.065	.561	-4.48	2.44	-3.852	1.693	-0.254	**.024***	-7.20	-0.50
Compulsive sexual behavior disorder (n=44)																		
Age (years)	0.002	0.016	0.026	.879	-0.03	0.04	0.210	0.290	0.118	.472	-0.38	0.80	-0.423	0.302	-0.194	.169	-1.04	0.19
Gender (0=female, 1=male)	0.300	1.073	0.046	.781	-1.87	2.47	1.673	19.245	0.014	.931	-37.32	40.67	-5.756	20.062	-0.039	.776	-46.40	34.89
Marital (0=married, 1=non-married)	0.023	0.351	0.012	.949	-0.69	0.73	-4.526	6.295	-0.126	.477	-17.28	8.23	13.158	6.562	0.300	.052	-0.14	26.45
Education (low levels)	0.580	0.408	0.261	.163	-0.25	1.41	11.382	7.312	0.275	.128	-3.43	26.20	4.068	7.622	0.081	.597	-11.38	19.51
Employment (0=unemployed, 1=employed)	0.520	0.377	0.241	.176	-0.24	1.28	10.894	6.761	0.271	.116	-2.81	24.59	-23.405	7.048	-0.476	**.002***	-37.69	-9.12
Socio-economic status (low levels)	-0.146	0.162	-0.192	.372	-0.47	0.18	-2.540	2.900	-0.179	.387	-8.42	3.34	1.645	3.023	0.095	.590	-4.48	7.77
Internet gaming disorder (n=95)																		
Age (years)	0.047	0.012	0.640	**.001***	0.02	0.07	1.031	0.305	0.563	**.001***	0.42	1.64	-0.658	0.312	-0.364	**.038***	-1.28	-0.04
Gender (0=female, 1=male)	-0.535	0.268	-0.205	**.049***	-1.07	0.00	-17.351	6.777	-0.267	**.012***	-30.82	-3.88	-13.129	6.929	-0.204	.061	-26.90	0.64
Marital (0=married, 1=non-married)	1.210	0.396	0.443	**.003***	0.42	2.00	31.548	9.996	0.463	**.002***	11.68	51.41	-11.180	10.221	-0.166	.277	-31.49	9.13
Education (low levels)	-0.259	0.178	-0.162	.148	-0.61	0.09	-4.999	4.482	-0.125	.268	-13.91	3.91	0.177	4.582	0.004	.969	-8.93	9.28
Employment (0=unemployed, 1=employed)	-0.673	0.299	-0.343	**.027***	-1.27	-0.08	-2.246	7.545	-0.046	.767	-17.24	12.75	-10.478	7.715	-0.217	.178	-25.81	4.85
Socio-economic status (low levels)	0.552	0.154	0.656	**.001***	0.25	0.86	6.694	3.888	0.319	.089	-1.03	14.42	-4.648	3.976	-0.224	.246	-12.55	3.25

Note. SCL-90-R: Symptom Checklist-Revised. TCI-R: Temperament and Character Inventory-Revised. B: un-standardized coefficient. SE: error standard. Beta: standardized coefficient. 95%CI: 95% confidence interval. *Bold: significant parameter.

Table 4. *Comparisons between the identified clusters*

		Cluster-1 (n=1,763)		Cluster-2 (n=2,247)				
Sociodemographic		*n*	*%*	*n*	*%*	χ^2	*p*	|*h*|
Gender	Female	276	67.6%	132	32.4%	103.40	**.001***	**0.72†**
	Male	1487	41.3%	2115	58.7%			
Marital status	Single	813	47.2%	908	52.8%	30.00	**.001***	0.11
	Married	688	39.2%	1069	60.8%			0.44
	Divorced	262	49.2%	270	50.8%			0.03
Education	Primary	983	45.6%	1171	54.4%	6.93	**.031***	0.17
	Secondary	636	41.4%	902	58.6%			0.35
	University	144	45.3%	174	54.7%			0.19
Employed	Unemployed	832	51.4%	786	48.6%	61.22	**.001***	0.06
	Employed	931	38.9%	1461	61.1%			0.45
Socio-economic status	High	30	38.5%	48	61.5%	24.82	**.001***	0.47
	Mean-high	94	41.0%	135	59.0%			0.36
	Mean	187	40.8%	271	59.2%			0.37
	Mean-low	549	40.1%	819	59.9%			0.40
	Low	903	48.1%	974	51.9%			0.08
Disorder	GD	1577	42.3%	2148	57.7%	74.15	**.001***	0.31
	CBD	112	76.7%	34	23.3%			**1.13†**
	CSBD	27	61.4%	17	38.6%			**0.51†**
	IGD	47	49.5%	48	50.5%			0.02
Substances		*n*	*%*	*n*	*%*	χ^2	*p*	|*h*|
Tobacco		1029	43.0%	1363	57.0%	2.16	.142	0.28
Alcohol		289	46.9%	327	53.1%	2.57	.109	0.12
Drugs		225	51.3%	214	48.7%	10.63	**.001***	0.05

	Cluster-1 (n=1,763)		Cluster-2 (n=2,247)				
	Mean	*SD*	*Mean*	*SD*	*T-stat*	*p*	|*d*|
Age (years)	41.37	12.80	40.31	13.44	2.53	**.011***	0.08
Age of onset of BA (years)	29.26	11.51	28.96	11.50	0.83	.405	0.03
Duration of BA (years)	6.45	6.18	5.50	5.60	5.07	**.001***	0.16
SCL-90-R Somatization	1.51	0.88	0.56	0.52	42.83	**.001***	**1.32†**
SCL-90-R Obsessive/compulsive	1.95	0.68	0.59	0.39	79.18	**.001***	**2.44†**
SCL-90-R Interpersonal sensitivity	1.70	0.82	0.57	0.52	52.95	**.001***	**1.64†**
SCL-90-R Depressive	2.22	0.80	0.99	0.66	53.50	**.001***	**1.68†**
SCL-90-R Anxiety	1.63	0.83	0.57	0.48	50.55	**.001***	**1.56†**
SCL-90-R Hostility	1.43	0.93	0.57	0.57	35.95	**.001***	**1.11†**
SCL-90-R Phobic anxiety	0.89	0.85	0.20	0.33	35.27	**.001***	**1.07†**
SCL-90-R Paranoid Ideation	1.43	0.83	0.57	0.56	38.78	**.001***	**1.21†**
SCL-90-R Psychotic	1.44	0.78	0.51	0.48	46.69	**.001***	**1.44†**
SCL-90-R GSI score	1.67	0.65	0.63	0.40	62.02	**.001***	**1.92†**
SCL-90-R PST score	63.75	15.14	33.82	17.17	57.67	**.001***	**1.85†**
SCL-90-R PSDI score	2.29	0.55	1.60	0.45	43.94	**.001***	**1.38†**
TCI-R Novelty seeking	110.47	13.75	108.38	14.51	4.62	**.014***	0.15
TCI-R Harm avoidance	112.34	15.03	92.62	14.29	42.40	**.001***	**1.34†**
TCI-R Reward dependence	95.11	15.05	100.39	14.40	11.30	**.001***	0.36
TCI-R Persistence	102.20	19.73	112.36	19.14	16.47	**.001***	**0.52†**
TCI-R Self-directedness	115.11	18.07	136.61	19.37	35.93	**.001***	**1.15†**
TCI-R Cooperativeness	125.33	16.46	133.92	15.38	17.01	**.001***	**0.54†**
TCI-R Self-transcendence	65.94	15.19	61.46	14.97	9.34	**.001***	0.30

Note. SD: standard deviation. GD: gambling disorder. CBSCs: compulsive buying-shopping concerns. CSBD: compulsive sexual behavior disorder. IGD: internet gaming disorder. SCL-90-R: Symptom Checklist-Revised. TCI-R: Temperament and Character Inventory-Revised. BA: behavioral addiction. *Bold: significant parameter. †Effect sizes in the mild-moderate to large-high range.

Table S1. *Partial correlation matrix (coefficients adjusted by gender and age)*

	GD *(n=3,725)*			CBSCs *(n=146)*			CSBD *(n=44)*			IGD *(n=95)*		
	Obsess-comp.	Harm avoid.	Persis-tence	Obsess-comp.	Harm avoid.	Persis-tence	Obsess-comp.	Harm avoid.	Persis-tence	Obsess-comp.	Harm avoid.	Persis-tence
BA Onset	-0.058	-0.028	0.058	0.067	0.110	0.082	**0.299†**	-0.025	-0.128	-0.067	-0.164	0.119
BA Duration	0.104	0.040	-0.045	-0.009	-0.124	0.021	**-0.291†**	-0.087	0.206	0.114	0.211	-0.105
Tobacco	0.003	0.025	0.010	-0.043	-0.012	-0.013	-0.145	-0.060	0.076	-0.186	-0.239	0.206
Alcohol	0.062	0.028	0.004	0.023	-0.089	0.087	-0.213	-0.125	0.079	0.129	0.037	0.050
Other drug	0.108	0.011	0.005	0.081	-0.086	-0.054	-0.100	-0.108	0.013	0.025	-0.091	0.132

Note. GD: gambling disorder. CBSCs: compulsive buying-shopping concerns. CSBD: compulsive sexual behavior disorder. IGD: internet gaming disorder. BA: behavioral addiction. †Effect size in mild-moderate to large-high range.