Impulsivity and compulsivity related to substance use disorders

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Impulsivity and compulsivity related to substance use disorders

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Editorial: Impulsivity and compulsivity related to substance use disorders

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Editorial on the Research Topic
Impulsivity and compulsivity related to substance use disorders

Impulsivity and compulsivity are fundamental behavioral constructs controlled by brain mechanisms essential for survival across species. When these mechanisms become dysfunctional, they contribute to a wide range of psychiatric disorders, imposing significant personal, social, and economic burdens. Understanding the neural underpinnings of impulsivity and compulsivity can facilitate targeted treatment strategies for individuals suffering from these maladaptive behaviors.

The American Psychiatric Association (APA, 2013) defines impulsivity as a predisposition toward rapid, unplanned reactions to internal or external stimuli, often disregarding negative consequences. Compulsivity, on the other hand, is characterized by repetitive behaviors aimed at reducing or preventing anxiety or distress, rather than seeking pleasure or gratification. Despite their differences, both constructs involve disruptions in response control and are mediated by overlapping yet distinct neural circuits, particularly those associated with motivational and decisional processes within the basal ganglia, limbic cortical inputs, and prefrontal control networks. While compulsive disorders such as obsessive-compulsive disorder (OCD) are often linked to increased frontal lobe activity, impulsive disorders like substance use disorders (SUD) and antisocial personality disorder (APD) are associated with reduced frontal lobe function.

Recent research has highlighted the role of impulsivity and compulsivity as risk factors in substance use disorders. Substance Use Disorder (SUD) is characterized by dysregulation in reward processing and inhibitory control systems, leading to increased sensitivity to immediate rewards and impaired response inhibition. Inhibitory control deficits have been recognized as both a determinant and a consequence of substance use disorders. This impaired inhibitory control results in difficulty resisting urges to consume substances despite negative consequences, further perpetuating the cycle of addiction. Additionally, impulsivity has been associated with higher rates of treatment dropout and relapse, emphasizing the need for interventions that specifically target this dimension.

The relationship between impulsivity, compulsivity, and psychiatric conditions remains a topic of debate. Some studies suggest that these constructs are distinct, with impulsivity being strongly linked to Substance Use Disorder (SUD) and aggressive behaviors, whereas

compulsivity has been predominantly studied in the context of OCD. However, others argue that these constructs overlap, particularly in disorders that transition from impulsive goal-directed behavior to compulsive stimulus-driven behavior, such as addiction and obsessive-compulsive spectrum disorders. Given their commonalities and differences, impulsivity and compulsivity are often used interchangeably to describe self-control deficits that contribute to repetitive psychopathological behaviors. This raises important questions about how these constructs should be conceptualized and measured, as well as the implications for diagnosis and treatment.

In addition to their role in substance use disorders, impulsivity and compulsivity are also central to other psychiatric conditions, including attention-deficit/hyperactivity disorder (ADHD), borderline personality disorder (BPD), and eating disorders. For instance, individuals with ADHD frequently display elevated levels of impulsivity, which can manifest as difficulty delaying gratification, poor decision-making, and heightened risk-taking behaviors. Meanwhile, BPD is characterized by both impulsive and compulsive tendencies, with individuals exhibiting impulsive behaviors such as self-harm and compulsive behaviors like repetitive reassurance-seeking. Similarly, in eating disorders, impulsivity has been linked to binge-eating episodes, whereas compulsivity is associated with rigid dietary restrictions and obsessive thoughts about food and body image.

This Research Topic aims to differentiate impulsivity and compulsivity, providing insight into their unique contributions to psychiatric disorders, particularly in the context of addictive disorders and maladaptive behaviors. The included studies explore various aspects of these constructs, offering valuable perspectives on their underlying mechanisms and clinical implications:

Hinuma et al. classify patterns of intrusive thoughts based on their mechanisms of emergence and persistence, contributing to a better understanding of cognitive factors underlying compulsivity. Intrusive thoughts are a hallmark of OCD and other anxiety-related disorders, and this study provides an updated classification system that may improve diagnostic precision and therapeutic approaches.

Mateo-Fernández et al. identify profiles of intimate partner aggressors based on substance use and impulsivity, assessing the effectiveness of treatment programs. Given the strong link between substance use and violent behavior, this study provides important insights into the role of impulsivity in domestic violence and the potential for targeted interventions to reduce recidivism.

Broul et al. present a case report on self-amputation induced by cannabis and kratom use, highlighting extreme psychiatric manifestations of Substance Use Disorder (SUD). This rare and severe outcome underscores the need for a better understanding of the psychiatric effects of emerging psychoactive substances.

Astudillo-Reyes et al. examine causal attributions of impulsive and compulsive behaviors, shedding light on individual perceptions of these traits. Understanding how individuals interpret their own impulsive and compulsive actions may help refine cognitive-behavioral interventions aimed at modifying maladaptive thought patterns.

Pino et al. explore impulsivity as a predictor of problematic internet use in university students with disabilities, emphasizing its role in behavioral addictions. As internet addiction becomes an increasing concern, particularly among vulnerable populations, this study highlights the importance of addressing impulsivity in digital health interventions.

Cantos et al. investigate hormonal differences in perpetrators of intimate partner violence, suggesting links between aggression, impulsivity, and biological factors. This research contributes to the growing field of neurocriminology, which seeks to understand the biological underpinnings of violent behavior.

Aguilar-Yamuza et al. provide a systematic review of treatments for impulsivity and compulsivity, summarizing therapeutic approaches and their effectiveness. By comparing pharmacological and psychotherapeutic interventions, this review offers valuable guidance for clinicians seeking to tailor treatment plans to individual patients.

Yin et al. compare impulsivity levels in individuals with methamphetamine and mephedrone use disorders, with implications for treatment interventions. Understanding the specific impulsivity profiles associated with different substances can inform targeted harm reduction strategies.

Muñoz-López et al. propose correction criteria for qualitative analysis of prison populations concerning substance possession/use and gender violence. Standardizing assessment criteria in forensic settings can lead to more accurate risk assessments and better rehabilitation outcomes.

Muñoz-López et al. analyze writing patterns in incarcerated individuals with personality disorders, exploring how language reflects psychological traits. Linguistic analysis in forensic psychology is an emerging field that may provide new tools for assessing risk and treatment progress.

Roncero et al. examine gender differences in ADHD and impulsivity among patients with alcohol or alcohol and cocaine dependence, emphasizing the need for gender-specific treatment strategies. The study highlights how impulsivity manifests differently in men and women and the importance of personalized treatment approaches.

Together, these contributions enhance our understanding of impulsivity and compulsivity in psychiatric disorders, guiding future research and clinical applications in addiction, violence, and other maladaptive behaviors. By differentiating these constructs and elucidating their underlying mechanisms, this issue provides a foundation for developing more precise and effective interventions tailored to individuals with impulse control disorders. Future research should continue to explore the neurobiological basis of impulsivity and compulsivity, as well as the effectiveness of novel treatment modalities, including neuromodulation techniques and digital therapeutics. Understanding the interplay between genetic, environmental, and neurodevelopmental factors will be crucial in advancing our knowledge of these complex behavioral constructs and their role in psychiatric pathology.

Author contributions

Conflict of interest

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Analysis of writing in personality disorders in prison population

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Abstract: Writing involves the activation of different processing modes than reading comprehension, and therefore the level of activation varies depending on the moment and the task.

Objectives: to analyze the profiles in terms of the proposed coding from the PROESC in terms of personality disorders [Antisocial Personality Disorder (ASPD) with drugs possession and consumption crimes (DPCC) and Obsessive-Compulsive Personality Disorder (OCPD)] with gender violence crimes (GVC) in the prisoners.

Design: The sample was composed of 194 men. The participants were divided into two groups. Group 1 (ASPD; DPCC) consisted of 81 men, and Group 2 (OCPD; GVC) consisted of 113 men.

Main outcome measures: They completed the Demographic, Offense, and Behavioral Interview in Institutions, the International Personality Disorders Examination (IPDE), and Writing Processes Evaluation Battery (PROESC).

Results: Group 2 made more mistake than Group 1 in narratives tasks.

Conclusion: Participants know phoneme-grapheme correspondence rules, language disturbances of a reiterative and persistent nature may appear in those who show compulsive behavior.

Introduction

Aggression can be conceptualized as impulsive or compulsive behavior, and depending on whether it is impulsive or compulsive, the treatment will be different. Impulsive behaviors can often be controlled, whereas compulsive behaviors require more specialized and multifactorial treatment (neuropsychological, neurophysiological, neuroanatomical, social, legal, safety, and economic), as they are usually part of a more severe problem (1, 2). Impulsivity and compulsivity are natural behaviors driven by brain mechanisms that are essential for survival in all species. Understanding these brain mechanisms can lead to targeted treatment strategies for these symptom areas when impulsivity and compulsivity become dysfunctional (3). Although impulsivity and compulsivity affect different aspects of response control, they are most likely mediated by related but distinct neural circuits associated with motivational and decision-making processes (involving the basal ganglia, their limbic cortical inputs, and top-down control by cortical prefrontal circuits) (1, 4). Ziegler et al. (2) argued that increased frontal lobe activity may characterize obsessive-compulsive disorders such as OCD. In contrast, decreased frontal lobe activity may characterize impulsive disorders such as substance abuse (SAD) and antisocial personality disorder (ASPD). In addition, numerous studies (1, 5) support the association between impulsivity, substance abuse disorders (SAD) and violent or aggressive behavior. In contrast, according to some authors (3, 4, 6), research linking impulsivity to such outcomes is sparse, as impulsivity has often been studied in OCD. It is then necessary to examine impulsivity and compulsivity from the same group of disorders in the DSM-5 (7). Therefore, it is important to distinguish writing disorders between these two disorders.

Writing involves the activation of different processing modes than reading comprehension, and therefore the level of activation varies depending on the moment and the task.

Information processing comprises a series of stages or sub-processes in mental operations that may act in a more or less autonomous and task-specific manner. Consequently, explicit responses are the result of these operations, and thus language assessment is concerned with identifying these processes to determine correct functioning. In this regard, the goal of language assessment is to discover the sequence of information processing that takes place from the time the individual receives it until it is manifest in an explicit response. Evaluating a given process (in this case, writing) implies knowing the transformations of the written text, from the activation of a mental representation as an abstract schema to the creation process (8–20).

The Writing Processes Evaluation Battery (PROESC) (21) is an individual test that aims to evaluate the main processes involved in creating texts. It is composed of six tests, which are: 1) Syllable dictation; 2) Word dictation; 3) Pseudoword dictation; 4) Sentence dictation; 5) Writing a narrative and 6) Writing an essay. Tests 5 and 6 assess the ability to plan a narrative text and an expository text and involve qualitative aspects.

Currently, there are many standardized tests to assess language and detect language difficulties in adults in opaque languages such as English. In other languages, such as Spanish, there are not many options. Moreover, a review study (22) concluded that research on language ability and language disorders has mainly focused on children and adolescents. Studies on the adult population are scarce and, to a large extent, adopt the perspective of adults who were diagnosed with disorders as children. However, these studies have developed methods for identifying, for the first time, language development deficits in English-speaking adults. Therefore, the objective of this study was to analyze the profiles based on the proposed coding using the PROESC (21) in terms of personality disorders (ASPD and OCPD) in the prison population.

Participants

The sample consisted of 194 men with a mean age of 37.08 years (SD=8.81) from the Granada Penitentiary Center. The participants were divided into two groups. Group 1 presented antisocial personality disorder (ASPD), composed of 81 men with a mean age of 36.86 years (SD=9.32), while Group 2 presented Obsessive-Compulsive Personality Disorder (OCPD) and was composed of 113 men with a mean age of 38.78 years (SD=8.47). The exclusion criteria in both cases were being over 50 years, presenting a psychiatric illness (schizophrenia or depression), and receiving psychopharmacological treatment. Table 1 present the sociodemographic characteristics of the sample described.

Procedure

First, participants were interviewed individually to check the inclusion criteria and, if eligible, were offered the opportunity to participate in the research. Next, they completed the International Personality Disorders Examination (IPDE) (23), and participants with Antisocial Personality Disorder (ASPD) and Obsessive-Compulsive Personality Disorder (OCPD) were selected. They then took part in an individual session in which they completed the measures listed below. Participants were reminded at the beginning of the session of their right to discontinue the procedure at any time, and their written consent was then obtained. Once the data collection process was completed, the data were corrected.

Finally, participants signed the informed consent form, and prison staff (psychologist and educator) collected the relevant sociodemographic data. This study was approved by the Ethics Committee of the Autonomous Community of Andalusia (PEIBA, 0766-N-21).

Instruments

Demographic, crime, and institutional behavior interview

This interview was designed for this research study and consists of collecting information about sociodemographic data, type of

	N=194			
	Group APD	Group OCPD	χ^2	p
Marital status (N)				
Single	41	48		
Married	10	35		
Divorced	12	15	**10.916**	**0.028**
Widower	1	0		
Cohabiting with partner	17	15		
Educational level (N)				
No Primary	17	16		
Primary	33	51		
Secondary	21	31	1.575	0.813
Baccalaureate	8	12		
Degree	2	3		
Nationality (N)				
Spain	78	106		
Europe	0	2		
South America	2	3	1.558	0.669
Africa	1	2		

Bold values in the tables represent those values that are statistically significant (p ≤ 0,05).

offenses and their penalties, and sanctions within the prison according to the Prison Regulations (Royal Decree 1201/1981, May 8, Articles 107 and 108).

International personality disorders examination (IPDE) Spanish version

This is a diagnostic instrument based on a semi-structured clinical interview (23), and his Spanish version (24), formulated according to the DSM-5 (7) assessment criteria. The items are open-ended, closed-ended, and yes/no questions are classified into six categories: work, self, interpersonal relationships, affect, reality testing, and impulse control. The instrument also includes a screening questionnaire that reduces the interview administration time, identifying personality disorders in which the person does not score and, therefore, discarding the questions referring to that disorder. The administration time ranges from 60 to 90 minutes and requires an examiner with training and experience in using the instrument. The reliability and stability indices obtained range between 0.70 and 0.96. It has been considered a useful and valid instrument for assessing personality disorders for research purposes (23).

Writing processes evaluation battery (PROESC)

This is an individual test that aims to evaluate the main processes involved in creating texts (21). It is composed of six tests, which are: 1) Syllable dictation; 2) Word dictation; 3) Pseudoword dictation; 4) Sentence dictation; 5) Writing a narrative and 6) Writing an essay. In this study, we used tests 5 and 6, which assess the ability to plan a narrative and an expository text. Although the instrument (21) has a high internal consistency of 0.82 (alpha coefficient) in the first four tests, it lacks quantitative criteria for the correction and interpretation of the writing tests (5 and 6). Our proposal of criteria for correction and interpretation was: Words and Paragraphs, Errors Related to Formal Aspects, Decoding Errors, Grammar, Revision and Net Total, Main and Secondary Ideas, Vocabulary, Planning Errors, Words and Paragraphs, Errors Related to Formal Aspects, Decoding Errors.

Data analysis

Data analyses were conducted using the SPSS Statistics 22.0 program. First, descriptive statistical analyses were used to determine the characteristics of the sample. Then, to analyze the profiles around the proposed coding from the PROESC (25) to categorize the *narratives* and *essays* according to personality disorders (ASPD and OCPD), we proceeded to check whether the narratives obtained according to the PROESC instructions differed between the groups. For this purpose, seven Multivariate analyses of Variance (MANCOVA) were conducted using a between-groups unifactorial design, using educational level as a covariate; the group (ASPD and OCPD) as the independent variable, and the variables derived from the categories (Category Words and Paragraphs; Errors Related to Formal Aspects; Decoding Errors; Category Grammar/Revision/Net Total; Main and Secondary Ideas; Planning and Vocabulary Errors) as dependent variables.

Results

Analysis of narrative categorization

The MANCOVAS revealed statistically significant results for the categories *Words and Paragraph*s (Number of words and Number of paragraphs; Wilks' Lambda = 0.933, $F_{2,190}$ = 6.866; p <.01); *Errors Related to Formal Aspects* (Number of punctuation errors, number of lines not respecting the margins, number of incorrect separations between words, number of incorrect conjunctions between words, number of repetitions, number of words with unreadable handwriting, and Total; Wilks' Lambda = 0.74, $F_{6,186}$ = 10.912; p <.001); *Decoding Errors* (Number of Substitutions, number of Additions, number of Omissions, number of Inversions, number of Rotations, number of Lexicalizations, Number of incorrect accents and Total; Wilks' Lambda = 0.686, $F_{7,185}$ = 12.107; p <.000); *Grammar* (Number of

grammatically incorrect sentences); *Revision* (Number of modifications made to the text) and *Net Total*; Wilks' Lambda = 0.801, $F_{3,189}$ = 15.699; p <.001); *Main and Secondary Ideas* (Number of main ideas and number of secondary ideas; Wilks' Lambda = 0.646, $F_{2,190}$ = 52.032; p <.001); *Vocabulary* (Number of technical vocabulary uses, number of coherent vocabulary uses, number of varied vocabulary uses and Total; Wilks' Lambda = 0.94, $F_{3,189}$ = 3.998; p <.01). No statistically significant differences were found in the *Planning Errors* category (number of disconnections between the main idea and the title, number of times secondary ideas do not appear, number of deviations from thematic continuity, number of times technical vocabulary is not used, number of times coherent vocabulary is not used, number of times varied vocabulary is not used, and Total).

Univariate ANCOVAs conducted for each of the levels of the dependent variables of the *Words and Paragraphs* category (Number of Words and number of Paragraphs) revealed statistically significant differences in the number of words ($F_{2,191}$ = 10.150; Mce =5684.14; p<.001) with the scores being higher for the OCPD group than the ASPD group; and in the number of paragraphs ($F_{2,191}$ = 13.76; Mce =21.75; p<.001) with the scores being higher for the OCPD group than the ASPD group (See Table 2).

For the dependent variables of the category *Errors Related to Formal Aspects* (Number of punctuation errors, number of lines not respecting the margins, number of incorrectly separated words, number of incorrect conjunctions between words, number of repetitions, number of words with unreadable handwriting, and Total) the ANCOVAs revealed statistically significant differences in the number of incorrect conjunctions between words ($F_{2,191}$ = 4.5558; Mce =15.15; p<.05) with scores being higher for the OCPD group than the ASPD group, and Total score ($F_{2,191}$ = 3.723; Mce =185.94; p<.05) with scores being higher for the OCPD group than the ASPD group. No statistically significant differences were found in the number of punctuation errors, the number of lines not respecting the margins, incorrectly separated words, repetitions, and the number of words with unreadable handwriting.

For the dependent variables of the *Decoding Errors* category (Number of substitutions, number of additions, number of omissions, number of inversions, number of rotations, number of lexicalizations, number of incorrect accents, and Total), the ANCOVAs revealed statistically significant differences in the number of substitutions ($F_{2,191}$ = 7.176; Mce =122.937; p<.01) with higher scores for the OCPD group than the ASPD group; number of additions ($F_{2,191}$ = 3.828; Mce =35.848; p<.05) with the OCPD group obtaining higher scores than the ASPD group; number of omissions ($F_{2,191}$ = 3.858; Mce =29.494; p<.05), with the OCPD group scoring higher than the ASPD group; and Total score ($F_{2,191}$ = 3.407; Mce =486.908; p<.05), with scores being higher for the OCPD group than the ASPD group. No statistically significant differences were found in the number of inversions, number of rotations, number of lexicalizations, and number of incorrect accents.

For the dependent variables of the Categories *Grammar* (Number of grammatically incorrect sentences); *Revision* (Number of modifications made to the text), and *Net Total*, ANCOVAs revealed statistically significant differences in *Revision*: Number of modifications made to the text ($F_{2,191}$ = 6.616; Mce =7.349; p<.01) with scores being higher for the OCPD group than the ASPD group and *Net Total* ($F_{2,191}$ = 15.482; Mce =95989.637; p<.001) with scores being higher for the OCPD group than the ASPD group. No statistically significant differences were found in *Grammar* (Number of grammatically incorrect sentences).

For the dependent variables of the *Main and Secondary Ideas* category (Number of main ideas and Number of secondary ideas), ANCOVAs revealed statistically significant differences in the number of secondary ideas ($F_{2,191}$ = 4.528; Mce =94.266; p<.05) with higher scores for the OCPD group than the ASPD group. No statistically significant differences were found in the number of main ideas.

For the dependent variables of the *Vocabulary* Category (Number of uses of technical vocabulary; Number of uses of consistent vocabulary; Number of uses of varied vocabulary, and Total score), the ANCOVAs revealed statistically significant differences in the number of uses of technical vocabulary ($F_{2,191}$ = 7.421; Mce =272.905; p<.01) with scores being higher for the OCPD group than the ASPD group; Number of varied vocabulary uses ($F_{2,191}$ = 7.882; Mce =48.921; p<.01) with scores being higher for the OCPD group than the ASPD group, and Total score ($F_{2,191}$ = 8.447; Mce =530.953; p<.001) with scores being higher for the OCPD group than the ASPD group. However, no statistically significant differences were found in a number of uses of coherent vocabulary (see Table 2).

Analysis of essays categorization

The MANCOVAS revealed statistically significant results for the Categories *Words and Paragraphs* (Number of words and Number of paragraphs; Wilks' Lambda = 0.873, $F_{2,190}$ = 13.779; p <.001); *Errors Related to Formal Aspects* (Number of punctuation errors, number of lines not respecting the margins, number of incorrect separations between words, number of incorrect conjunctions between words, number of repetitions, number of words with unreadable handwriting, and Total; Wilks' Lambda = 0.677, $F_{6,186}$ = 14.794; p <.001); *Decoding Errors* (Number of substitutions, number of additions, number of omissions, number of inversions, number of rotations, number of lexicalizations, number of incorrect accents, and Total; Wilks' Lambda = 0.625, $F_{8,184}$ = 13.804; p <.001); *Grammar* (Number of grammatically incorrect sentences); *Revision* (Number of modifications made to the text) and *Net Total*; Wilks' Lambda = 0.69, $F_{3,189}$ = 28.28; p <.001); *Main and Secondary Ideas* (Number of main ideas and Number of secondary ideas; Wilks' Lambda = 0.661, $F_{2,190}$ = 48.650; p <.001); *Planning Errors* (Number of disconnections between main idea and title, number of times secondary ideas do not appear, number of deviations from thematic continuity, number of times technical vocabulary not used, number of times coherent vocabulary not used, number of times varied vocabulary not used, and Total; Wilks' Lambda = 0.841, $F_{6,186}$ = 5.855; p <.001); *Vocabulary* (Number of uses of technical vocabulary, number of

TABLE 2 Mean. standard deviation. and significance level obtained by the groups when comparing.

CATEGORIES	VARIABLES	NARRATIVES							ESSAYS						
		Group APD		Group OCPD		F/χ^2	p	η	Group APD		Group OCPD		F/χ^2	p	η
		Mean	SD	Mean	SD				Mean	SD	Mean	SD			
WORDS AND PARAGRAPHS	Number of words	**139**	**66.74**	**156**	**85.20**	**10.150**	**0.000**	**0.096**	**136.83**	**67.54**	**151.26**	**69.60**	**6.63**	**0.002**	**0.065**
	Number of paragraphs	**1.6**	**1.05**	**1.9**	**1.51**	**13.758**	**0.000**	**0.126**	**1.65**	**1.15**	**1.71**	**1.10**	**12.475**	**0.00**	**0.116**
ERRORS RELATING TO FORMAL ASPECTS	Number of punctuation errors	6.53	4.37	7.25	5.30	1.955	0.144	0.020	7	**5.10**	7.24	4.56	3.337	0.038	**0.034**
	Number of lines not respecting margins	0.60	2.63	0.79	2.74	0.215	0.806	0.002	1.05	3.38	0.59	2.12	1.386	0.253	0.014
	Number of incorrect separations between words	0.31	0.79	0.49	1.56	1.731	0.180	0.018	0.26	0.70	0.34	1	0.872	0.420	0.009
	Number of incorrect conjunctions between words	**0.42**	**1.04**	**0.73**	**2.26**	**4.558**	**0.012**	**0.046**	0.78	1.80	0.72	1.67	2.457	0.088	0.025
	Number of repetitions	0.01	0.11	0.02	0.13	0.055	0.946	0.001	0	0	0.02	0.13	0.733	0.482	0.008
	Number of words with unreadable handwriting	0.26	0.79	0.38	1.37	1.797	0.169	0.018	0.14	0.38	0.42	1.75	2.580	0.078	0.026
	TOTAL	**8.14**	**5.65**	**9.65**	**8.04**	**3.723**	**0.026**	**0.038**	**9.22**	**6.74**	**9.32**	**6.44**	**6.238**	**0.002**	**0.061**
DECODING ERRORS	Number of Substitutions	**4.67**	**3.74**	**4.70**	**4.62**	**7.176**	**0.001**	**0.070**	**4.58**	**4**	**4.81**	**423**	**8.702**	**0.000**	**0.084**
	Number of Additions	**2.33**	**2.75**	**2.61**	**3.35**	**3.828**	**0.023**	**0.039**	**1.91**	**2.24**	**2.46**	**2.93**	**4.768**	**0.010**	**0.048**
	Number of Omissions	**2.72**	**2.57**	**2.96**	**2.97**	**3.858**	**0.023**	**0.039**	**2.94**	**4.01**	**3.31**	**3.01**	**6.312**	**0.002**	**0.062**
	Number of Inversions	0.17	0.52	0.19	0.53	0.121	0.886	0.001	0.20	1.15	0.22	0.79	0.160	0.853	0.002
	Number of Rotations	–	–	–	–	.	.	.	0.01	0.11	0.04	0.47	0.825	0.440	0.009
	Number of Lexicalizations	0.12	0.46	0.08	0.33	0.474	0.623	0.005	0.16	0.54	0.06	0.28	2.206	0.113	0.023
	Number of incorrect accents	7.95	5.25	8.43	5.13	0.239	0.787	0.002	8	4.84	8.55	4.75	1.531	0.219	0.016
	TOTAL	**17.95**	**10.99**	**18.98**	**12.88**	**3.407**	**0.035**	**0.034**	**17.79**	**12.66**	**19.46**	**12.27**	**6.633**	**0.002**	**0.065**
GRAMMAR	Number of grammatically incorrect sentences	4.57	3.04	4.55	2.99	0.279	0.757	0.003	**4.31**	**2.85**	**4.50**	**2.88**	**4.682**	**0.010**	**0.047**
MAIN AND SECONDARY IDEAS	Number of main ideas	1.11	0.42	1.14	0.40	2.286	0.104	0.023	1.26	0.57	1.23	0.48	0.730	0.483	0.008
	Number of secondary ideas	**9.80**	**3.96**	**10.27**	**5.09**	**4.528**	**0.012**	**0.045**	9.33	3.94	9.88	4.40	2.657	0.073	0.027
PLANNING ERRORS	Number of disconnections between the main idea and the title	0.40	0.75	0.44	0.72	1.408	0.247	0.015	**0.74**	**1.18**	**0.41**	**0.84**	**3.313**	**0.039**	**0.034**
	Number of times that secondary ideas do not appear	0.06	0.46	0	0	1.216	0.299	0.013	0.06	0.40	0.02	0.19	1.308	0.273	0.014

(Continued)

TABLE 2 Continued

CATEGORIES	VARIABLES	NARRATIVES							ESSAYS						
		Group APD		Group OCPD		F/χ^2	p	η	Group APD		Group OCPD		F/χ^2	p	η
		Mean	SD	Mean	SD				Mean	SD	Mean	SD			
	Number of deviations from thematic continuity	0.20	0.46	0.23	0.50	1.041	0.355	0.011	0.31	0.66	0.22	0.48	1.689	0.187	0.017
	Number of non-uses of technical vocabulary	1.57	1.78	1.32	1.73	0.529	0.590	0.006	**1.62**	**1.79**	**0.98**	**1.30**	**6.468**	**0.002**	**0.063**
	Number of non-uses of coherent vocabulary	0.07	0.49	0.04	0.39	0.857	0.426	0.009	0.12	0.75	0.03	0.28	1.530	0.219	0.016
	Number of non-uses of varied vocabulary	1.80	1.74	1.48	1.61	1.042	0.355	0.011	1.65	1.87	1.18	1.43	2.020	0.136	0.021
	TOTAL	4.10	4.47	3.51	3.62	1.014	0.365	0.011	**4.51**	**5.07**	**2.83**	**3.05**	**5.379**	**0.005**	**0.053**
VOCABULARY	Number of uses of technical vocabulary	**9.19**	**6.51**	**10.31**	**6.07**	**7.421**	**0.001**	**0.072**	**11.02**	**7.72**	**11.78**	**6.72**	**9.929**	**0.000**	**0.094**
	Number of uses of coherent vocabulary	0.06	0.40	0.04	0.47	1.120	0.329	0.012	0.14	0.89	0.16	1.26	.873	0.419	0.009
	Number of uses of varied vocabulary	**3.04**	**2.32**	**3.61**	**2.74**	**7.882**	**0.001**	**0.076**	**3.74**	**2.61**	**3.69**	**2.71**	**7.553**	**0.001**	**0.073**
	TOTAL	**12.28**	**8.23**	**13.96**	**8.19**	**8.447**	**0.000**	**0.081**	**14.90**	**9.60**	**15.63**	**8.57**	**10.240**	**0.000**	**0.097**
REVISION	Number of times modifications were made to the text	**0.46**	**0.84**	**0.82**	**1.21**	**6.616**	**0.002**	**0.065**	0.58	0.84	0.90	1.11	2.805	0.063	0.029
NET TOTAL		133.95	70.59	152.14	92.68	15.48	0.000	0.140	128.15	74	143.59	75.38	13.918	0.000	0.127

Bold values in the tables represent those values that are statistically significant (p ≤ 0,05).

uses of coherent vocabulary, number of uses of varied vocabulary, and Total; Wilks' Lambda = 0.95, $F_{3,189}$ = 3.33; p <.05).

Univariate ANCOVAs conducted for each of the levels of the dependent variables of the *Words and Paragraphs* Category (Number of Words and Number of Paragraphs) revealed statistically significant differences in number of words ($F_{2,191}$ = 6.630; Mce =29779.342; p<.01) with higher scores for the OCPD group than the ASPD group; in Number of paragraphs ($F_{2,191}$ = 12.476; Mce =13.971; p<.001) with the OCPD group obtaining higher scores than the ASPD group (See Table 2).

For the dependent variables of the Category *Errors Related to Formal Aspects* (Number of punctuation errors, number of lines not respecting margins, number of incorrect separations between words, number of incorrect conjunctions between words, number of repetitions, number of words with unreadable handwriting and Total) the ANCOVAs revealed statistically significant differences in number of punctuation errors ($F_{2,191}$ = 3.337; Mce =74.399; p<.05) with scores being higher for the OCPD group than the ASPD group, and Total score ($F_{2,191}$ = 6.238; Mce =253.868; p<.01) with scores being higher for the OCPD group than the ASPD group. No statistically significant differences were found in the number of lines that did not respect the margins; number of incorrect separations between words; number of incorrect conjunctions between words; number of repetitions, and number of words with unreadable handwriting.

For the dependent variables of the *Decoding Errors* category (Number of substitutions, number of additions, number of Omissions, number of inversions, number of rotations, number of lexicalizations, number of incorrect tildes, and Total), the ANCOVAs revealed statistically significant differences in number of substitutions ($F_{2,191}$ = 8.702; Mce =137.266; p<.001), showing higher scores for the OCPD group than the ASPD group; number of additions ($F_{2,191}$ = 4.768; Mce =32.777; p<.05) with scores being higher for the OCPD group than the ASPD group; number of omissions ($F_{2,191}$ = 6.312; Mce =71.529; p<.01) with the OCPD group showing higher scores than the ASPD group, and Total score ($F_{2,191}$ = 6.633; Mce =968.669; p<.01), with the OCPD group obtaining higher scores than the ASPD group. However, no statistically significant differences were found in the number of inversions, number of rotations, number of lexicalizations, and number of incorrect accents.

For the dependent variables of the Categories *Grammar* (Number of grammatically incorrect sentences); *Revision* (Number of modifications made to the text), and *Net Total*, ANCOVAs revealed statistically significant differences in Grammar (Number of grammatically incorrect sentences) ($F_{2,191}$ = 4.682; Mce =39.904; p<.05) with scores being higher for the OCPD group than the ASPD group, and Net Total ($F_{2,191}$ = 13.918; Mce =69059.771; p<.001) with scores being higher for the OCPD group than the ASPD group. No statistically significant differences were found in Revision (Number of modifications made to the text).

For the dependent variables of the *Planning Errors* Category (Number of disconnections between the main idea and the title, number of times secondary ideas do not appear, number of deviations from thematic continuity, number of times technical

vocabulary not used, number of times coherent vocabulary not used, number of times varied vocabulary not used, and Total) the ANCOVAs revealed statistically significant differences in the number of disconnections between the main idea and the title ($F_{2,191}$ = 3.313; Mce =3.287; p<.05) with the scores being higher for the ASPD group than he OCPD group; number of times technical vocabulary not used; ($F_{2,191}$ = 6.468; Mce =14.783; p<.01) with scores being higher for the ASPD group than the OCPD group; and Total score ($F_{2,191}$ = 5.379; Mce =86.235; p<.01) with the ASPD group obtaining higher scores than the OCPD group. No statistically significant differences were found in the number of times secondary ideas did not appear, the number of deviations from thematic continuity, the number of times coherent vocabulary was not used, and the number of times varied vocabulary was not used.

For the dependent variables of the *Vocabulary* Category (Number of uses of technical vocabulary; Number of uses of coherent vocabulary; Number of uses of varied vocabulary, and Total score), the ANCOVAs revealed statistically significant differences in the number of uses of technical vocabulary ($F_{2,191}$ = 9.929; Mce =464.199; p<.001) with scores being higher for the OCPD group than the ASPD group; Number of varied vocabulary uses ($F_{2,191}$ = 7.553; Mce =50.197; p<.01) with scores being higher for the ASPD group than the OCPD group, and Total score ($F_{2,191}$ = 10.24; Mce =756.371; p<.001) with scores being higher for the OCPD group than the ASPD group. No statistically significant differences were found in a number of uses of coherent vocabulary.

For the dependent variables of the *Main and Secondary Ideas* Category (Number of main ideas and number of secondary ideas), the ANCOVAs did not reveal statistically significant differences (See Table 2).

Discussion

This study aimed to analyze the profiles in terms of the proposed coding from the PROESC in terms of personality disorders (ASPD/ DPCC and OCPD/GVC) in the prison population.

In the writing of narratives and essays, we found statistically significant group differences in the *Number of Words and Number of Paragraphs*, with the OCPD/GVC group obtaining higher scores than the ASPD/DPCC group. This is a novel finding and could be explained by the fact that the narratives and essays are informal and unstructured tasks (they received few instructions, were freely themed, and participants were given the time they needed). Individuals with OCPD/GVC can create longer texts because of the absence of a time limit and because they use more frequent words with which they feel they have more control and fluency, which is characteristic of this personality profile (26).

Regarding the *Errors Related to Formal Aspects*, the scores were higher for the OCPD/GVC group than the ASPD/DPCC group in both narratives and essays. Specifically, in the short narratives, the OCPD/ GVC group scored higher on the Number of incorrect word conjunctions and Total score than the ASPD/DPCC group. For the essays, the OCPD group showed higher scores on the number of punctuation errors and Total score than the ASPD/DPCC group. This

means that the OCPD/GVC group made more errors than the ASPD/DPCC group in the analyzed variables related to grammar and phonological awareness. However, the OCPD/GVC group compensates and avoids errors by showing above average performance on other skills, such as memory or known vocabulary (12).

Concerning *Decoding Errors*, we found that for both narratives and essays, the OCPD/GVC group performed better than the ASPD/DPCC group. Specifically, in the narratives, we found statistically significant differences in performance regarding number of substitutions, number of additions, number of omissions, and total scores, all of which were higher for the OCPD/GVC group than the ASPD/DPCC group. For the essays, we found significant differences in the number of substitutions, number of additions, number of omissions, and total score, being, all of which were higher for the OCPD/GVC group than the ASPD/DPCC group. These results are novel and agree with those obtained in other studies (12, 19, 27, 28) showing that individuals with dyslexia present great difficulties in using basic spelling rules. However, another study found that participants with dyslexia did not make more decoding errors than control or non-dyslexic participants (29).

Regarding the categories *Grammar, Revision*, and *Net Total*, we found that the OCPD/GVC group obtained higher scores on grammar in the essays than the ASPD/DPCC group; that is, they have shown more difficulties in this category. In addition, the OCPD/GVC group obtained higher net total scores on essays and narratives than the ASPD/DPCC group, which indicates that they have more difficulties in general. However, for the narratives, the OCPD/GVC group performed better on Revision than the ASPD/DPCC group. These findings could be explained by the fact that the dyslexia profile is characterized by showing difficulties in grammar and syntax (16, 18). In addition, the net total scores obtained by OCPD/GVC group are particularly noteworthy, since these indicate writing difficulties similar to those observed in dyslexia. However, in the Revision category, the OCPD/GVC group performed better on the task than the ASPD/DPCC group. This category is intuitive (placing higher demands on cognitive processes such as attention, memory, and concentration) and the errors are related to analysis and error detection. We can highlight, therefore, the characteristic OCPD/GVC profile that includes preoccupation with details, rules, lists, order, and perfectionism (26).

Concerning the *Main and Secondary Ideas* Category, we also found that the OCPD/GVC group scored higher than the ASPD/DPCC group in the number of secondary ideas in the narratives. For example, in the *Planning Errors* Category, we found statistically significant differences in the number of disconnections between the main idea and the title, the number of times that technical vocabulary was not used, and the Total score in the essays, all of which were the higher for the ASPD/DPCC group than the OCPD/GVC group. Although contrary to the findings observed in the rest of the categories, these results are quite novel. Although we know that a typical error observed in dyslexia is the difficulty or problems in creating sequences and ordering them, together with the enrichment of such content (30), we can again, highlight the OCPD/GVC profile, which is characterized by a preoccupation with organization, planning and excessive dedication to work and productivity. These

tasks focus on mental processes such as planning that include operations such as idea generation and organization to create a design of what is written and how it will be written (18).

And finally, concerning the *Vocabulary* Category, we found statistically significant differences in the narratives regarding the number of uses of technical vocabulary, number of uses of varied vocabulary, and total score, all of which were higher for the OCPD/GVC group than the ASPD/DPCC group. In a similar vein, when analyzing the essays, in this same category (Vocabulary)**,** we found statistically significant differences in the number of uses of technical vocabulary and total score, which, in both cases, were higher for the OCPD/GVC group than the ASPD/DPCC group. On the other hand, the ASPD/DPCC group obtained higher scores than the OCPD/GVC group on the number of varied vocabulary uses. This result, although contradictory, is in line with what has been described previously regarding the characteristic profile of OCPD/GVC, including preoccupation with details, rules, lists, order, organization, or schedules to the point of losing sight of the main object of the activity. Moreover, they are perfectionists and even tend to enrich their vocabulary (characteristic of dyslexia). Thus, OCPD/GVC is better in all categories because it uses more appropriate vocabulary, although it takes time to access long-term memory (31).

On the contrary, our observation that varied vocabulary use in the essays was higher in the ASPD/DPCC group than the OCPD/GVC group could be due to possible impairments in the working memory of individuals with OCPD/GVC. According to the literature (30, 32), these deficits could explain the presence of dyslexia in OCPD/GVC; that is, they do not have adequate access to general vocabulary in terms of both variety and richness. However, for individuals with OCPD/GVC, the retrieval of technical vocabulary would be more precise when these are frequently used words.

Currently, treatments aimed at the prison population present several problems. These problems could be due to the lack of specificity of the content of the treatment, which result from the lack of knowledge of OCPD/GVC and its relationship with dyslexia (31). This lack of knowledge could underlie the ineffectiveness of interventions for reintegrating the prison population. Therefore, knowledge of language problems in this population in general and in OCPD/GVC in particular could even help to reduce recidivism and improve the effectiveness of targeted interventions in the prison population.

Our results are consistent with multiple studies on text writing (16, 18). The elevated scores in the text writing task of OCPD/GVC participants could be due to the profile characteristics mentioned above, since these tasks involve the use of analysis, error detection, organization, and planning tools. One significant aspect of this text writing task that could negatively affect ASPD/DPCC scores is the profile that characterizes them (lack of self-control, planning and attention problems, and irresponsibility in task execution) (18).

In summary, our study has yielded three main findings. First, the OCPD/GVC group scored better than the ASPD/DPCC group on the categories of number of words and number of paragraphs in narratives and essays, errors related to formal aspects of narratives, errors in decoding narratives, revision and the net total score on

narratives, main and secondary ideas of narratives, the vocabulary of narratives, errors related to formal aspects of essays, errors in decoding essays, and grammar and the net total score on essays. Second, the OCPD/GVC and ASPD/DPCC groups did not differ on tasks related to narrative grammar, narrative planning errors, or revision and main and secondary ideas of the essays. Third, ASPDs/DPCCs scored better than OCPDs/GVC on the categories of errors in planning and vocabulary of essays (number of varied vocabulary uses). This difference is in accord with the results of other studies (16, 18, 31) that have reported how some aspects such as planning directly influence text production, and it is these aspects that are the most difficult to learn and acquire. Moreover, if we consider the predisposition to develop dyslexia and social exclusion factors, we can explain the discrepant results found in this study. According to these same studies (16, 18, 31), youngsters who have not acquired writing skills during school are very likely to fail to write correctly. Moreover, recent studies (16, 29, 32) have shown that many students have not acquired the necessary skills to develop writing correctly. These problems in phonological awareness and phoneme-grapheme correspondence may prevail until adulthood. In addition, and in a similar vein, other studies (31) have added that writing automation takes place between elementary school (6-11 years) and the age of 15 years. Although the associated alterations may be readily treatable, it is necessary to detect such difficulties. If these problems are added to a potential disorder in reading and writing, such as dyslexia, together with school dropout, we could find a common profile characterized by OCPD/GVC, dyslexia, and social exclusion.

As with all research, our results must be evaluated in the context of several limitations. The main limitation is the absence of a non-custodial control group and a non-custodial dyslexia group, with which we should have compared the results we have presented. In addition, the language difficulties explored in this study require a more exhaustive analysis of the cognitive processes involved, such as learning, attention, working memory, and executive functions. Besides, the sample analyzed only included men. However, this was the case for the following three reasons: 1) one of the crimes analyzed was gender violence, which is understood as male aggression toward women; 2) no women were serving a prison sentence for intimate partner violence; and 3) the prison population contains five times more men than women, so that, given our inclusion and exclusion criteria, it would have been impossible to conduct this study with women. However, no other study has provided a separate in-depth analysis of each component of these writing tasks.

This study is novel since it focuses on aspects that have scarcely been studied in the literature, such as the relationship between personality disorders and language difficulties and the analysis of linguistic differences between OCPD/GVC and ASPD/DPCC. Our results confirm the need for speech-language pathology and therapy intervention in the prison population. Such an intervention could have considerable legal, social, and economic impact. In particular, a multidisciplinary intervention program that includes speech-language therapy would exponentially enrich prison care and education. Such a program could detect, in an early manner, those cases where we find a negative education outcome, a language difficulty, or a personality disorder (OCPD/GVC) that would otherwise lead to aggressive and maladaptive behaviors. However,

such a program would not only focus on preventive aspects in the penitentiary environment but would also include social and labor reinsertion. Improving language enriches the possibilities of finding employment and communicating more effectively with the environment, both immediate and far. In addition, the improvement of language could favor the conscience of the prisoner and regenerate the negative vision that society has of this population.

We believe that in the future, other disorders such as attention deficit hyperactivity disorder (ADHD), dyslexia, or other difficulties should be evaluated in the prison population. In addition, Electroencephalogram (EEG) and functional Magnetic Resonance Imaging (fMRI) should be employed to reveal common neuropsychological mechanisms underlying compulsivity and language pathologies that may affect vulnerability to gender violence in particular or criminal behavior in general. In addition, a further element that could enrich other similar studies is the use of techniques that measure eye movements. Although these are very complex measures, they can be very useful when information cannot be obtained by other simpler means and when some aspect of the response is related to the variable under study.

Conclusions

Although individuals know phoneme-grapheme correspondence rules, language disturbances of a reiterative and persistent nature may appear in those who show compulsive behavior. This finding could be related to co-occurrences in the behavior of compulsive individuals and those with learning difficulties. Language therapy in patients with high levels of compulsivity could improve self-control and self-criticism, thereby enhancing the capacity to form social relationships and show empathy.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: http://dx.doi.org/10.30827/Digibug.89489.

Ethics statement

The studies involving humans were approved by Comité Ético de Consejería de Salud y Familia, Junta de Andalucia, España (PEIBA, 0766-N-21). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. B-F-G-V: Methodology, Resources, Writing – review & editing, Investigation, Supervision, Visualization. SL-R: Methodology, Writing – review & editing, Conceptualization, Writing – original draft. MS-B: Methodology, Writing – review & editing, Resources.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Hormonal differences in perpetrators of intimate partner violence

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Objective: In order to gain a better understanding of the individual and joint impact of testosterone and cortisol on behavior, the present study was developed to test the differences in each hormone alone and conjointly between perpetrators of IPV and non-violent controls.

Method: Perpetrators of IPV on probation were compared to a control group of non-aggressive males from Hidalgo County in the Rio Grande Valley on baseline testosterone and cortisol, as well as several relevant questionnaires measuring aggression and trait anger. Differences in cortisol following exposure to a stressful event were also examined. Procedures included two laboratory visits consisting of questionnaires, a number of salivary testosterone and cortisol collections, and exposure to a stressor.

Results: Perpetrators had higher basal testosterone and post stressor cortisol levels than non- violent controls as well as a higher T/C ratio. In addition, trait anger moderated the relationship between both testosterone alone, and the testosterone/cortisol ratio and perpetration of IPV.

Conclusion: Results are consistent with the hypothesis that testosterone leads to antisocial behavior, including perpetration of violence. The results are also consistent with the dual hormone hypothesis, i.e., that testosterone and cortisol work together to jointly regulate social dominance and aggression. Both the increased freestanding testosterone and the increased cortisol following exposure to stress places these men at risk for perpetrating violence. Clinical implications are discussed.

Hormonal differences in perpetrators of intimate partner violence

Intimate partner violence (IPV), including physical and psychological aggression, is associated with numerous negative outcomes (e.g., depression, poor physical health) that significantly impair the functioning of individuals and their families and have high costs for society at large. For both men and women, physical IPV victimization was associated with increased risk of current poor health, depressive symptoms, substance use, developing a chronic disease, chronic mental illness, and injury (1). In a related population-based study with 4,060 women, Hispanic women in the United States who were IPV victims had disproportionate rates of depression, post-traumatic stress disorder, substance misuse, and anxiety, in decreasing orders of prevalence, i.e., with depression having the highest prevalence (2).

Despite the research on psychological characteristics of perpetrators of IPV, research into the biological factors that underlie the perpetration of IPV has been limited. With the exception of brain imaging for highly aggressive men (3), the field of aggression research has largely relied on self-report, observer-report, observation of dyads, and interview data in order to identify risk factors (e.g., personality traits, attitudes towards aggression, and exposure to aggression in the family or origin) (3, 4). Recently, organizations such as the National Institute of Mental Health have emphasized the importance of understanding phenomena through direct observable behavior as well as through neurobiological measures (5). Thus, biomarkers, or biological states that differentiate between aggressive and non-aggressive individuals, represent an important and necessary next step in the evolution of aggression research.

The field has reasonably complex multivariate psychosocial models of intimate partner aggression (6), but Raine (7) has argued for evaluations of both psychological as well as biological predictors of aggression. Accordingly, we turn to discussion of biological markers of aggression, along with analyses of how such markers might be used in an interactive or additive manner with psychosocial risk factors. Further, if one can use biological markers of aggression that can be obtained readily in an office, such as salivary hormonal assays, the practical utility of such markers increases. A literature review of biological markers of IPV perpetration (8) suggests that biological variables in the domains of head injury, neuropsychology, psychophysiology, neurochemistry, metabolism and endocrinology, and genetics play a significant role in the etiology of IPV. The authors concluded that at the most basic level, neurochemical alterations in perpetrators, specifically excessive testosterone or reduced serotonin activity, reflect an alteration of neuronal function that can be simplistically thought of as promoting rapid responding to threatening external stimuli.

An analysis of archival data from 4,462 U.S. military veterans concluded that testosterone leads directly to antisocial behavior since testosterone was correlated with a variety of antisocial behaviors for all individuals (9). However, a review of over 42 correlational studies concluded that there is a small association ($r = 0.08$) between testosterone levels and measures of aggression and that these associations were strongest for young men and offenders

(10). Archer (11) also concluded that people with higher existing levels of testosterone are more likely to show higher scores on a variety of different assessments of dominance, although this is a weak relationship. The relatively weak association between testosterone and aggression has led some to argue that this weak association may be due to the failure to account for levels of a second hormone, namely, cortisol. Thus, the Dual-Hormone Hypothesis proposes that the hormones testosterone and cortisol jointly regulate social dominance and aggression in humans. The neuroendocrine systems that produce testosterone and cortisol are thought to be diametrically opposed, with cortisol modulating the effects of testosterone on aggressive psychopathology (12, 13). The combination of high levels of testosterone (associated with dominance-seeking behavior), and low levels of cortisol (associated with avoidance behavior) may be associated with increased dominance and aggression more consistently than the levels of testosterone or cortisol, individually (13).

A few studies have investigated the role of testosterone and cortisol on intimate partner violence. Romero-Martinez et al. (14) compared participants who had previously been jailed for IPV and controls matched for SES and absence of partner aggression on testosterone and cortisol levels. Their methodology involved having subjects stressed by performing the Trier Social Stress Test (TSST). IPV perpetrators experienced decreases in salivary testosterone (T) levels, a moderate worsening of mood, slight anxiety, and a salivary cortisol (C) level increase. Moreover, high basal T was related to high levels of anger, anxiety, and worse mood. Controls experienced smaller changes in T and larger changes in C and psychological mood. The authors concluded that together with social aspects involved in IPV, differences in psychobiological variables and their relationships could play a relevant role in the onset and perpetuation of violent behavior. In a follow-up study by the same lab group, Romero-Martinez et al. (15) compared IPV perpetrators with men matched for SES and no IPV. They found that while IPV perpetrators had higher antisocial, borderline, and narcissistic personality traits and anger expression than controls, they did not differ in basal T/C ratio. However, only in IPV perpetrators was there a positive relationship between these variables, the T/C ratio playing a moderating role in the relationship of antisocial and borderline traits with anger expression. This led the researchers to conclude that in IPV perpetrators the T/C ratio may explain why certain personality traits are associated with high risk of becoming violent. In a third study from the same lab group in Valencia, Spain, IPV perpetrators were compared with men with no IPV who were matched for age and SES (16).

Both the IPV perpetrators and the non IPV perpetrators were stressed using the Trier Social Stress Test. Perpetrators of IPV against women had lower salivary cortisol and higher salivary testosterone/cortisol ratio levels during the post- acute cognitive laboratory stressor period, as well as higher total levels (average) of salivary oxytocin than controls. In addition, high levels of baseline anxiety and negative affect were related to high rises in cortisol during the stress task only in the perpetrators.

An additional study from a different lab group evaluated the association of T/C with IPV of male undergraduate college students

using the Trier Social Stress Task (17). Trait aggression moderated the relationship between the ratio of testosterone to cortisol (T/C) and IPV perpetration. High T/C ratio, or more testosterone relative to cortisol, was associated with elevated IPV in men low in trait aggression, whereas the association between T/C ratio and IPV was non-significant in men high in trait aggression (17). This result seems counter to the overall result of others -where Archer (10) found the association greatest in young men and criminals.

Overall, a major review by Archer et al. (10) concluded that the correlation between T and aggression is small (-.08). In addition, the association, if detected, appeared to be evident in young men and criminal offenders. Later research looked at the simultaneous role of T and C as it was believed that C would moderate or dampen the role of T. Research on the simultaneous role of T and C has proven to be complex as it is unclear if differences in T would be evident as a baseline measure in men or whether men need to be stressed to detect differences in T as some believe that rises when males are threatened. Similarly, should differences in the stress hormone, cortisol, across groups of aggressive and non-aggressive men be evident during a baseline non- stress period or only when the men are stressed, and cortisol has risen. Recent research in the T/IPV arena has used men who have been charged with physical assault against their female partners to obtain men who engage in more severe levels of aggression, T and C are evaluated simultaneously, and some stressor is used to potentially elevate both T and C.

The present study

In order to gain a better understanding of the individual and joint impact of testosterone and cortisol on behavior, the present study was developed to test the differences in each hormone alone and conjointly between perpetrators of IPV on probation and non-violent controls.

Differences in cortisol following exposure to a stressful event were also examined. In addition, this study assessed the moderation of the testosterone hypothesis and the dual hormone hypothesis by trait anger, using measures of testosterone and cortisol for the prediction of IPV.

Procedures included two laboratory visits consisting of questionnaires, and a number of salivary testosterone and cortisol collections. First, we hypothesized that perpetrators of IPV would have higher baseline testosterone, lower cortisol than the non-aggressive controls and that perpetrators would have a greater increase from pre to post stressor cortisol. Second, we hypothesized that a ratio of high testosterone to cortisol (T/C) would differentiate between male perpetrators of IPV and those men in the control group who have no history of aggression toward their partner. A third prediction was that trait anger would moderate the relationship between testosterone and perpetration of IPV. In addition, the current study proposed to test the Hypothesis 4) moderation of the dual hormone hypothesis by trait anger, using measures of testosterone and cortisol for the prediction of IPV.

Method

Sample

The sample was composed of 60 adult male volunteers: 30 perpetrators of IPV and 30 men without a history of IPV perpetration. The IPV volunteers were recruited from the Hidalgo County Probation Department in Edinburg, Texas in the Rio Grande Valley (RGV). Adults who were on probation for IPV were asked to participate voluntarily in this study. The inclusion criteria were as follows: (a) the participant is a male, (b) is at least 18 years of age, (c) on probation for an IPV-related offense in the RGV and (d) not currently taking medication which would interfere hormone measurements. The control sample of men who had no history of IPV were recruited via flyers distributed at local community centers.

Measures

Demographics and socioeconomic status

Demographic characteristics were assessed using single items, and they included age, race/ethnicity, highest level of education, and annual salary. The highest level of education was assessed using five categories: (1) *less than 4th grade*; (2) *high school diploma*; (3) *associate degree*; (4) *bachelor's degree*; and (5) *master's degree*. Similarly, annual salary was assessed using five categories (1) *less than $10,000*; (2) *$11,000-$20,000*; (3) *$21,000-$30,000*; (4) *$31,000-$45,000*; and (5) *$45,000 or more*.

Physical intimate partner violence perpetration

Physical IPV perpetration was measured using the physical assault subscale of the Revised Conflict Tactics Scale-2, the most widely used measure in the field of IPV (CTS-2) (18). The CTS-2, a 39-item scale (78 questions), is used to assess instances of five types of abusive behavior within the last twelve months: Negotiation, Psychological Aggression, Physical Assault, Sexual Coercion, and Injury. Questions are paired; respondents first answer regarding their behavior towards a partner in a dating, cohabiting, or marital relationship and then their partner's behavior towards them. Items are rated on a seven-point Likert scale system with the following distinctions: 1 = *Once in the past year*, 2 = *Twice in the past year*, 3 = *3-5 times in the past year*, 4 = *6-10 times in the past year*, 5 = *11-20 times in the past year*, 6 = *More than 20 times in the past year*, 7 = *Not in the past year, but it did happen before*, 0 = *This has never happened*. This scale demonstrates sound psychometric properties, with mean internal consistency of the CTS-2 to be.77. To analyze physical assault in the present study, the 12 items that constitute the physical assault scale were analyzed as outlined by Straus et al. (18). A variable was created that comprised the sum of all 12 items that load into the physical assault scale with higher scores indicating a

higher frequency of physical IPV. Internal consistency for the present study was α = .51 for the physical assault scale.

State trait anger expression

The State-Trait Anger Expression Inventory 2 (STAXI-2) [19] measures the intensity of anger as an emotional state (State Anger) and the disposition to experience angry feelings as a personality trait (Trait Anger). It consists of 57 items that load into 6 scales and an Anger Expression Index (total anger expression score). This scale is rated on a 4-point Likert scale system that assesses intensity of anger at a particular moment and the frequency of anger experience, expression, and control. This well-known anger measure has supported data for high reliability and validity. Alpha coefficients for the normative data, including both the general and psychiatric population, were above.84 for all scales and subscales, except for Trait Anger/Angry Reaction (assesses the respondent's angry reaction to negative situations) which had an alpha coefficient of.76 and.73 for women and men, respectively. Based on normative data factor analyses and factor loadings, support is available for the construct validity of the STAXI-II.

The present study used the sum score of the 15 items that load into the state anger subscale (internal consistency: α = 0.73) and the 10 items that load into the trait anger subscale(internal consistency: α = 0.84). A higher score was indicative of higher anger intensity as an emotional state and higher personality dimension of anger proneness.

Testosterone-cortisol ratio

Saliva samples were measured using a human testosterone and cortisol ELISA from Enzo Life Sciences (Farmingdale, NY, USA: Cat# ADI-900-176 and ADI-900-071). The assay sensitivity was 56.72 and 2.6 pg/mL (picograms per milliliter) for cortisol and testosterone, respectively. Samples were measured in duplicate, and the mean sample was utilized in our analyses. The curve was a standard curve using known concentrations included in the kit of the respective hormones. Good precision was obtained, with inter-assay and intra-assay variation coefficients for cortisol and testosterone of less than 10%. The concentration of cortisol and testosterone was expressed as pg/mL.

Procedure

Participants were individually briefed about the research plan, received, and signed the informed consent form, with all the required provisions explained. Participants were seen in the morning on two occasions to complete the research questionnaires via an unstructured interview format. Research participants were interviewed at a designated office at the Hidalgo County Probation Department and control participants were interviewed at a research office located at the university psychology training clinic. All study

protocols were reviewed and approved by the Institutional Review Board of the University of Texas Rio Grande Valley in accordance with the declaration of Helsinski.

Session 1. It was requested that participants avoid eating a major meal, foods with high sugar or acidity, high caffeine content, alcohol, nicotine, or drugs (prescription/over-the-counter-medication), brushing their teeth, or doing exercise two hours before arriving to their appointment. Participants were then asked to provide two saliva samples for hormonal analysis: Drool 1 was gathered at the beginning of the session and Drool 2 was gathered at the end of the session. Questionnaires administered during this session included a sociodemographic questionnaire and the CTS-2 [18]. Participants were asked what time they woke up the morning of session 1 and this time was recorded and used as a control variable in analyses to control the natural diurnal cycle of cortisol. The sampling of saliva was non-invasive; the participant was asked to slowly drool into a straw which was attached to a small plastic vial. Research assistants immediately secured the vial and placed it in a -20-degree Celsius freezer to be transferred to the university endocrinology research laboratory.

Session 2. Participants were asked what time they woke up and this time was again recorded. A third saliva sample (Drool 3) was obtained. Participants then proceeded to complete the State Trait Anger Expression Inventory-2 (STAXI-2) [19]. The participants then engaged in a stress induction exercise that differed for control and research participants. Control participants were asked to speak and describe about the most stressful situation they had experienced in the last 12 months, and research participants were asked to speak about the situation that led them to be placed on probation and asked to describe if they believed it was fair that they were arrested and mandated to probation. Subsequently, Drool 4 was collected, and the STAXI-2 was administered again. After 20 minutes, Drool 5 was obtained followed by a third administration of the STAXI-2, and 20 minutes later, Drool 6 was obtained followed by the fourth administration of the STAXI-2.

Results

Descriptive statistics

The total sample of mostly Hispanic men (98.3%) consisted of 30 control participants from the community and 30 men placed on probation for perpetrating intimate partner violence. Demographic characteristics of the study sample are provided in Table 1.

Table 2 provides group means, standard deviations, percentages, and comparisons between the control and research group participants on demographic variables. Independent samples t-tests were conducted to examine differences in age, education, and income between groups. The results of these tests indicated that there was a significant difference in age observed between the control group ($M = 24.13$, $SD = 4.28$) and the research group ($M= 30.80$, $SD = 8.43$), $t(58) = -3.86$, $p <.001$. There was also a significant difference in education observed between the control group ($M = 13.53$, $SD = 2.61$) and the research group ($M= 11.50$, $SD = 2.86$), $t(58) = 2.88$, $p <.05$.

TABLE 1 Demographic characteristics of the total sample ($N = 60$).

	Variable	N (%)
Age		27.47 (7.4)[a]
	18-23	22 (36.7)
	24-29	19 (31.7)
	30-35	10 (16.7)
	36-41	6 (10.0)
	42-47	2 (3.3)
	48-51	1 (1.7)
Race/Ethnicity		
	Hispanic/Latino	59 (98.3)
	African American	1 (1.7)
Highest Level of Education		12.52 (2.90)[a]
	Less than 4th grade	4 (6.7)
	High School Diploma	33 (55.0)
	Associate degree	9 (15.0)
	Bachelor's degree	14 (23.3)
Annual Salary		18.70 (11.54)[b]
	Less than $10,000	28 (46.7)
	$11,000-$20,000	7 (11.7)
	$21,000-$30,000	8 (13.3)
	$31,000-$45,000	12 (20.0)
	$45,000 or more	5 (8.3)

[a]Mean (SD) provided; [b]Mean (SD); Gross yearly family income in thousands of dollars.

Hypothesis 1a and 1b

There was a significant difference in testosterone in session 1 for the control group ($M = 334.00$, $SD = 110.73$) and the research group ($M= 413.89$, $SD = 126.11$), $t(58) = -2.61$, $p <.05$, $d= 0.66$. There was also a significant difference in testosterone in session 2 for the control group ($M = 325.81$, $SD = 103.52$) and the research group ($M= 417.48$, $SD = 128.27$), $t(58) = -3.05$, $p <.05$, $d = 0.78$. There were no significant differences between the control and research group in

TABLE 2 Differences in demographic variables in control and research participants ($N = 60$).

Variable	Control ($n = 30$)		Research ($n = 30$)	
	M	SD	M	SD
Age (years)*	24.13	4.28	30.80	8.43
Education (years)*	13.53	2.61	11.50	2.86
Race/Ethnicity				
Hispanic/Latino	30		29	
African American	0		1	

*statistically significant difference.

cortisol in session 1 ($M= 6513.33$, $SD = 549.50$ and $M = 6535.00$, $SD = 412.72$, respectively), session 2 ($M = 6647.67$, $SD =449.31$ and $M = 6680.67$, $SD = 476.84$, respectively) and before the stressor ($M= 6667.67$, $SD =429.38$ and $M = 6682.33$, $SD = 459.78$, respectively). A significant difference in cortisol after the stressor was found between the control group ($M = 6681.67$, $SD = 586.30$) and the research group ($M= 7219.33$, $SD = 435.07$), $t(58) = -4.03$, $p <.001$, $d = 1.04$. Table 3

Hypothesis 2

The second hypothesis was that a ratio of high testosterone to cortisol (T/C) would differentiate men placed on probation for IPV and men in the control group with no history of aggression. An independent samples t-test was conducted to compare the T/C ratio levels in the control and research groups in session 1 and session 2. There was a significant difference in the T/C ratio in session 1 for the control group ($M = .05$, $SD = .02$) and the research group ($M= .06$, $SD = .02$), $t(58) = -2.55$, $p <.05$, $d = 0.66$. In addition, a significant difference in the T/C ratio was found in session 2 for the control group ($M = .05$, $SD = .01$) and the research group ($M= .06$, $SD = .02$), $t(58) = -3.00$, $p <.05$, $d = 0.77$. Table 4

Hypothesis 3

The third hypothesis predicted that the levels of testosterone would be positively related to perpetration of IPV as reflected on scores of the Physical Assault scale of the CTS-2 scale.

There was a positive correlation between the Physical Assault scale and the testosterone value of session 2, $r (60) = .26$, $p <.05$. In addition, when the mean of the two testosterone values (session 1 and session 2) was obtained, it was also positively related to perpetration of IPV, $r (60) = .25$, $p <.05$.

Hypothesis 4

The fourth hypothesis predicted that trait anger would moderate the relationship between testosterone at both session 1 and 2 and perpetration of IPV. Given that age was significantly associated with testosterone at session 1 and 2 ($r(60)=-44$, $p = .001$; $r (60)=-41$, $p = .001$, respectively), it was included in the models as a control variable. Results from the binary logistic regression assessing the relationship between trait anger, testosterone at session 1 and physical IPV perpetration indicated that testosterone at session 1 ($B = .08$, $p = .01$), and trait anger ($B = 1.41$, $p = .01$) were significant predictors of physical IPV perpetration. When the moderation of trait anger on the association between testosterone at session 1 and physical IPV perpetration was assessed, results indicated that there was a significant interaction ($B = -.003$, $p= .03$), thus there was a moderation effect of trait anger on the relationship between testosterone at session 1 and IPV perpetration.

TABLE 3 Differences in testosterone and cortisol in control and research participants (*N* = 60).

Hormones	Control (*n* = 30)		Research (*n* = 30)	
	M	SD	M	SD
Testosterone Session 1*	334	110.73	413.89	126.11
Testosterone Session 2*	325.81	103.52	417.48	128.27
Cortisol Session 1 Sample	6513.33	549.5	6535	412.72
Cortisol Session 2 Sample	6647.67	449.31	6680.67	476.84
Cortisol Before Stressor	6667.67	429.38	6682.33	459.78
Cortisol After Stressor*	6681.67	586.3	7219.33	435.07

*statistically significant difference

When the relationship between trait anger, testosterone at session 2 and physical IPV perpetration was assessed via binary logistic regression, testosterone at session 2 (B = .09, *p* =.01), and trait anger (B = 1.61, *p* = .01) were significant predictors of physical IPV perpetration.

In addition, the moderation of trait anger on testosterone at session 2 and IPV perpetration was also significant (B = -.004, *p* = .02). Table 5

Hypothesis 5

The current study proposed to test the moderation of the dual hormone hypothesis by trait anger, using measures of testosterone and cortisol for the prediction of IPV. Results from the binary logistic regression assessing the relationship between trait anger, the T/C ratio at session 1 and physical IPV perpetration indicated that the T/C ratio at session 1 and trait anger were significant predictors of physical IPV perpetration (B = 530.68, *p* <.01; B = 1.48, *p* = .01, respectively). When the moderation of trait anger on the association between the T/C ratio at session 1 and physical IPV perpetration was assessed, results indicated that there was a significant interaction (B = -.02, *p* = .03), thus there was a moderation effect of trait anger on the relationship between the T/C ratio at session 1 and IPV perpetration.

When the relationship between trait anger, the T/C ratio at session 2 and physical IPV perpetration was assessed via binary logistic regression, the T/C ratio at session 2, and trait anger were significant predictors of physical IPV perpetration (B = 930.00, *p* <.01; B = 2.39, *p* = .01, respectively). In addition, the moderation of trait anger on the T/C ratio at session 2 and IPV perpetration was significant (B = -42.57, *p* = .02). Table 6

Discussion

As predicted, perpetrators of IPV had higher baseline testosterone than the non- aggressive controls on both days, despite the controls being significantly younger. In addition, as predicted, levels of testosterone were found to be positively related to perpetration of IPV as reflected on scores on the CTS-2. Contrary to prediction, perpetrators did not differ from the controls on baseline cortisol but as predicted, the perpetrators showed a larger increase in cortisol than the controls following exposure to a stressor, probably reflecting the fact that speaking about the stress of being arrested for IPV was a significant stressor for the perpetrators. We believe that the use of a stressor such as the report of being arrested for IPV is more ecologically valid than the use of the often-used Trier stressor which involves solving difficult math problems.

These results are consistent with the hypothesis that testosterone leads to antisocial behavior, including perpetration of violence since perpetrators had significantly higher levels of testosterone than non-aggressive controls and testosterone was correlated with measure of perpetration of intimate partner violence. These results are consistent with results of a study with a large military sample of over 4,462 military veterans, in which testosterone was associated with men's physical aggression to their wives [20] and a study which found elevated testosterone levels were associated with both verbal and physical aggression toward an intimate partner in culturally diverse men of low socioeconomic status who had a main sexual partner (r=.24) [21].The results are further consistent with a review of over 42 correlational studies which concluded that there is a small association (*r* = 0.08) between testosterone levels and measures of aggression which were strongest for young men and offenders [10]. The finding that perpetrators

TABLE 4 Differences in T/C ratio in session 1 and 2 (*N* = 60).

Ratio	Control (*n* = 30)		Research (*n* = 30)	
	M	SD	M	SD
Testosterone Day 1 / Cortisol Day 1*	.05	.02	.06	.02
Testosterone Day 2 / Cortisol Day 2*	.05	.01	.06	.02

*statistically significant difference.

TABLE 5 Binary logistic regression models: trait anger as a moderator of the relationship between testosterone at session 1 and 2 and physical IPV perpetration.

Variables	Nagelkerke R²	B (OR)	95% CI for OR
Physical IPV Perpetration			
	.81		
Age		.64 (1.89)**	[1.32,2.79]
Testosterone Session 1		.08 (1.08)*	[1.17,2.47]
Trait Anger		1.41 (4.08)*	[1.38,13.90]
Trait Anger x Testosterone Session 1		-.003 (1.00)*	[.96, 1.00]
Physical IPV Perpetration			
	.83		
Age		.64 (1.91)*	[1.28,2.85]
Testosterone Session 2		.09 (1.10)*	[1.03,1.17]
Trait Anger		1.61 (5.01)*	[1.44, 17.44]
Trait Anger x Testosterone Session 2		-.004 (1.00)*	[0.99, 1.00]

*p < 0.05. **p < 0.01. Values were rounded to the nearest tenth. OR, odds ratio. CI, confidence interval. Lines in between indicate separate regression models. Dependent variables are in bold.

TABLE 6 Binary logistic regression models: Trait anger as a moderator of the relationship between T/C ratio at session 1 and 2 and physical IPV perpetration.

Variables	Nagelkerke R²	B (OR)	95% CI for OR
Physical IPV Perpetration			
	.82		
Age		.65 (1.92)**	[1.32,2.79]
T/C Ratio Session 1		530.68 (2.95E+23)*	[2.98E+67,-]
Trait Anger		1.48 (4.38)*	[1.38,13.90]
Trait Anger x T/C Ratio Session 1		-22.48 (.00)*	[.00,.09]
Physical IPV Perpetration			
	.88		
Age		.80 (2.22)**	[1.30,3.77]
T/C Ratio Session 2		930.00 (-)**	[7.39E+103,-]
Trait Anger		2.39 (10.94)*	[1.65, 72.33]
Trait Anger x T/C Ratio Session 2		-42.57 (00)*	[.00,.00]

*p < 0.05. **p < 0.01. Values were rounded to the nearest tenth. OR, odds ratio. CI, confidence interval. Lines in between indicate separate regression models. Dependent variables are in bold.

were higher than controls in freestanding levels of testosterone is consistent with the first hypothesis that the testosterone response to challenge increases aggression since perpetrators are starting off with higher levels of testosterone even before being exposed to the challenge. A single administration of testosterone has been shown to rapidly modulate men's perceptions of their own physical dominance, which may possibly explain the link between testosterone and dominance related behaviors (22). Testosterone has also been shown to causally modulate emotional decision making and to increase affective sensitivity (23).

There was no difference on baseline cortisol between perpetrators and controls. This finding is somewhat inconsistent with the literature. However, in a review of the literature on the relationship between cortisol and aggression, Salis (17) suggested that although the wealth of the evidence indicates hypocortisolism is related to aggressive behavior, a number of studies found no association and or that the relationship may be reversed depending on the characteristics of the sample and that the relationship between cortisol and aggression may depend on a number of different factors. Studies have shown that certain characteristics in conjunction with aggressive behavior may also lend themselves towards higher rather than low cortisol (17, 24). Cima, Smeets and Jelicic (25) found that non psychopathic aggressive men had high diurnal cortisol. Given that the perpetrators in the present study were found to engage mostly in reactive violence (26), it may be that

the sample of perpetrators in this study were mostly non psychopathic as evidenced by the higher cortisol levels. In addition, previous studies have shown that type II or reactive perpetrators present a hyper-reactivity in anticipation of stress (27), so it could be that, in addition, the fact that they were interviewed at the department of probation, the stress associated with reminder of their being on probation produced a stress response and associated rise in cortisol.

As predicted, perpetrators of IPV evidenced a greater increase in cortisol following exposure to a naturalistic stressor, than non-aggressive controls, indicating that perpetrators of IPV are more reactive to stress. Cortisol has been shown to increase after exposure to stress (28). The results of this study suggest that in addition to the higher risk involved due to the higher testosterone, their greater response and reactivity to stress, as indicated by the increase in cortisol, places them at even higher risk for perpetrating intimate partner violence in situations where their coping resources are taxed.

As predicted, a ratio of high testosterone to cortisol (T/C) differentiated men placed on probation for IPV and men in the control group with no history of partner aggression. On both days, this ratio was higher for perpetrators than the non-violent controls. These results are consistent with results from studies that reported that consistent with the "Dual-Hormone Hypothesis," which proposes that in humans, the hormones testosterone and cortisol work together to jointly regulate social dominance and aggression, greater T/C ratios were associated with greater aggression (29, 30). However, other studies have shown that testosterone was positively related to aggression/violent crime only among low-cortisol individuals but not among high-cortisol individuals (31, 32).

Summary of findings

Perpetrators had higher testosterone and post stressor cortisol levels than non-violent controls as well as a higher T/C ratio. In addition, trait anger moderated the relationship between both testosterone alone, and the testosterone/cortisol ratio and perpetration of IPV, indicating that the hormonal effect is more pronounced in perpetrators of IPV that have higher levels of trait anger. Subregions of prefrontal cortex, insula, amygdala, basal ganglia and hippocampus play a major role within neural networks related to aggression and have been consistently implicated in biology of aggression (33). Prototypical cases of impulsive aggression, those associated with anger, involve the recruitment of the acute threat response system structures; that is, the amygdala, hypothalamus, and periaqueductal gray (34). Results are consistent with the hypothesis that testosterone leads to antisocial behavior, including perpetration of violence and are also consistent with the dual hormone hypothesis, that testosterone and cortisol work together to jointly regulate social dominance and aggression, with greater T/C ratios being associated with greater aggression (29, 30). The increased testosterone places these men at risk for perpetrating violence as a result of testosterone's influence on making more automatic judgements, biased by emotional factors due to a higher emotional sensitivity in conflictual situations (23). The increased cortisol following exposure to a stressor also suggests that perpetrators react more intensely to stress which further places them at risk for perpetration of violence and could explain the fact that the majority of the violence perpetrated is reactive (26).

Clinical implications

The results of this study suggest that it would be important to assess hormonal patterns, specifically, testosterone and cortisol, in addition to personality characteristics, such as trait anger, impulsivity and psychopathy, and that this assessment might lead to fine tuning interventions designed to help reduce the level of recidivism of these perpetrators. For example, future studies might show that perpetrators high in testosterone and low in cortisol, who are supposedly the more callous, psychopathic perpetrators, who engage in intimate terrorism, would derive more benefit from an intervention based on power and control. Alternatively, perpetrators high in testosterone and higher on cortisol, might benefit from interventions addressing anger and impulse control. Irrespective of the combinations of hormonal patterns and personality characteristics of perpetrators, perpetrators high on testosterone are prone to responding aggressively, and would benefit from skills training and relapse prevention types of interventions which would train perpetrators in responding non aggressively to high-risk situations. Just providing perpetrators high on testosterone with information regarding their propensity to react to certain types of situations in an aggressive manner might have a beneficial impact with respect to curtailing their aggression (35).

It is important that pretreatment assessments for perpetrators of intimate partner violence acknowledge the heterogeneity involved in both the type of violence committed, such as reactive/proactive, self-defense, intimate terrorism, mutual combat, heterosexual, LGBT, Trans, as well as the characteristics of the perpetrators including, biological, hormonal, head injury, family only/generally violent, attachment issues, borderline personality issues, impulse control issues, anger profiles, experiential avoidance, history of trauma, alcohol and substance use, power and control issues, stage of motivation to change, underclass variables and culture identification (36). Given the heterogeneity involved, there is no one treatment that can address all the issues and it is incumbent on the providers to conduct a comprehensive assessment prior to assigning the perpetrators to a lengthy intervention which might be inappropriate to address their treatment needs, does little to nothing to reduce recidivism and simply places the victims at greater risk and only serves to misguide the public into thinking that something is being done to address the violence that is being perpetrated against significant others in the context of intimate relationships. The field needs to continue to conduct experimental studies to assess specific intervention outcomes in order to be able to address Gordon Paul's (37) epic question: What treatment, by whom is most effective for this individual with that specific problem, and under which set of circumstances.

Research on testosterone and IPV needs to have replications across several labs. The research by Romero and colleagues (14–16) in Spain is well executed and it has been conducted with men arrested for IPV. Based on the Archer et al. (10) review, the strength of the association of T and general aggression is small (.08), and the association of T and IPV in the present study was also small (r= .28) but numerically larger than in the large review. However, the review noted that the association of T and aggression was larger with young men andoffenders. The association herein was with offenders, and we do not know what the association of T and IPV would be in a general population. It might well be less. The ratio of T/C in the research group, the partner aggressive men, was higher than in the control group, the non-aggressive men, but the ratio differences were extremely small, and ratios are notable for being less reliable than a simple mean. The role of cortisol as a stress hormone is very well established as stress increases cortisol increases. In addition, the diurnal nature of cortisol is well known with cortisol being high in the morning and low at night. However, the correlation of cortisol and aggression is unclear in humans (38) and replications are needed with clinical and representative samples to evaluate the role of cortisol, testosterone and IPV.

Limitations

First and foremost, it needs to be understood that this is a small sample size and that the perpetrators are from a border city in Texas which is mostly, 90%, Hispanic and the results may not be generalizable to the rest of the population of men who aggress against their partner.

However, it is also a strength in that it is a homogenous population with respect to ethnicity and it contributes to an understanding of the characteristics of Hispanic (mostly of

Mexican American origin) perpetrators of intimate partner violence on probation, in a specific region of the US. Second, the alpha for the physical assault scale of the CTS was low (.51). There is a concern with using the CTS, which is a self-report scale, for perpetrators to report on their use of physical violence towards their partner because the men tend to minimize the violence they perpetrated and most of their scores were near zero, in spite of the fact that they have been placed on probation following an arrest and the victim has described that they committed violence as reflected in the police reports.

Third, both groups were exposed to slightly different stressors. The assumption was that talking about being arrested would be an ecologically valid stressor for the perpetrators and that talking about the most stressful situation they experienced in the past year would be an equally ecologically valid stressor for the control group. In any case, both stressors are more ecologically valid than conducting a mathematical test, making a presentation or exposure to color words printed in different colors of ink, which are often used psychological stressors in experimental studies.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by University of Texas Rio Grande Valley IRB. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Causal attributions of impulsive and compulsive behaviors

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Introduction: Aggression, and therefore gender-based violence, can be an impulsive or compulsive behavior, depending on the consumption of alcohol and/or drugs. In Europe, the prevalence of gender-based violence is 16 to 23%. This prevalence shows that there is a need to make further progress in the treatment of aggression against women. Qualitative techniques allow us to understand perceptions and attributions holistically by analyzing what people who commit the crime say, why they say it and how they say it.

Aim: To explore the experience of physical and verbal aggression by a partner, dependent on the presence or absence of alcohol and drug use, in the prison population.

Method: A mixed methodology was used (combining qualitative and quantitative techniques). The sample was made up of 140 men divided into two focus groups [with alcohol and/or drug consumption (SAD) and without alcohol and/or drug consumption (NSAD)] who completed the Demographic, Criminal and Behavioral Interview in Penitentiary Institutions; the Gender Violence Questionnaire (both developed for this study) and the MultiCAGE CAD-4 Questionnaire. Qualitative data were analyzed using thematic analysis and quantitative data were obtained using contingency tables.

Results: It was found that the SAD group attributed the crime committed to alcohol and/or drug consumption, while the NSAD group attributed it to jealousy and to their partner. The SAD group revealed that the consequence of the physical aggressions was to get what they were looking for from their partner and the consequences of the verbal aggressions was regret, unlike the NSAD group that did not get anything from the aggressions. The SAD group recognized that to avoid future aggressions they would have to avoid alcohol and/or drug use, while the NSAD group mentioned that they would have to avoid contact with their partner.

Discussion: The need to include perceptions and attributions as well as the use of alcohol and/or drugs is emphasized when assessing individuals who commit the crime of gender-based violence.

Introduction

Gender-based violence (GBV) is defined as a set of acts of physical and psychological violence, produced by aggressions to sexual freedom, threats, coercion and arbitrary deprivation of liberty. This type of violence also includes behaviors that reflect discrimination, inequality and power relations exercised by men against women, specifically by those who are or have been their spouses or who have maintained similar affective relationships, with or without cohabitation. Such acts may be manifested in both the public and private spheres (1). It is estimated that 1 in 3 women over the age of 15 has suffered GBV at least once in their life, making it a primary concern in terms of public health, gender equity, and human rights worldwide (2). In Europe, there is a 16% to 23% prevalence of GBV; specifically, 43% of psychological violence, 20% of physical violence, 12% of economic violence and 7% of sexual violence (3). In Spain, the European Survey on GBV revealed that 28.7% of women between the ages of 16 and 74 have experienced some form of violence by their partner throughout their lives (4). Consequently, 11.3% of the prison population is serving sentences for GBV crimes. The sentences are aimed at reeducation and social reintegration through specialized rehabilitation treatments. However, there is a recidivism rate of 41-60% for GBV crimes, making it one of the crimes with the highest recidivism rates in the country (5).

In classical research (6, 7), aggressive behavior has been linked to two subtypes: impulsive aggressive behavior and premeditated (compulsive) aggressive behavior. Impulsive aggression is defined as an aggressive response that arises in response to provocation and leads to a loss of behavioral control. On the other hand, premeditated (compulsive) aggression is a planned or conscious aggressive act that is not related to a state of agitation due to anger issues. Alcohol and drug use are considered impulsive behaviors (8–10), while GBV could be associated with compulsive behaviors (11). The association between aggression and impulsive or compulsive behaviors has been linked to inefficient frontal lobe function, reflecting complex neurocircuits (12). Although these terms are often used in clinical contexts, they are often imprecise and contradictory, necessitating further exploration of the topic. Conversely, the association between alcohol and drug use and GBV has been widely documented in quantitative research (13–16).

However, there is a need for qualitative research to analyze the factors influencing GBV as perceived by the perpetrators. Much of what we know about this topic comes from studies that have used quantitative measures to characterize an individual's use of violent acts over a specific period (17). A recent study (18) highlights that these measures have been criticized for not considering the context in which aggression occurs. For example, physical aggression may differ in severity and meaning depending on the motive for the aggression and the cultural context in which it occurs. That is, the aggressive act can be perceived as memorable or distressing, depending on the conflict in which it occurs or the prior history of violence. Therefore, qualitative studies (19) allow for a holistic examination of contextual factors and the subjective meaning of violence. The words of the person who committed the crime when describing an aggressive act provide information on how they

perceive that experience and what motivated them to do it. It also allows for understanding the links between events and emotions that drive criminal behavior.

The complexity of the explanatory variables of GBV has sparked particular interest in variables related to attributions (20, 21), motivations (18, 22, 23), and alcohol and/or drug use (17, 19, 24) among people who have committed GBV crimes and exhibit alcohol and/or drug use.

Regarding causal attributions, it has been found (20) that individuals who committed GBV crimes transferred responsibility for their behavior, especially to the victim. That is, they presented external attributions of guilt and minimized or denied the criminal behavior. It has also been found (21) that the causal explanations for GBV crimes were closely related to the expectations of the perpetrators (provoked by patriarchal views) about their partners' behavior, lack of affection, poor communication, economic problems, and jealousy. Participants blamed their partners, denied responsibility for the crime, and attributed it to a lack of impulse control.

In terms of perceived motivations for criminal behavior, the results of a study (22) revealed that the aggressions committed in GBV crimes were learned behaviors from childhood in the family environment (participants had witnessed physical violence suffered by their mother, had been abused by their caregivers, and later exercised violence against their children and partners). This behavior pattern reveals the transmission of violence from generation to generation, becoming a normalized behavior and one of the main motivations for the crime. Additionally, participants mentioned that they assaulted the victim as a result of relationship problems characterized by jealousy, revenge, ingratitude, and sadness. Finally, it is noted that those who committed the crime perceived themselves as victims of the judicial system because they considered the complaint and consequences to be unjust, provoking desires for revenge against their partner.

Likewise, the motivational factors for committing the GBV crime in people who were receiving treatment for having assaulted their partner have been analyzed (23). The thematic analysis found that the factors motivating the commission of a GBV crime were adverse childhood experiences (bullying, neglect in upbringing, physical or sexual violence), communication problems with the partner (arguments, lack of mutual listening, and denial of the existence of problems), the outcome obtained as a result of the aggression (information, causing harm, revenge), and the positive interpretation of the consequences of the aggression (achieving their goal and continuing the relationship after the aggression). Similarly, the reasons for the use of physical aggression by people who have committed GBV crimes were studied (18) and found that there were three main reasons. The first reason for the use of physical aggression was to express emotions and feelings. Participants described physical aggression as something that allowed them to express their discomfort and disagreement with their partner when verbal expression was inadequate. The second reason for the use of physical aggression was instrumental, meaning they assaulted their partner to achieve a specific purpose (to distance their partner to end the conflict or to detain their

partner to continue the conflict). Lastly, the third reason for the use of physical aggression was punishment. Participants mentioned that they assaulted their partner to punish them for infidelity, for assaulting them, or for the victim's drug use.

Finally, regarding the influence of alcohol and/or drug use on GBV, a study (24) analyzed the behaviors, interactions, and conditions that occurred before, during, and after GBV, according to the perspective of those who committed the crime. It was found that before the violent act, there were feelings of contempt towards the victim due to relationship conflicts provoked by the victim's recurrent threats to leave or take their children and refusal to have sexual relations. Additionally, there were communication problems, economic difficulties, work stress, and alcohol and/or drug use by the person who committed the crime. During the violent act, participants highlighted those feelings of anger and frustration, and the use of alcohol and/or drugs triggered the GBV crime (shouts, insults, and hitting). Finally, it was found that after the violent act, those who committed a GBV crime exhibited feelings of guilt, remorse, and behaviors such as distancing, reconciliation, and alcohol and/or drug use. Lastly, it was found that participants tried to prevent violent incidents at all stages (before, during, and after). To achieve this, they avoided talking about conflicting topics with their partner, vented with friends and family, and went out to consume alcohol and/or drugs. It has also been evidenced (19) that those who committed GBV crimes justified their criminal behavior with the effect of alcohol and/or drug use or abstinence and the stress they felt due to relationship conflicts (jealousy, suspicion of infidelity, breakups), unemployment, and economic problems. Justifying criminal behavior is a commonly used mechanism by those who commit GBV crimes to give moral sense to violent behaviors, thus alleviating feelings of guilt and avoiding social exclusion. This aspect was also evidenced in a qualitative study (17) in which it was found that participants perceived that the crime committed was solely due to alcohol and/or drug addiction (both under its effects and under the effects of withdrawal syndrome) and showed a minimization of criminal behavior, indicating that GBV incidents were isolated and unusual, caused by the loss of control due to jealousy. Conversely, their partners or ex-partners described the GBV incidents as continuous and highly dangerous, not isolated and unusual events.

Studies focused on attributions, motivations, and alcohol and/or drug use related to GBV reveal that those who commit these crimes do not accept responsibility for their behavior and minimize the consequences of violence. They present attributions characterized by the denial of personal responsibility, blaming the victim, and other external attributions of guilt (family problems, effects of alcohol and/or drugs, economic difficulties) that allow them to justify their criminal conduct. Therefore, increasing our understanding of why GBV occurs from the perspective of the perpetrator is essential for developing effective treatments. This aspect is even more important given the poor effectiveness of treatments aimed at this population (25, 26), due to limitations in studies focused on this topic. Specifically, the limitations of studies on GBV relate, firstly, to the excessive use of quantitative methodologies (13). Secondly, the few qualitative studies conducted with those who have committed GBV crimes have been carried out with unrepresentative samples,

preventing the generalization of the results (20, 27). Thirdly, the perceptions of this population regarding the type of violence exerted, for example, physical or verbal, have not been analyzed (18). Lastly, it has not been studied whether people who consume alcohol and/or drugs present causal attributions for the crime differently from those presented by people who do not consume alcohol and/or drugs (28). For this reason, the objective of this study is to explore the experiences related to physical and verbal partner aggression, based on the presence or absence of alcohol and drug use, in a prison population.

Materials and methods

Participants

The sample consisted of 140 men, with a mean age of 40.08 years (SD = 10,85), selected through intentional sampling at the Penitentiary Center of Granada (Spain). The only prison treatment they were receiving at the time of participating in this study was the intervention program aimed at people who commit crimes of gender violence. Sampling was carried out during the first two weeks of said treatment. Participants were divided into two focal groups based on the presence or absence of alcohol and/or drug consumption, according to the MultiCAGE CAD-4 (29). Group 1, with alcohol and/or drug consumption (SAD), comprised 70 men, with a mean age of 40.41 years (SD = 10,64). Group 2, without alcohol and/or drug consumption (NSAD), consisted of 70 men, with a mean age of 39.74 years (SD = 11,11). Inclusion criteria were being male, aged between 18 and 63 years, having committed a Domestic Violence and Gender Violence (GBV) offense, and agreeing to voluntary participation in the study by signing an informed consent form. Exclusion criteria were being over 63 years old, suffering from a physical or psychiatric illness (schizophrenia and/or depression), and currently undergoing psychopharmacological treatment. Table 1 presents the sociodemographic characteristics of the described sample.

Instruments

The assessment instruments used in the present study were as follows:

Demographic, Offenses, and Behaviors Interview in Penitentiary Institutions: This interview was designed specifically for this study to collect sociodemographic data, type of offense, and participants' sentence lengths and types.

Gender Violence Questionnaire: This questionnaire, developed for this study, aims to explore experiences related to physical and/or verbal partner aggression. It consists of 14 open-ended questions about events before, during, and after violent incidents (arguments, insults, assaults, and hits) and how such events could have been avoided. Completing this questionnaire takes 45 minutes, and the questions are based on the proposal by Ager (24).

MultiCAGE CAD-4 Questionnaire (29): This test evaluates the presence of addictive behaviors. It is self-administered and

TABLE 1 Sociodemographic variables.

	Group with alcohol and/ or drug consumption (SAD)	Group without alcohol and/ or drug consumption (NSAD)	χ^2/F	p
Age (X/DT)	40,41 (10,64)	39,74 (11,11)	0,133	0,716
Civil Status (N)			1,301	0,729
Single	34	31		
Married	18	15		
Divorced	11	14		
Domestic partner	7	10		
Educational level (N)			6,595	0,086
No education	6	5		
Primary/ESO	39	49		
Baccalaureate/ HVTC	15	14		
Undergraduate/ Postgraduate	10	2		
Type of Crime (N)			2,029	0,154
Injury crime	20	28		
Crime of threats	50	42		
Penalty time (N)			1,343	0,854
20 days - 1,22 months	20	20		
2 - 5 months	8	9		
6 - 9, 01 months	35	30		
10 - 16,04 months	4	6		
21-24 months	3	5		
Penalty type (N)			0,034	0,853
Work for the benefit of the community	20	21		
Prison	50	49		

answered using a dichotomous scale (Yes/No). It consists of 32 items divided into 8 categories (alcohol, gambling, drugs, food, internet, video games, shopping, and sex). Each category contains 4 items related to 4 symptoms. Two affirmative responses indicate the possible existence of that problem, three affirmative responses suggest the highly likely existence of that problem, and four affirmative responses confirm the existence of that problem. It is

a tool with high reliability (Cronbach's alpha 0.86) and adequate criterion validity (between 90% and 100%).

Procedure

The Demographic, Offenses, and Behaviors Interview in Penitentiary Institutions was conducted individually to verify the inclusion criteria and propose voluntary participation in this study. Participants were informed of their right to interrupt the procedure at any time, and their written consent was obtained. Additionally, they completed the MultiCAGE CAD-4 Questionnaire (29) to form the study groups (SAD and NSAD). The criterion for determining Group 1 (SAD) was to respond affirmatively to two or more questions related to alcohol and drug use in the MultiCAGE CAD-4 (29). In contrast, the criterion for determining Group 2 (NSAD) was to respond negatively to all questions or to respond positively to only one question related to alcohol and drug use in the MultiCAGE CAD-4 (29). Subsequently, participants autonomously completed the Gender Violence Questionnaire in groups to gather their main perceptions and attributions regarding relationship problems. Finally, the instruments were scored, and the data were interpreted and analyzed. Permission for this study was obtained from the Ethics Committee of the University of Granada (2254/ CEIH/2021).

Data analysis

The qualitative data were studied through a thematic analysis (30), which was carried out in six phases. The first phase was the familiarization with the data, in this initial phase several readings were made of the answers given by the participants in the qualitative questionnaire on gender-based violence, in order to identify possible patterns or emerging themes. The second phase was the generation of provisional codes, this phase consisted of giving a name (code) to the potentially relevant and common data mentioned by the participants. For example, in question 1, where they were asked to describe the event that provoked them to go to prison, it was observed that the participants presented common patterns in their answers, mentioning events provoked by *alcohol/ drug use, jealousy, aggression or economic problems*. For this reason, these were the first codes assigned in this question. The third phase was the search for themes and sub-themes; in this phase, broader names were assigned that grouped the codes established in the previous phase. For example, in question 1, the codes *alcohol/drug use, jealousy, aggression and economic problems* were grouped into three subthemes (*self, partner, both*), which in turn were part of the theme *events*. The fourth and fifth phases were the review of themes and subthemes, in these phases the coherence and relevance of each of them was analyzed. For example, the need was identified to assign two new codes (*accepts aggression and does not accept aggression*) that belonged to the first subtheme (*self*) to give greater meaning to the participants' responses. Finally, the sixth phase was the description of the results; this phase focused on making sense of all the themes, subthemes and codes identified in the previous

phases in order to respond to the objective of the study. For example, in question 1, in this sixth phase, it was determined that participants attributed the blame for their crime primarily to events caused by their own alcohol/drug use and to the jealousy they felt for their partner. In addition, it was identified that they accepted the aggressions, minimizing the consequences of the events or denied the aggressions, justifying their behavior. Secondly, they attributed the blame for their crime to events provoked by their partner, as a consequence of alcohol/drug consumption, jealousy and aggression that they exercised against the participants, which caused them to physically or verbally assault them. Finally, in third place, they attributed the blame for their crime to events provoked by alcohol/drug consumption, jealousy and economic problems of both, which generated more couple conflicts.

The quantitative data were analyzed using the statistical program SPSS 26. First, to determine the sociodemographic characteristics of the sample, a descriptive statistical analysis was conducted. Secondly, contingency tables were created to demonstrate the differences between the groups (SAD and NSAD) according to the themes identified in the questionnaires.

Results

As seen in Table 2, 14 themes were identified through thematic analysis. These themes were divided into 54 subthemes related to events (guilt as an attribution of aggression, partner, both); Feelings and behaviors following a couple's problem (feelings, behaviors, nothing); Attributions of discussions (self, partner, both, no one); Attributions of aggressions (self, partner, both, no one); Behaviors at the end of a discussion (avoidance, resolving problems, continuing the discussion, nothing); Behaviors at the end of aggression (avoidance, resolving problems, continuing the discussion, nothing); Consequences of discussions (losing, getting what they wanted, regret, nothing); Consequences of aggressions (losing, getting what they wanted, regret, nothing); Reasons for discussions (self, partner, both, nothing); Reasons for aggressions (self, partner, both, nothing); Prevention of discussions (avoidance, self-control, ending the relationship, nothing); Prevention of aggressions (avoidance, self-control, ending the relationship, nothing); Prevention of future discussions (avoidance, self-control, ending the relationship, nothing); and Prevention of future aggressions (avoidance, self-control, ending the relationship, nothing).

We found statistically significant differences between the groups (SAD and NSAD) in five themes identified in the questionnaires (Table 3). The first theme, "Event: guilt as an attribution of aggression" ($\chi 2$ = 12.518; p=0.014) had the highest positive frequencies for alcohol and/or drugs in the SAD Group; and jealousy, accepting the aggression, and not accepting the aggression were highest in the NSAD Group. The second theme, "Consequences of discussions: regret" ($\chi 2$ = 4.155; p = 0.042) had the highest positive frequencies of feeling bad, frustration, low self-esteem, and discomfort in the SAD Group. The third theme, "Consequences of aggressions: getting what they wanted" ($\chi 2$ = 11.082; p=0.011) had the highest positive frequencies for understanding, being listened to,

TABLE 2 Categorization of open-ended responses on gender violence.

Themes	Subthemes	Description
1. Events	Guilt as an attribution of aggression (self)	Alcohol and/or drugs
		Jealousy
		Accepting the aggression
		Not accepting the aggression
	Partner	Alcohol and/or drugs
		Jealousy
		Aggression
	Both	Alcohol and/or drugs
		Jealousy
		Economic problems
2. Feelings and behaviors following a couple's problem	Feelings	I feel bad, sad, frustrated, worried, guilty, regretful, helplessness
		Anger, anxiety
	Behaviors	Walking, walking away, ignoring her in solitude.
		Going out with friends, family.
		Talk, solve problems, ask for forgiveness.
		Use of alcohol, tobacco, drugs.
	Nothing	
3. Attributions of discussions	Self	
	Partner	
	Both	
	No one	
4. Attributions of aggressions	Self	
	Partner	
	Both	
	No one	
5. Behaviors at the end of a discussion	Avoidance	Going out to see friends, going for a walk, getting away
		Ignoring the partner
	Resolving problems	Talk to fix the problem, come to your senses
		Ask for forgiveness, reconcile, sex
	Continuing the discussion	Keep going until someone stops, stay angry, revenge
		Ending the relationship, prison
	Nothing	
6. Behaviors at the end of aggression	Avoidance	Going out to see friends, going for a walk, getting away
		Ignoring the partner

(Continued)

TABLE 2 Continued

Themes	Subthemes	Description
	Resolving problems	Talk to fix the problem, come to your senses
		Ask for forgiveness, reconcile, sex
	Continuing the discussion	Keep going until someone stops, stay angry, revenge
		Ending the relationship, prison
	Nothing	
7. Consequences of discussions	Losing	End the relationship, the situation gets worse, she gets angrier
		Complaint, prison, children, work
	Getting what they wanted	Understanding, being listened to, being silenced
		Venting anger, letting off steam, speaking my mind
		Revenge, leave me alone, defend me
	Regret	Feeling bad, frustration, low self-esteem, discomfort
	Nothing	
8. Consequences of aggressions	Losing	End the relationship, the situation gets worse, she gets angrier
		Complaint, prison, children, work
	Getting what they wanted	Understanding, being listened to, being silenced
		Venting anger, letting off steam, speaking my mind
		Revenge, leave me alone, defend me
	Regret	Feeling bad, frustration, low self-esteem, discomfort
	Nothing	
9. Reasons for discussions	Self	Alcohol/Drugs
		Jealousy
		Impulse, stress, explodes, revenge, rage, punishment, hurt
	Partner	Alcohol/Drugs
		Jealousy
		Provocations, insults first, abuses, does not listen to me, prevents visits to his children, does not fulfill obligations
	Both	Alcohol/Drugs
		Jealousy

(Continued)

TABLE 2 Continued

Themes	Subthemes	Description
		Lack of respect, toxic relationship, normal behavior, disagreements
	No one	
10. Reasons for aggressions	Self	Alcohol/Drugs
		Jealousy
		Impulse, stress, explodes, revenge, rage, punishment, hurt
	Partner	Alcohol/Drugs
		Jealousy
		Provocations, insults first, abuses, does not listen to me, prevents visits to his children, does not fulfill obligations
	Both	Alcohol/Drugs
		Jealousy
		Lack of respect, toxic relationship, normal behavior, disagreements
	No one	
11. Prevention of discussions	Avoidance	Stop consuming alcohol/drugs
		Walking away, going for a smoke, staying at work, staying quiet, staying still, sticking objects
	Self-control	Controlling my emotions, calming myself, breathing, counting to 10, crying, biting my tongue
		Psychological therapy
		Thinking about the consequences, reflecting, putting myself in their shoes, empathizing
		Resolve conflict, talk respectfully, converse, give gifts, have sex, etc.
	Ending the relationship	Separate, do not continue, end at the first sign
	Nothing	
12. Prevention of aggressions	Avoidance	Stop consuming alcohol/drugs
		Walking away, going for a smoke, staying at work, staying quiet, staying still, sticking objects
	Self-control	Controlling my emotions, calming myself, breathing, counting to 10, crying, biting my tongue
		Psychological therapy

(Continued)

TABLE 2 Continued

Themes	Subthemes	Description
		Thinking about the consequences, reflecting, putting myself in their shoes, empathizing
		Resolve conflict, talk respectfully, converse, give gifts, have sex, etc.
	Ending the relationship	Separate, do not continue, end at the first sign
	Nothing	
13. Prevention of future discussions	Avoidance	Stop consuming alcohol/drugs
		Walking away, going for a smoke, staying at work, staying quiet, staying still, sticking objects
	Self-control	Controlling my emotions, calming myself, breathing, counting to 10, crying, biting my tongue
		Psychological therapy
		To think about the consequences, to reflect, to put myself in their shoes, to empathize
		Resolve conflict, talk respectfully, converse, give gifts, have sex, etc.
	Ending the relationship	Separate, do not continue, end at the first sign
	Nothing	
14. Prevention of future aggressions	Avoidance	Stop consuming alcohol/drugs
		Walking away, going for a smoke, staying at work, staying quiet, staying still, sticking objects
	Self-control	Controlling my emotions, calming myself, breathing, counting to 10, crying, biting my tongue
		Psychological therapy
		To think about the consequences, to reflect, to put myself in their shoes, to empathize
		Resolve conflict, talk respectfully, converse, give gifts, have sex, etc.
	Ending the relationship	Separate, do not continue, end at the first sign
	Nothing	

being silenced; venting anger, catharsis, saying what I think; revenge, being left in peace, and defending oneself, in the SAD Group. The fourth theme "Consequences of aggressions: nothing" ($\chi 2 = 11.459$;

p = 0.001) had the highest positive frequencies in the NSAD Group. The fifth theme, "Prevention of future discussions: avoidance" had the highest positive frequencies for stopping alcohol and/or drug use in the SAD Group; and moving away, going to smoke, staying at work, staying silent, still, and hitting objects in the NSAD Group.

Discussion

In this study, the experiences related to physical and verbal partner aggression were explored based on the presence or absence of alcohol and drug use in the prison population. To achieve this objective, a mixed methodology was used, which consists of combining qualitative and quantitative techniques, allowing for a deep understanding of the phenomenon under study (31). The results revealed that there are statistically significant differences in the experiences related to physical and verbal partner aggression between the study groups (SAD and NSAD). In other words, the presence or absence of alcohol and/or drug use in individuals who commit gender violence (GBV) offenses influences how they perceive their reality and how they manifest aggressive behavior (impulsive or compulsive).

Specifically, there were differences between the groups regarding the perception of "guilt as an attribution of aggression". The SAD group mentioned more frequently than the NSAD group that they were the ones who caused the events that led to their imprisonment as a consequence of their alcohol and/or drug use. Participants indicated that their "use of alcohol and/or drugs" was the main trigger for the violent event, attributing their behavior to the substance's effect. This result is consistent with previous studies (19, 27) that reveal men who assault their partners consider alcohol and/or drugs a stress factor that provokes their offense. However, it has been observed that this is a way to justify their lack of self-control and neutralize their responsibility for the acts in order to maintain a positive self-identity (19). This result is also reaffirmed by various authors (13–17) who have demonstrated a close relationship between alcohol and/or drug use and GBV.

In relation to the NSAD group, three types of attributions (jealousy, external, and internal) related to aggression were more frequently found compared to the SAD group. Regarding "jealousy" as an attribution for aggression, participants mentioned they assaulted their partner due to distrust and fear of being betrayed. This result is consistent with findings in various studies (20, 32, 33), which also identified jealousy as one of the main causes of GBV. Specifically (32), it has been demonstrated that participants who commit this offense make causal attributions, such as expressions of anger at disagreement or betrayal by the partner. Additionally (20), found that jealousy arises from a need for dominance and exclusivity, manifested in supervision and coercive control behaviors over the woman's autonomy. Concerning external attributions of aggression, we observed that the NSAD group "does not accept the aggression" more frequently than the SAD group. Participants stated they did not assault their partner and that during the trial, they only accepted the aggression based on legal advice to reduce their sentence. This finding is coherent with other studies (17, 21), which found that denying responsibility for the

TABLE 3 Differences in perceptions and attributions of the crime GBV based on the presence or absence of alcohol and/or drug consumption.

Themes	Subthemes	Group with alcohol and/or drug consumption (SAD)	Group without alcohol and/or drug consumption (NSAD)	χ^2	p
Event 1 (Guilt as an attribution of aggression - self)				**12,518**	**0,014**
	Another answer	25 (55,6%)	20 (44,4%)		
	Alcohol and/or drugs	9 (100%)	0 (0%)		
	Jealousy	6 (46,2%)	7 (53,8%)		
	Accepting the aggression	3 (30%)	7 (70%)		
	Not accepting the aggression	27 (42,9%)	36 (57,1%)		
Event 2 (Partner)				2,095	0,553
	Another answer	57 (50,4%)	56 (49,6%)		
	Alcohol and/or drugs	57 (50,4%)	56 (49,6%)		
	Jealousy	9 (60%)	6 (40%)		
	Aggression	2 (28,6%)	5 (71,4%)		
Event 3 (Both)				6,083	0,103
	Another answer	58 (47,5%)	64 (52,5%)		
	Alcohol and/or drugs	2 (66,7%)	1 (33,3%)		
	Jealousy	9 (81,8%)	2 (18,2%)		
	Economic problems	1 (25%)	3 (75%)		
Consequences of discussions 1 (Losing)				1,144	0,564
	Another answer	49 (53,3%)	43 (46,7%)		
	End the relationship, the situation gets worse, she gets angrier	18 (43,9%)	23 (56,1%)		
	Complaint, prison, children, work	3 (42,9%)	4 (57,1%)		
Consequences of discussions 2 (Getting what they wanted)				1,923	0,589
	Another answer	47 (48,5%)	50 (51,5%)		
	Understanding, being listened to, being silenced	9 (47,4%)	10 (52,6%)		
	Venting anger, letting off steam, speaking my mind	10 (66,7%)	5 (33,3%)		
	Revenge, leave me alone, defend me	4 (44,4%)	5 (55,6%)		
Consequences of discussions 3 (Regret)				**4,155**	**0,042**
	Another answer	60 (47,2%)	67 (52,8%)		
	Feeling bad, frustration, low self-esteem, discomfort	10 (76,9%)	3 (23,1%)		
Consequences of discussions 4 (Nothing)				0,598	0,439
	Another answer	54 (51,9%)	50 (48,1%)		
	Nothing	16 (44,4%)	20 (55,6%)		

(Continued)

TABLE 3 Continued

Themes	Subthemes	Group with alcohol and/or drug consumption (SAD)	Group without alcohol and/or drug consumption (NSAD)	χ^2	p
Consequences of aggressions 1 (Losing)				1,008	0,604
	Another answer	65 (49,6%)	66 (50,4%)		
	End the relationship, the situation gets worse, she gets angrier	4 (50%)	4 (50%)		
	Complaint, prison, children, work	1 (100%)	0 (0%)		
Consequences of aggressions 2 (Getting what they wanted)				**11,082**	**0,011**
	Another answer	54 (44,6%)	67 (55,4%)		
	Understanding, being listened to, being silenced	5 (71,4%)	2 (28,6%)		
	Venting anger, letting off steam, speaking my mind	2 (100%)	0 (0%)		
	Revenge, leave me alone, defend me	90 (90%)	1 (10%)		
Consequences of aggressions 3 (Regret)				1,867	0,172
	Another answer	66 (48,9%)	69 (51,1%)		
	Feeling bad, frustration, low self-esteem, discomfort	4 (80%)	1 (20%)		
Consequences of aggressions 4 (Nothing)				**11,459**	**0,001**
	Another answer	25 (75,8%)	8 (24,2%)		
	Nothing	45 (42,1%)	62 (57,9%)		
Prevention of future discussions 1 (Avoidance)				**7,085**	**0,029**
	Another answer	55 (53,9%)	47 (46,1%)		
	Stop consuming alcohol/drugs	3 (100%)	0 (0%)		
	Walking away, going for a smoke, staying at work, staying quiet, staying still, sticking objects	12 (34,3%)	23 (65,7%)		
Prevention of future discussions 2 (Self-control)				3,528	0,474
	Another answer	31 (43,1%)	41 (56,9%)		
	Controlling my emotions, calming myself, breathing, counting to 10, crying, biting my tongue	12 (54,5%)	10 (45,5%)		
	Psychological therapy	2 (66,7%)	1 (33,3%)		
	To think about the consequences, to reflect, to put myself in their shoes, to empathize	8 (66,7%)	4 (33,3%)		
	Resolve conflict, talk respectfully, converse, give gifts, have sex, etc.	17 (54,8%)	14 (45,2%)		

(Continued)

TABLE 3 Continued

Themes	Subthemes	Group with alcohol and/or drug consumption (SAD)	Group without alcohol and/or drug consumption (NSAD)	χ^2	p
Prevention of future discussions 3 (Ending the relationship)				2,120	0,145
	Another answer	61 (48%)	66 (42%)		
	Separate, do not continue, end at the first sign	9 (69,2%)	4 (30,8%)		
Prevention of future discussions 4 (Nothing)				2,745	0,098
	Another answer	63 (52,9%)	56 (47,1%)		
	Nothing	7 (33,3%)	14 (66,7%)		

Significant differences p=<0.05 are highlighted.

offense is a commonly used mechanism for addressing conflicts. Finally, regarding internal attributions of aggression, we found that the NSAD group "accepts the aggression" more frequently than the SAD group. In this case, participants acknowledged assaulting their partner but indicated that their violent behavior occurred as a normal reaction during an argument where they could not control their anger. This result aligns with a previous study (28), which identified that individuals who commit a GBV offense tend to minimize the consequences of their acts and justify their behavior when acknowledging the aggression. This minimization is due to the normalization of violence use and masculinity stereotypes.

We also found differences between the study groups (SAD and NSAD) regarding the "consequences of physical and verbal aggression". Participants mentioned that physical aggression manifested through hitting, pushing, or slapping. Verbal aggression occurred during arguments with insults, shouting, or threats. For "physical aggression", the SAD group more frequently indicated that the consequence of physically assaulting their partner was "getting what they wanted," unlike the NSAD. That is, through aggression, they made their partner listen, retaliated, and vented their anger. This result is consistent with literature (16, 18) highlighting various functions related to using physical aggression towards a partner. Among the most common functions, aggression is used as an instrument to get what they want from their partner, as revenge for the partner's behavior, and as an emotional outlet (18). It has also been observed that there is physical aggression in GBV (16).

Regarding perceived consequences of "physical aggression", we also found that the NSAD group mentioned more frequently than the SAD group that physical aggression "did not get what they wanted" from their partner. Participants indicated that aggression did not help them achieve their desired outcome. On the contrary, after physically assaulting their partner, they had more problems (legal, family, and social). This result also highlights the important role of alcohol and/or drugs in achieving what they wanted from their partner. Participants who used alcohol and/or drugs got what they wanted more frequently than those who did not use substances. This result is consistent with other authors' findings (22), emphasizing the relationship between increasing or decreasing

criminal behaviors (problematic alcohol and/or drug use and GBV) and the type of consequences for those who commit these offenses.

On the other hand, regarding the results on the consequences of "verbal aggression," the SAD group more frequently expressed "regret" compared to the NSAD group. Participants described regret as a feeling of discomfort, sadness, and frustration after assaulting their partner. This result aligns with recent studies (23, 24), which found that the discomfort caused by aggression generates a need to remedy the damage through promises of change and reconciliation attempts. This result has significant clinical importance in treating individuals who commit GBV offenses and consume alcohol and/or drugs. Regret can provoke greater reflection on the acts, becoming an opportunity to generate awareness of personal responsibility for self-behavior.

Finally, we found differences between the groups (SAD and NSAD) regarding the "prevention of future verbal aggression". Specifically, the SAD group more frequently mentioned that the strategy for preventing future verbal aggression would be "abstaining from alcohol and/or drugs". In contrast, the NSAD group more frequently mentioned that the best way to prevent verbal aggression would be "avoiding contact". For the SAD group, participants who attributed their behavior solely to alcohol and/or drugs considered abstinence the best solution. This result is consistent with various authors' findings (13, 14) who found a direct relationship between alcohol and/or drug use and the recurrence of GBV offenses. For the NSAD group, participants mentioned that to avoid verbally assaulting their partner in the future, they would resort to behaviors that avoid confrontation, such as staying silent, distancing themselves, or going out for a cigarette. These prevention strategies were also observed in a previous study (24), highlighting that individuals who commit a GBV offense try to prevent aggression before, during, and after a violent event. Therefore, it emphasizes the need to focus treatment on strengthening these prevention strategies through emotion management and cognitive restructuring to generate more stable behavior changes.

This study allows us to draw three crucial conclusions about the differences between the study groups (SAD and NSAD) regarding experiences related to physical and verbal partner aggression. First,

regarding "guilt as an attribution of aggression", we found that the SAD group attributes aggression towards the partner solely to alcohol and/or drug use, while the NSAD group more frequently attributes it to jealousy. Additionally, this group presents an external attribution when not accepting the aggression and an internal attribution when accepting the aggression, although minimizing responsibility. Second, regarding the "consequences of physical and verbal aggression", we found that for physical aggression, the SAD group mentioned that the consequence of physically assaulting their partner was getting what they wanted (being heard, revenge, and expressing anger), unlike the NSAD group, who did not get what they wanted outcome with physical aggression. For verbal aggression consequences, the SAD group more frequently expressed regret compared to the NSAD group. Finally, regarding the "prevention of future verbal aggression", the SAD group more frequently mentioned that abstaining from alcohol and/or drugs would be the best decision to avoid verbally assaulting their partner, in contrast to the NSAD group, who more frequently suggested avoiding contact with their partner.

It is necessary to mention that this study has three limitations. The first limitation is that the sample was composed only of men, as it only studied individuals who had committed GBV offenses. However, to deepen knowledge about intimate partner aggression, the perceptions of women who have committed or received violence should also be evaluated. The second limitation is the absence of a control group, meaning we did not study individuals who had not been convicted of GBV offenses. Therefore, it is recommended that this study be replicated with a non-prison sample. Finally, the third limitation is the bias in participants' responses. Biases can occur unconsciously (due to memory errors related to past events) or consciously (due to social desirability). Nevertheless, it is also important to highlight three significant strengths. The first strength is the use of a mixed methodology, which has allowed us to leverage the richness of qualitative and quantitative techniques to deepen our understanding of GBV. Qualitative techniques enabled a holistic understanding of the perceptions and attributions of GBV from the perspective of the perpetrator. Quantitative techniques allowed us to know the frequency and statistical differences of these perceptions between study groups (SAD and NSAD). The second strength is that the results of this study present high reliability and applicability, especially due to data saturation and the methodological triangulation used in the analysis. Lastly, the third strength is that it is the study with the largest number of participants (N = 140) that analyzes both qualitatively and quantitatively two of the most common issues in the prison population and most relevant to public health in Spain (alcohol and/or drug use and GBV).

The results of this study have important practical implications, especially in the treatment of people who commit GBV offenses. Knowing the perceptions and attributions of the crime committed, as well as the role of alcohol and/or drug use in partner aggression, is essential to identify the cognitive distortions that maintain this behavior. In other words, these results help us to increase the specificity of treatments, which, in turn, enhance adherence to therapy, motivation to change and prevention of recidivism. Specifically, the repentance shown by the participants as a consequence of the crime can be a key tool to promote awareness

of their actions and encourage significant behavioral changes. In addition, knowing the prevention strategies used by the participants (avoiding alcohol and/or drug use and contact with their partner during a conflict) allows us to strengthen these strategies in intervention treatments, through specific components aimed at alcohol and/or drug use cessation, conflict resolution, emotion management and cognitive restructuring. Finally, we recommend that future lines of research focus on conducting comparative studies to learn about the experiences of physical and verbal partner aggression among subgroups. For example, we could compare people with different types of drug use or criminal records. This would help to design more personalized treatments.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Ethics Committee of the University of Granada (2254/CEIH/2021). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

KA-R: Investigation, Supervision, Writing – original draft. AIS: Methodology, Supervision, Writing – original draft. ML-A: Data curation, Formal analysis, Investigation, Validation, Writing – review & editing. MPM: Formal analysis, Investigation, Supervision, Writing – review & editing. LM-L: Conceptualization, Investigation, Methodology, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Correction criteria for the qualitative analysis of the prison population: drugs possession/consumption and gender violence

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Introduction: People with language difficulties cannot face challenges related to social skills. Those language disorders affect academic, work environments, and social interaction, leading to maladaptive and aggressive behaviors. Young inmates are at high risk of experiencing unrecognized language deficiencies. It is, therefore, necessary to analyze linguistic pathologies that can influence criminal behavior (drugs possession/consumption and gender violence crimes). There are many standardized tests to evaluate and detect language difficulties in adults in English. However, there are relatively few options in Spanish; there are no tests that evaluate language qualitatively and in depth. Most of the research is conducted with children and adolescents.

Objectives: To propose a reliable coding system for the correction and interpretation of narratives (essays and narratives) from the Battery for the Evaluation of Writing Processes (PROESC) in the prisoners charged of drugs possession or consumption and gender violence crimes.

Design: The sample was composed of 287 men.

Main outcome measures: They completed the Demographic, Offense, and Behavioral Interview in Institutions, the International Personality Disorders Examination (IPDE), and PROESC.

Results: We found that the proposed coding system presented high concordance, that is, high inter-rater reliability.

Conclusion: The classification system for the correction and interpretation of narratives was shown to be reliable.

KEYWORDS

qualitative analysis, language disorders, drugs possession or consumption, gender violence, writing

Introduction

People with language difficulties cannot face challenges related to social skills. Fitzsimons and Clark (1) state that language disorders affect academic, work environments, and social interaction, leading to maladaptive and aggressive behaviors. Along the same lines, Morken et al. (2) highlight that young inmates are at high risk of experiencing unrecognized language deficiencies. It is, therefore, necessary to analyze linguistic pathologies that can influence criminal behavior (drugs possession/consumption and gender violence crimes).

Most standardized tests are currently focused on opaque languages such as English (2). However, there are barely any tests in Spanish that assess language in adults. In young adults, the Test de Evaluación de los Procesos de Escritura (PROESC; 3) evaluates the main processes involved in writing. It has adequate dictation tasks to assess each writing processing module and dictation tasks record the number of errors and the type of error made for later analysis the dictation tasks record the number of errors and the type of error made for later analysis. Besides, it allows comparison between comprehension processes in the two modalities of written language. In this way, it is possible to determine whether writing impairments are dependent on the written form or whether they involve a more generalized impairment process (Afonso et al., 2015; Carreteiro et al., 2016; 4, 5; Gutiérrez-Fresneda & Díez-Mediavilla, 2017; Gutiérrez-Fresneda, 2017; 6; Marques-de Oliveira et al., 2017; Martínez-García et al., 2019; 7; Nigro et al., 2015; 8).

This test constitutes a very structured evaluation procedure where the participant must respond according to the indications that appear at the beginning of the test and the instructions of the researcher. Paper and pencil tasks are inexpensive, flexible, and portable methods (9). However, while these tasks are very objective and easily replicable procedures, tasks 5 and 6 require an analysis qualitative.

Qualitative research fills a gap in the analysis of certain problems by adopting various content or discourse analysis procedures. The main objective of this technique is to describe the qualities of a phenomenon as a whole using a flexible approach. This technique begins from a holistic perspective, i.e., it tries to examine a specific situation in detail (10). It is based on the decomposition and classification of information collected through interviews, stories, observations, images, advertisements, news, and political discourse (11).

Qualitative aspects of language can also be evaluated, including the adequacy, precision, or magnitude of written expression. In some cases, it is possible to evaluate the ability to express the message correctly, often providing important additional information to help understand the written result (in the form of a narrative or essay). This type of study is mostly used in the prison population, particularly men convicted for drug offenses and violence (12). It has been shown that qualitative methodology is essential for studies with individuals belonging to these populations. Due to their characteristics and the type of experiences they present, this type of methodology allows for a deeper analysis, the results of which can inform the development of prevention and intervention processes.

Qualitative methodology uses a series of instruments that are not highly structured and standardized. Its scoring system is quite flexible, can be structured according to the objectives, and can be analyzed through qualitative procedures and transformed into quantitative data (13).

Qualitative aspects of language such as planning, transcription, and revision can also be evaluated. In some cases, it is possible to evaluate more specific aspects, such as decoding errors and informal aspects. The qualitative method comprises a series of instruments whose items are relatively unstructured and standardized, with a scoring system that can be used flexibly depending on the objectives. Moreover, the results can be analyzed through qualitative and quantitative procedures, transforming qualitative information into quantitative information. It is necessary to establish a coding system that corresponds to a model that can serve as a guide for analyzing and coding the writing.

Language difficulties in prisoners have attracted the attention of much of the scientific community for decades (1, 2). The authors highlight that there is a very diverse prevalence of writing disorders that may be due to the lack of consensus in the definition of dyslexia or reading-writing disorders. Due to the social nature of language, language in prisoners must be analyzed to enhance social inclusion. Morken et al. (2) points out that there is a relationship between the severity of a crime, the presence of an oral language disorder, and personality disorders. Therefore, the objective of this study was to propose a reliable coding system for the correction and interpretation of narratives and essays from the Writing Process Evaluation Battery (PROESC) (3) in the prison population.

Participants

The sample consisted of 287 men mean age 37.69 (SD=8.84) from the Granada Penitentiary Center. The inclusion criteria were to have been charged of drugs possession or consumption and gender violence crimes. The exclusion criteria in both cases were being over 50 years, presenting a psychiatric illness (schizophrenia or depression), and receiving psychopharmacological treatment. First, participants were interviewed individually to check the inclusion criteria and, if eligible, were offered the opportunity to participate in the research. The interview was carried out by the prison psychologist and the duration of the interviews was not evaluated. They then took part in an individual session in which they completed the measures listed below. Participants were reminded at the beginning of the session of their right to discontinue the procedure at any time, and their written consent was then obtained. Once the data collection process was completed, the data were corrected. This study was approved by the Ethics Committee of the Autonomous Community of Andalusia (PEIBA, 0766-N-21).

Procedure

Regarding the correction and interpretation of the narratives and essays, Tables 1, 2 were used for coding. Participants were requested to create two different writings, a narrative one about folk tale or story and a free topic essay. The speech-language pathologist conducted the task. The analysis of the narratives and essays were developed by three evaluators (speech-language pathologist, linguist, and expert in quality and care management). To calculate the inter-rater reliability, three evaluators coded the narratives and essays. Table 3 presents a proposal of correction criteria obtained considering Tables 1, 2.

Instruments

Demographic, crime, and institutional behavior interview

This interview was designed for this research study and consists of collecting information about sociodemographic data, type of offenses (drug possession and/or consumption and gender violence crimes) and their penalties, and sanctions within the prison according to the Prison Regulations (Royal Decree 1201/1981, May 8, Articles 107 and 108).

Writing Processes Evaluation Battery (PROESC)

This is an individual test that aims to evaluate the main processes involved in creating texts. It is composed of six tests, which are: 1) Syllable dictation; 2) Word dictation; 3) Pseudoword dictation; 4) Sentence dictation; 5) Writing a narrative and 6) Writing an essay. In this study, we used tests 5 and 6, which assess the ability to plan a narrative and an expository text. Although the instrument (3) has a high internal consistency of 0.82 (alpha coefficient) in the first four tests, it lacks quantitative criteria for the correction and interpretation of the writing tests (5 and 6). For this reason, in this study, we used only tasks 5 and 6.

Data analysis

Data analyses were conducted using the SPSS Statistics 22.0 program. The analysis of inter-rater concordance was performed by calculating the kappa index and Pearson correlations to address.

TABLE 1   Findings of the analyzed studies.

Authors	Motive	Findings	References
Benítez, 2000	Aspects to be evaluated in the generation of texts	Elements to be evaluated in texts: organizational criteria	Benítez-Figari, R. (2000). The rhetorical situation: Its importance in learning and teaching written production. *Signos Journal*, *33*(48), 49-67. https://dx.doi.org/10.4067/S0718-09342000004800005. https://dx.doi.org/10.4067/S0718-09342000004800005
Bereiter and Scardamalia (1987)	Basic text with elements of writing processes	Psychological processes in writing	Bereiter C. & Scardamalia M. (1987). Fostering Reflective Process. In The Psychology of written composition (389). New York: Routledge.
Berninger et al. (1994)	Contributions to writing levels	Intraindividual differences in writing levels (syllables, words, phrases, sentences, paragraphs, texts)	Berninger, W.V., Mizokawa, D.T., Bragg, R., Cartwright A. & Yates, C. (1994) Intraindividual Differences in Levels of Written Language. *Reading & Writing Quarterly*, 10:3, 259-275, https://doi.org/10.1080/1057356940100307
Berninger et al. (2015)	Aspects to be evaluated in written texts	Sub-words (handwriting), words (spelling) and syntax (sentence composition)	Berninger, V. W., Nagy, W., Tanimoto, S., Thompson, R., & Abbott, R. D. (2015). Computer instruction in handwriting, spelling, and composing for students with specific learning disabilities in grades 4-9. *Computers and Education*. https://doi.org/10.1016/j.compedu.2014.10.005
Berninger et al. (2008)	Previous research on dyslexia and its environment	Previous studies have focused on reading, not writing.	Berninger, V. W., Nielsen, K. H., Abbott, R. D., Wijsman, E., & Raskind, W. (2008). Writing problems in developmental dyslexia. *Journal of School Psychology*, 46 (2008) 1-21 Writing. https://doi.org/10.1016/j.jsp.2006.11.008
Etchepareborda et al. (2001)	Neuroanatomical basis of dyslexia	Early studies on the brain and dyslexia	Etchepareborda, M., Etchepareborda, M., & Habib, M. (2001). Neurobiological Basis of Phonological Awareness: Compromise of This. *Dyslexia*. 5-23.
Graham (1999)	Basic characteristics of dyslexia	Writing difficulties can interfere with the performance of other composition processes and restrict writing development	Graham, S. (1999). Handwriting and spelling instruction for students with learning disabilities: A review. *Learning Disability Quarterly*. 22(2), 78-98. https://doi.org/10.2307/1511268
Graham (1999)	Metawriting	The influence of spelling errors on perceptions of writing ability. Difficulties in literacy affect the	Graham, S. (1999). The role of text production skills in writing development: A special issue - I. *Learning Disability Quarterly*. 22(2), 75-77. https://doi.org/10.2307/1511267

(Continued)

TABLE 1 Continued

Authors	Motive	Findings	References
		rate of writing and the course of writing development.	
Hayes and Flower (1980)	Aspects to evaluate in the generation of texts	Elements to evaluate in texts: planning, translation, and proofreading	Hayes, J. R., & Flower, L. (1980). Identifying the Organization of Writing Processes. In L. W. Gregg, & E. R. Steinberg (Eds.), Cognitive Processes in Writing: An Interdisciplinary Approach (pp. 3-30). Hillsdale, NJ: Lawrence Erlbaum.
Herrada-Valverde and Herrada-Valverde (2018).	Adult writing models	Writing skills of adults with difficulties in producing texts.	Herrada-Valverde, G, & Herrada-Valverde, R. I. (2018). Procedural competencies to elaborate written summaries: the case of students of the Faculty of Education of the University of Salamanca. *Mexican Journal of Educational Research*, *23*(77), 505-525. Retrieved June 05, 2021, from http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1405-66662018000200505&lng=es&tlng=es.
Kellogg and Raulerson (2007)	Specific aspects of proofreading	Elements to be evaluated in texts: correct spelling, punctuation, etc.	Kellogg, R.T., Raulerson, B.A. (2007). Improving the writing skills of college students. *Psychonomic Bulletin & Review*. 14, 237-242. https://doi.org/10.3758/BF03194058.
Longcamp et al. (2016).	Contribution of the neuroscience of writing	Handwriting processes in adults with handwriting difficulties.	Longcamp, M., Richards, T. L., Velay, J. L., & Berninger, V. W. (2016). Neuroanatomy of Handwriting and Related Reading and Writing Skills in Adults and Children with and without Learning Disabilities: French-American Connections. Pratiques, 171-172, 3175. https://doi.org/10.4000/pratiques.3175.
Richards et al. (2017)	Neuroimaging in writing	Writing tasks and instructions during neuroimaging tests: DTI, fMRI	Richards, T. L., Berninger, V. W., Yagle, K. J., Abbott, R. D., & Peterson, D. J. (2017). Changes in DTI Diffusivity and fMRI Connectivity Cluster Coefficients for Students with and without Specific Learning Disabilities In Written Language: Brain's Response to Writing Instruction. *Journal of Nature And Science*, *3*(4), e350. Available in PMID: 28670621; PMCID: PMC5488805
Rincón-Camacho (2013)	Describe writing and learning	Processes related to the generation and planning of texts	Rincón-Camacho, L. J. (2013). Los estilos cognitivos: una aproximación al estudio de las diferencias individuales en la composición escrita: An approach to the study of individual differences in written composition. *Revista Colombiana de Educación*, (64), (64), 107-130. https://doi.org/10.17227/01203916.64rce107.130
Singer and Bashir (2004)	General aspects of proofreading	Elements to evaluate in texts: planning, generation, revision, and organization of texts.	Singer, Bonnie & Bashir, Anthony (2004). Developmental Variations in Writing Composition Skills. In A.Stone, E.R. Silliman, B.J. Ehren & K. Akpel (Eds.), Handbook of Language & Literacy. The Guilford Press: New York.
Tanimoto et al. (2015).	Characteristics of the population with dyslexia	Major difficulties in handwriting, spelling, morphology and phonetics, comprehension, and composition.	Tanimoto, S., Thompson, R., Berninger, V. W., Nagy, W., & Abbott, R. D. (2015). Computerized Writing and Reading Instruction for Students in Grades 4 to 9 With Specific Learning Disabilities Affecting Written Language. *Journal of Computer Assisted Learning*, *31*(6), 671-689. https://doi.org/10.1111/jcal.12110.
Thompson et al. (2016)	Specific aspects of proofreading	Elements to be evaluated in texts: spelling, among others.	Thompson, R., Tanimoto, S., Berninger, V., & Nagy, W. (2016). Coding, reading, and writing: Integrated instruction in written language. 2016 IEEE Symposium on Visual Languages and Human-Centric Computing (VL/HCC), 73-77. https://doi.org/10.1109/VLHCC.2016.7739667.
Wallis et al. (2017).	General aspects of proofreading	Elements to be evaluated in texts: transcription and text generation	Wallis, P., Richards, T., Boord, P., Abbott, R., & Berninger, V. (2017). Relationships between Translation and Transcription Processes during fMRI Connectivity Scanning and Coded Translation and Transcription in Writing Products after Scanning in Children with and without Transcription Disabilities. *Creative education*, *8*(5), 716-748. https://doi.org/10.4236/ce.2017.85055

Results

Inter-rater reliability analysis

Regarding inter-rater reliability, the concordance analysis yielded very high coefficients (see Table 4).

Discussion

Analyzing language difficulties in the prison population, charged of drugs possession or consumption and gender violence crimes,

through writings (narratives and essays) may be relevant to discover specific issues and identifying the differences in this population. For this reason, and according to the reviewed bibliography (Tables 1, 2), we have proposed a categorization system for the interpretation of the writings of the prison population.

This study aimed to provide a reliable coding system for correcting and interpreting narratives and essays from the Writing Process Evaluation Battery (PROESC) (3). We found that the proposed coding system presented high concordance, that is, high inter-rater reliability. Furthermore, the degree of agreement was very high for all the proposed categories. This classification provides novel and useful information for the evaluation of writing

TABLE 2 Text correction criteria from the reviewed literature categorized according to Gutiérrez-Fresneda (2018).

Categories	Processes	Definition	Author's correction	Self-correction
PLANNING Preverbal representation	Generation	Retrieval of words or segments that facilitate the creation of a theme (Hayes and Flower, 1980).	**Hayes and Flower (1980):** - Recovery using memory - Potentially useful recovered items - Evaluation of recovered elements - Writing notes	- Recovery using memory - Potentially useful recovered items - Analyzes the recovered elements - Write notes
	Organization		**Benítez et al. (2000):** - Topic selection - Relate the task to the objective of the evaluation. - Define the scope of rhetorical purposes. - Write the task in a clear way - Evaluate the quality of the subject **Hayes and Flower (1980):** - Usefulness of the subject - Identify, if possible, the first or the last topic. - Order and respect topics according to order of appearance - Search for data to stay on topic - Identify category	- Select a topic - Define the scope of the purposes of the text - Write the task clearly - Evaluates the quality of the subject - Identifies the first or last topic of the text - Order and respect topics according to order of appearance - Relates data to stay on topic
	Establishment of goals	Selection of what is generated in the "Generation" process.		
TRANSLATION		Transform into text, from memory, following the planning guide (Hayes and Flower, 1980).	**Kellogg and Raulerson (2007)):** - Correct spelling - Scoring - Grammar - Diction (correct use of words) - Thematic sentences - Main idea - Consistent links **Singer and Bashir (2004):** - Phonological awareness - Morphosyntax - Appropriate semantics - Cohesion and consistency **Hayes and Flower (1980):** - Good form - Full text - Grammatically correct sentences - Logical structure - Structured paragraphs	Words: - Correct spelling - Score - Grammar (morphosyntax) - Diction (correct use of words) - Thematic sentences - Main idea present - Consistent links Text: - Good form - Full text - Logical structure - Structured paragraphs - Appropriate semantics
REVIEW. Perception and self-correction	Reading	Examine written material (Hayes and Flower, 1980).		
	Editing	Detect and correct possible errors in the previous processes (Hayes and Flower, 1980).	**Hayes and Flower (1980):** - Spelling errors - Grammar errors - Search for alternatives - Word errors - Elimination of ambiguities - Change to common words - Uniformity	- Detection and correction of spelling errors - Detection and correction of grammar errors - Search for alternatives - Word error detection and correction - Detection and correction of ambiguity errors - Change to common words

processes. Furthermore, the context in which this study has been conducted — a prison setting — advances our understanding of the writing difficulties of inmates that have, until now, never been analyzed. The results obtained are in line with Busetto et al. (10) Douglass et al. (13) and Moser and Korstjens (11), who point out the importance of creating, developing and applying qualitative evaluation methods to develop more detailed means of analysis and gain in-depth knowledge of the samples received from participants

in various studies. In our study, we can verify that the categorization created from the PROESC (3) could conscientiously show the possible alterations in language and writing that prison population could suffer.

According to Larrazabal et al. (9), the use of classical or traditional means is very useful and reliable to know in detail the language alterations of the inmate population. To this we add the analysis created from the categorization proposed in this study to obtain a very

TABLE 3 PROESC correction proposal: Text writing (narrative and essay).

CATEGORIES	VARIABLES	DEFINITION
WORDS AND PARAGRAPHS	Number of words	This consists of counting the total number of words in the text.
	Number of paragraphs	The aim is to check the organization within the text Paragraphs into which the text could have been divided. For example, this will be scored according to the missing paragraphs.
ERRORS RELATING TO FORMAL ASPECTS	Number of punctuation errors	This involves checking for punctuation, i.e., the use of periods, commas, exclamations, question marks, and hyphens.
	Number of lines not respecting margins	Refers to the framing of the text on the page, such as tabs, margins, and enumerations.
	Number of incorrect separations between words	We look for fragmented words or broken words. Example: un fortunately, ha bí a
	Number of incorrect word conjunctions	The number of incorrect conjunctions between words that appear throughout the text is computed. The aim is to look for the phenomenon of coarticulation, i.e., the joining of words. Example: habersi, demiabuela.
	Number of repetitions	The appearance of two consecutive occurrences of the same complete word is counted. Example: On the, I went to my mother's house). Emphasis of an affirmation or negation is not considered repetition. Example: porque me gusta porque si, es guapo guapo. Number of incorrect repetitions
	Number of words with unreadable handwriting	Words that cannot be read because of alteration of grapho-motor aspects (when the writing stroke is so altered that it is not possible to distinguish the letters to identify the word) are computed.
	TOTAL	TOTAL (Sum of the items of the Errors Relating to Formal Aspects)
DECODING ERRORS	Number of Substitutions	Refers to the substitution of one letter/grapheme for another. For example, pallaso for payaso, empello for empeño, olo for ola, lla instead of ya.
	Number of Additions	Refers to whether a letter/grapheme is added. For example, addictions for

(Continued)

TABLE 3 Continued

CATEGORIES	VARIABLES	DEFINITION
		additions, haver si instead of a ver si, Hera instead of era.
	Number of Omissions	Refers to whether a letter/grapheme is removed. Example: ola for hello, sensibiidad for sensibilidad, tre instead of tres.
	Number of Inversions	This refers to the change of order of the letter/grapheme, consonant, or vowel. For example, Plalta instead of plata, honor instead of horno, Lavaro instead of Alvaro.
	Number of Rotations	This is the writing of a letter/grapheme in mirror image. Letters can also be rotated on their own axis. Example: pombo instead of bombo; agua for ana.
	Number of Lexicalizations	Indicates changing a complete word for another, e.g., minister for marriage, active for perspective.
	Number of incorrect accents	Indicates misplaced accents, either accents that are not where they should be or accents that are where they should not be. For example, jamon instead of jamón or jámon instead of jamón.
	TOTAL	TOTAL (Sum of the Decoding Errors items)
GRAMMAR	Number of grammatically incorrect sentences	Indicates the number of grammatically misspelled sentences with either an incorrect preposition, a misconjugated verb, or incorrect gender-number agreement.
MAIN AND SECONDARY IDEAS	Appearance of the main idea	This refers to whether the main idea can be found easily when reading the text, that is, what is being talked about (daily routine, story of Little Red Riding Hood). This is why it is important to take into account the title.
	Appearance of secondary ideas	This refers to whether we can find secondary ideas that enrich the text.
PLANNING ERRORS	Number of disconnections between the main idea and the title	Number of times that the main idea is unrelated to the title of the text. Number of times an idea unrelated to the main idea of the text appears.
	Number of times that secondary ideas do not appear	Number of times that secondary ideas do not appear and should appear. Number of

(Continued)

TABLE 3 Continued

CATEGORIES	VARIABLES	DEFINITION
		times the common thread (plot) is lost. Refers to additional information. For example, in the stories, what Little Red Riding Hood carries in her basket and how many push-ups she does per day when describing her daily routine.
	Number of deviations from thematic continuity	This refers to the number of times that events do not follow a sequence (thread). For example, In the morning I exercise, I get up and have breakfast and then I eat but in the middle of the morning I go the pottery workshop.
	Number of times technical vocabulary not used	This refers to the non-use of specific words related to the text. If talking about the mechanical aspects of cars, the tools will be mentioned, and the name of the tools would be classified as technical vocabulary. Or if talking about a physical activity, it is important to specify what kind of activities are performed, for example, squats and sit-ups would be regarded as technical vocabulary. Thus, "I get up in the morning and exercise my tummy" should have instead read " I do sit-ups".
	Number of times coherent vocabulary not used	Words that do not fit in with the theme of the text, that is, presence of words that have nothing to do with the subject of the text. For example, when talking about a forest, the writer should refer to pine trees, and when talking about physical exercise, they should refer to abs.
	Number of times varied vocabulary not used	Repeats the same word several times in the same sentence and does not use synonyms and/or antonyms. For example, my car was really cool, we had really cool races and got really cool tattoos.
	TOTAL	TOTAL (Sum of the Planning Errors items)
VOCABULARY	Use of technical vocabulary	This refers to the use of specific words related to the text. Example: if talking about the mechanical aspects of cars, the tools should be mentioned, and the names of the tools would be regarded as technical vocabulary. Or when talking about a physical activity, the

(Continued)

TABLE 3 Continued

CATEGORIES	VARIABLES	DEFINITION
		writer should specify what kind of activities are performed; for example, squats and sit-ups would be regarded as technical vocabulary.
	Use of coherent vocabulary	This refers to the use of words whose meaning is in accordance with the text. For example, when talking about a forest, reference is made to pine trees, and when talking about physical exercise, referring to abs.
	Use of varied vocabulary	This refers to the use of a wide variety of words, including use of synonyms and antonyms.
	TOTAL	TOTAL (Sum of Vocabulary items)
REVISION	Number of modifications made to the text	This checks whether the user corrects letters, words, or group of words. The correction is scored according to whether an error is identified, corrected, and made visible in the text. A score is given according scored whether the correction has been done well. For example, a crossed-out word next to the new word or proposal.

reliable and viable evaluation method (10). Therefore, this study is the first to propose a model for categorizing and correcting texts in both narratives and essays while confirming its reliability and effectiveness through a comprehensive inter-rater analysis.

Conclusions

There are few studies where language in prisoners is analyzed. This is why we highlight the novel nature of this study, since it proposes a model for categorization and correction of texts, both narratives and essays, which exhaustively study their reliability and effectiveness through interjudge analysis. To identify the difficulty of writing in the prison population that have used and trafficked with drugs, or have committed gender violence crimes, the following categories should be considered: Words and Paragraphs, Errors Related to Formal Aspects, Decoding Errors, Grammar, Revision and Net Total, Main and Secondary Ideas, Vocabulary, Planning Errors, Words and Paragraphs, Errors Related to Formal Aspects, Decoding Errors.

Although individuals know phoneme-grapheme correspondence rules, language disturbances of a reiterative and persistent nature may appear in those who show aggressive behavior (those participants who committed gender violence or drugs trafficking and/or consumption crimes). This finding could be related to co-occurrences in the behavior of compulsive individuals and those with learning difficulties. Language therapy in patients with high levels of compulsivity could improve self-

TABLE 4 Inter-rater reliability [Kappa (K) and Pearson (P) coefficients].

CATEGORIES	VARIABLES	NARRATIVES						ESSAYS					
		E1-E2		E2-E3		E1-E3		E1-E2		E2-E3		E1-E3	
		K	P	K	P	K	P	K	P	K	P	K	P
WORDS AND PARAGRAPHS	Number of words	0.09	0.99	0.46	0.99	0.09	0.99	0.10	0.98	0.75	0.99	0.10	0.97
	Number of paragraphs	0.95	0.99	0.89	0.99	0.93	0.99	0.48	0.80	0.85	0.89	0.55	0.80
ERRORS RELATING TO FORMAL ASPECTS	Number of punctuation errors	1	1	0.93	1	0.93	0.99	0.98	1	0.93	0.99	0.95	0.99
	Number of lines not respecting margins	1	1	0.98	1	0.98	1	1	1	1	1	1	1
	Number of incorrect separations between words	0.52	0.89	0.79	0.91	0.56	0.85	1	1	1	1	1	1
	Number of incorrect word conjunctions	0.89	0.99	0.84	0.99	0.93	0.99	1	1	1	1	1	1
	Number of repetitions	1	1	1	1	1	1	1	1	1	1	1	1
	Number of words with unreadable handwriting	1	1	1	1	1	1	1	1	1	1	1	1
	TOTAL	0.82	0.99	0.84	0.99	0.77	0.99	0.98	1	0.93	0.99	0.95	0.99
DECODING ERRORS	Number of Substitutions	0.16	0.90	0.38	0.92	0.43	0.96	0.23	0.87	0.84	0.98	0.18	0.87
	Number of Additions	0.99	0.99	0.95	0.99	0.97	0.99	0.97	0.99	0.94	0.99	0.97	0.99
	Number of Omissions	0.96	0.99	0.95	0.99	0.98	0.99	0.36	0.89	0.89	0.99	0.38	0.89
	Number of Inversions	0.41	0.73	0.64	0.84	0.42	0.75	0.74	0.85	0.70	0.92	0.76	0.86
	Number of Rotations	NOT GIVEN						0.80	0.27	NOT GIVEN			
	Number of Lexicalizations	1	1	1	1	1	1	0.95	0.96	0.94	0.99	0.89	0.95
	Number of incorrect accents	0.93	0.99	0.87	0.99	0.93	0.99	0.91	0.99	0.87	0.99	0.96	0.99
	TOTAL	0.98	1	0.96	1	0.98	1	1	1	1	1	1	1
GRAMMAR	Number of grammatically incorrect sentences	0.50	0.96	0.41	0.93	0.40	0.95	0.96	0.99	0.93	0.99	0.97	0.99
MAIN AND SECONDARY IDEAS	Appearance of the main idea	1	1	1	1	1	1	1	1	1	1	1	1
	Appearance of secondary ideas	0.89	0.99	0.81	0.99	0.91	0.99	0.47	0.97	0.47	0.94	0.53	0.96
PLANNING ERRORS	Number of disconnections between the main idea and the title	0.99	0.99	0.98	0.99	0.99	0.99	1	1	1	1	1	1
	Number of times that secondary ideas do not appear	0.87	0.99	0.87	0.99	1	1	1	1	1	1	1	1
	Number of deviations from thematic continuity	1	1	1	1	1	1	1	1	1	1	1	1
	Number of times technical vocabulary not used	0.98	0.99	0.97	0.99	0.99	0.99	1	1	1	1	1	1
	Number of times coherent vocabulary not used	1	1	1	1	1	1	1	1	1	1	1	1
	Number of times varied vocabulary not used	0.99	1	0.99	1	1	1	1	1	1	1	1	1
	TOTAL	0.97	0.99	0.95	0.99	0.98	0.99	1	1	1	1	1	1
VOCABULARY	Use of technical vocabulary	1	1	0.96	0.99	0.96	0.99	0.99	1	0.95	0.99	0.95	0.99
	Use of coherent vocabulary	1	1	1	1	1	1	1	1	1	1	1	1
	Use of varied vocabulary	1	1	1	1	1	1	0.98	0.99	0.98	0.99	0.99	1
	TOTAL	1	1	0.96	0.99	0.96	0.99	0.98	1	0.93	0.99	0.94	1
REVISION	Number of modifications made to the text	1	1	1	1	1	1	1	1	1	1	1	1
NET TOTAL		0.1	0.99	0.4	1	0.1	0.99	0.04	0.98	0.59	0.99	0.04	0.97

control and self-criticism, thereby enhancing the capacity to form social relationships and show empathy.

Knowing the linguistic skills of this part of society is vital to know in detail social aspects of prisoners. Furthermore, given that the main

reason for incarceration is to work on social inclusion, we must know the state of this social stratum. Since the job of penitentiaries is to reintroduce inmates and make them proactive elements in society, we must rehabilitate all altered aspects of them. This is why we must

develop useful tools to know the linguistic status and knowledge of prisoners so that they can fully access the language, enhance their social inclusion and achieve their job placement. After having carried out this analysis and having delved into the existing studies, new questions arise: why are there no studies that analyze language disorders in the prison population? Why are there no language tests for adults? Why are there no language tests for adults? Is there no qualitative method to analyze language?

We have detected several limitations in our study. Our sample has been reduced to men with a series of crimes determined to evaluate language. This is because the number of women in the penitentiary center was small and the majority did not meet the inclusion criteria, so they were discarded. Our future lines of work will focus on analyzing the female prison population. On the other hand, although the results of the interjudge analysis are positive, another limitation found is having a low, although representative, number of evaluators.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: https://digibug.ugr.es/handle/10481/89488.

Ethics statement

Participants were reminded at the beginning of the session of their right to discontinue the procedure at any time, and their written consent was then obtained. Once the data collection process was completed, the data were corrected. This study was approved by the Ethics Committee of the Autonomous Community of Andalusia (PEIBA, 0766-N-21).

Author contributions

LM: Writing – review & editing, Writing – original draft. BF: Writing – review & editing, Writing – original draft. SL: Writing – review & editing, Writing – original draft. BA-A: Writing – review & editing, Writing – original draft.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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A systematic review of treatment for impulsivity and compulsivity

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Introduction: The aim of this study was to comprehensively review existing treatments for impulsivity and compulsivity in non-substance addictions, driven by the importance of these factors in addictive disorder development and treatment efficacy.

Methods: A systematic review carried out following PRISMA guidelines identified 14 articles from a total of 764 studies, highlighting the limited literature that is available on psychological treatments for non-substance addictions, in particular studies focusing on impulsivity and compulsivity. The studies were categorized by behavioral addiction type.

Results: For compulsive sexual behavior and problematic pornography use, cognitive-behavioral therapy (CBT) has shown significant improvements in compulsivity. In gambling disorder, interventions like cognitive bias modification and motivational interviewing combined with CBT have been effective in reducing impulsivity. Cognitive-behavioral therapy was advocated for compulsive shopping, although results varied. For problematic internet use, dialectical behavior therapy and acceptance and commitment therapy have been effective in addressing impulsivity. Despite literature supporting CBT for most behavioral addictions, the review noted that some articles indicate that dialectical behavior therapy and acceptance and commitment therapy were also effective for problematic internet use, suggesting different underlying mechanisms for this type of addiction.

Discussion: It also highlighted limitations, including the small number of studies and the lack of standardized assessment measures. Further research is needed to understand underlying mechanisms and develop tailored treatments for impulsivity and compulsivity in non-substance addictions. These findings offer new directions for research and intervention guidelines in behavioral addictions.

Introduction

Both impulsivity and compulsivity are currently considered central constructs linked to addictive behaviors, including substance addictions and behavioral or non-substance addictions (1, 2). Impulsivity is defined as a trait that leads to unplanned, unintended, but rewarding actions that are quite inappropriate or dangerous for a given situation and often result in undesirable consequences (3, 4). Compulsivity has been defined as repetitive acts determined by a feeling that the person has to perform despite being aware that they are not in line with the overall goal (5). That is to say, compulsivity would be characterized by a lack of control over a goal-directed behavior. More specifically, compulsivity would be enhanced by the possibility of decreasing discomfort or distress, whereas impulsivity would be enhanced by desire, pleasure, enthusiasm, and gratification (6).

Both concepts have been described using different definitions in the scientific literature. For example, some phenomenological models designed to explain the origin and maintenance of addictions have postulated that addictions progress from impulsivity, characterized by positive reinforcement, to compulsivity, characterized by negative reinforcement, regardless of the possible aversive consequences of consuming a substance or of the consuming behavior itself (7, 8). However, the two types of behaviors can also share certain characteristics, such as the inability to voluntarily prevent or delay repetitive behavior, the lack of response inhibition, ineffective planning, and sensitivity to expectations of rewards (either positive or negative) (9, 10).

In contrast, Lee et al. (1) assert that compulsivity may be a broader, more multifaceted construct than impulsivity. Under this interpretation, compulsivity would also encompass an affective component that triggers an irresistible urge to behave in a certain way in order to experientially avoid the negative internal feelings that are often associated with withdrawal (11–14).

Several studies have pointed out the role played by both impulsivity and compulsivity in the origin, maintenance, and treatment of addictive behaviors (1, 9, 15, 16). Impulsivity, compulsivity and emotional dysregulation have been established as important transdiagnostic dimensions, which are relevant for comprehend both psychiatric disorders and addictive-like behaviors (1). They might be described as two ways of not being in contact with the feelings, thoughts and/or behaviors, limiting the ability to engage in goal directed or planned action (1). Impulsive actions, particularly when in distress (i.e., "negative urgency"), may be of particular relevance for the initiation of maladaptive behaviors, including addictions and addictive-like behaviors (9). Moreover, compulsivity actions, are related to entrenched behaviors in the presence of distress, stress and anxiety, potentially as these kinds of negative and assumingly dysregulated emotions, seem to increase the likelihood of overreliance on (maladaptive) habits (1). In this paper we focus on behavioral addictions. These have been defined as a particular group of addictions that do not involve the use of a psychoactive substance (17, 18). Like substance addictions, however, behavioral addictions are clinical entities involving a series of impulsive, repetitive behaviors that would appear to be characterized by: loss of control over the behavior in question, a

strong compulsive desire to engage in the behavior, and emotional discomfort or distress that leads to persistence in the behavior despite the aversive consequences it may have (19).

The Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR) (20) includes a preliminary mention of certain behavioral addictions, such as exercise addiction, shopping addiction and sex addiction, but the only behavioral addiction it recognizes as a clear diagnostic entity is gambling disorder (20). On the other hand, the International Classification of Diseases (ICD-11) not only includes gambling disorder (under the heading *Disorders due to addictive behaviors*) but also recognizes other behavioral addictions diagnosable as *Other Specific Impulse Control Disorders* (21). Although there are many other excessive and problematic behaviors which can be understood as potentially addictive behaviors (compulsive shopping, problematic use of the Internet or social networks, etc.), these are not included in the DSM-5 or ICD-11. They are, however, mentioned in the scientific literature (17) or included in guidelines (22). Indeed, pre-existing levels of impulsivity and compulsivity have been identified as indicators of an increased risk of developing addictive problems (16, 23, 24). People who show a higher level of both impulsivity and compulsivity, for example, also present higher levels of problematic Internet use (23, 25), gambling disorder (26, 27), compulsive buying disorder (28, 29) and exercise addiction (30, 31).

It should also be emphasized that, depending on the behavioral addiction in question, differences can be appreciated between levels of impulsivity and compulsivity. Gambling disorder dependence, for example, has been consistently linked to high levels of impulsivity and compulsivity when performing different types of neurocognitive tasks (1, 32). More specifically, people with pathological gambling habits tend to show deficits in response inhibition, attentional set shifting, and contingency-related cognitive inflexibility tasks (1). Sensation seeking has also been found to be a good predictor of gambling (33). With regard to other behavioral addictions, however, little literature can be found that relates them to phenomena like impulsivity or compulsivity. Since they have, to date, been studied less frequently, no measures have yet been obtained which address compulsivity in those disorders (1). Even less information is currently available on the most appropriate treatment with which to address phenomena such as impulsivity and compulsivity in behavioral addictions (34).

Current psychosocial treatments for addictive disorders, such as cognitive-behavioral therapy, 12-step programs, or motivation-focused programs, have been found to have certain limitations in addressing impulse control (35, 36). Likewise, although cognitive remediation represents a promising complementary approach for improving impulse control in addictive disorders (37, 38), its efficacy remains unproven. A considerable amount of research has highlighted third generation treatments or contextual therapies, including a variety of psychotherapies for addressing and reducing impulsivity among people with addictive substance use disorders (39–42). However, although the number of studies on treatments that reduce the level of impulsivity and compulsivity in substance use disorders has increased in recent years, scientific works focused on behavioral addictions are scarce (34, 43). Finally, the systematic reviews found to the date (34, 44, 45) only address

treatment for a specific behavioral addiction, without providing a generalized summary of the current situation with respect to other non-substance addictions. According to the results of these reviews, the treatments of choice seem to be: cognitive-behavioral treatment and motivational interviewing combined with cognitive-behavioral therapy; which are in line with the previous data. For this reason, this study proposes a review that gathers all the information about the treatments in force for all behavioral addictions to date.

In view of the facts that 1) both impulsivity and compulsivity are important factors in the onset, maintenance and treatment of addictive disorders (27, 46); 2) psychological intervention produces significant improvements in a person's impulsivity, compulsivity and quality of life (47); and 3) the literature available on the psychological approach to impulsivity and compulsivity in behavioral addictions is so scarce, the aim of the present study was therefore to conduct a comprehensive literature search and review of the different existing treatments for both constructs in non-substance addictions.

Method

To find scientific publications addressing the psychological treatment of impulsivity and/or compulsivity in behavioral addictions, a systematic review methodology following the PRISMA model (46) was used. Four online searches were conducted on March 8, 2024, in each of the following databases: PubMed, Cochrane Library, Web of Science, and Scopus. The search strategy used the terms and Boolean operators shown in Table 1. No filters were applied and the search was performed by title, abstract and keywords.

Inclusion and exclusion criteria

Inclusion criteria were: (1) scientific articles; (2) quantitative empirical results/data; and (3) psychological treatment of impulsivity and/or compulsivity in behavioral addictions. Exclusion criteria were: (1) single case studies; (2) qualitative results; (3) descriptive results; (4) pharmacological treatment; and (5) substance addictions. It should be clarified that, although all publications date from 2020 to 2023, the criterion used was not that the articles should be recent.

TABLE 1 Search strategy.

Search	Search criteria used in each of the databases
1	("Behavioral Addiction"[Mesh]) AND "Impulsivity"[Mesh] AND "Compulsivity"[Mesh] AND "Treatment"[Mesh]).
2	("Behavioral Addiction"[Mesh]) AND "Impulsivity"[Mesh] AND "Treatment"[Mesh]).
3	("Behavioral Addiction"[Mesh]) AND "Compulsivity"[Mesh] AND "Treatment"[Mesh]).

Selection of articles

Articles were selected in accordance with the PRISMA guidelines (48) (see Figure 1). Out of a total of 349 articles, 270 were rejected after review of the abstract or title. A total of 79 articles were selected for detailed full-text review. The selection procedure was carried out independently by two researchers. When there was a disagreement, a third party was involved to resolve it. The final sample comprised 14 articles that met the inclusion criteria and all of the exclusion criteria referred to in the previous section.

Extraction of results

The characteristics of the 14 selected studies are shown in Table 2.

Quality assessment

The quality of the articles was assessed using the Quality Assessment Tool for Cohort and Cross-Sectional Observational Studies (49). 78.57% (n = 11) of the articles were assessed by both authors. Once the researchers had come to an agreement regarding discrepancies (97.2%), the quality assessment was deemed complete.

The articles were classified as being of "good", "fair" or "poor" quality according to an overall judgment based on the 14 criteria proposed by the Quality Assessment Tool for Cohort and Cross-Sectional Observational Studies. These criteria, which are shown in Appendix: Annex 1, were not applicable to 3 of the 14 articles (1, 2 and 8) because they were systematic reviews.

Results

The different sections below, established according to the type of behavioral addiction being addressed, describe the different interventions carried out in each case. That is to say, to ensure that the results are clearly presented, the different studies found are grouped together according to the clinical problems they address.

Compulsive sexual behavior and problematic pornography use

Three articles were found that addressed compulsive sexual behavior. The first of these was a systematic review by Antons et al. (44). This included a total of 24 articles addressing the treatment of compulsive sexual behavior and problematic pornography use. In its results, the study reveals clinically significant improvements in compulsivity mainly when psychotherapy based on cognitive-behavioral treatment was applied. The second study, by Holas et al. (50), only addresses compulsive sexual behavior in relation to a mindfulness-based relapse prevention program. According to
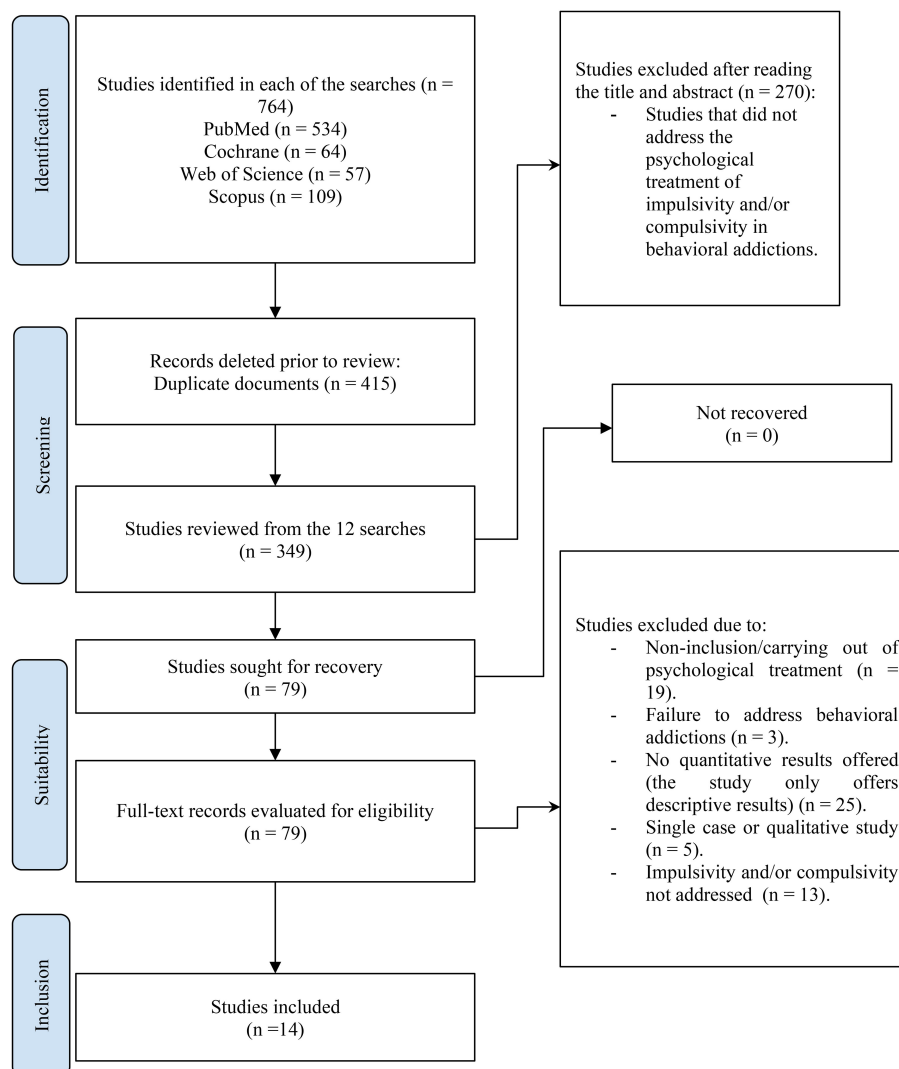
FIGURE 1
PRISMA flow chart.

the results obtained, the program in question would also produce improvements in compulsivity with a medium effect size ($r = .43$). Finally, the systematic review conducted by Boumparis et al. (34) focused on the problematic use of pornography. In their results, the authors state that motivational interviewing combined with cognitive-behavioral therapy produced a reduction in impulsivity levels, which were measured pre- and post-intervention using the Barratt Impulsiveness Scale (BIS).

Gambling disorder

Three articles addressing gambling disorder were included. The first, by Boumparis et al. (34), found that an intervention aimed at modifying cognitive bias produced improvements in impulsivity levels. The second revealed that motivational interviewing conducted together with cognitive-behavioral therapy produced improvements in impulsivity (47). Impulsivity was measured

using the Impulsive Behavior Scale (UPPS-P) and significant differences were found in the following dimensions of that scale: 1) negative urgency ($p = .001$); 2) positive urgency ($p = .001$); 3) lack of premeditation ($p = .029$); and 4) lack of perseverance ($p = .048$). The third article also reported improvements in impulsivity when working with addiction substitution and/or concurrent recovery (51). Here, improvements were observed in the following dimensions: 1) negative urgency ($p = .038$); and 2) lack of premeditation ($p = .04$).

Compulsive shopping

Two articles addressing compulsive shopping were included. Both of them advocate cognitive-behavioral therapy as the treatment of choice. The first, which measured compulsivity based on the Obsession/Compulsion dimension of the SCL-90-R, did not, however, find significant improvements in compulsive

TABLE 2 Descriptive characteristics of the articles selected, in alphabetical order (n = 14).

Reference	Location	Sample (proportion of women)	Type of problem	Type of treatment	Behavior/ trait addressed	Results	Quality score
Antons et al. (44)	Germany	N = 24	Compulsive sexual behavior (CSBD) and problematic pornography use (PPU).	Psychotherapy based on cognitive-behavioral treatment	Compulsiveness	General improvement of symptomatology associated with PPU and CSBD and significant improvements in compulsivity.	–
Boumparis et al. (34)	Switzerland	N = 29	1) Gambling disorder (pathological gambling). 2) Problematic use of pornography.	1) Intervention aimed at modifying cognitive bias. 2) Motivational interviewing combined with cognitive-behavioral therapy.	Impulsivity	A reduction in impulsivity levels, measured using the Barratt Impulsiveness Scale (BIS), was observed in both problems.	–
Holas et al. (50)	South and North Dakota	N = 13 (0% female)	Compulsive sexual behavior	Relapse prevention based on mindfulness.	Compulsiveness	Compulsivity was measured with the Obsessive-Compulsive Inventory-Revised (OCI-R). r = .43; mean effect (Cohen, 1988).	Regular
Garcia-Caballero et al. (47)	Spain	N = 18 (0% female)	Gambling disorder (pathological gambling).	Motivational interviewing and cognitive behavioral therapy.	Impulsivity	Impulsivity was measured with the Impulsive Behavior Scale (UPPS-P). - Negative urgency: p = .001 - Positive urgency: p = .001 - Lack of premeditation: p = .029 - Lack of perseverance p = .048	Regular
He et al. (59)	China	N = 48 (81.25% female)	Problematic use of online gambling.	Bias modification treatment of the stimulus-response compatibility approach.	Impulsivity	Impulsivity was measured with the Barratt Impulsiveness Scale (BIS). None of the results showed significance.	Good
Kim et al. (51)	Canada and the United States	N = 185 (43.2% women)	Gambling disorder (pathological gambling)	Simultaneous addiction substitution and/or recovery	Impulsivity	Impulsivity was measured with the Impulsive Behavior Scale (UPPS-P). - Negative urgency: p = .038 - Lack of premeditation: p = .040	Good
Mestre-Bach et al. (52)	Spain	N = 77 (100% women)	Compulsive shopping.	Cognitive-behavioral treatment.	Compulsivity	Compulsivity was measured with the SCL-90-R. - Obsessive/compulsive dimension: No significant improvements were found (p= .267), obtaining a small effect size (|d| = .28).	Good
Müller et al. (45)	Germany	N = 13	Compulsive shopping.	Cognitive-behavioral treatment.	Impulsivity and compulsivity	A reduction in the levels of impulsivity and compulsivity, measured with the ICD-SCID and Richmond-CBS questionnaires, respectively, was observed in both patients.	–
Na et al. (53)	South Korea	N = 20 (75% women)	Excessive use of internet and/or computer games	Acceptance and commitment therapy.	Impulsivity	A significant decrease in impulsivity was observed. (p = .018).	Good
Romo et al. (54)	France	N = 1423 (53% women)	Problematic use of social networks	Cognitive-behavioral therapy	Impulsivity	Impulsivity was measured using the Impulsive Behavior Scale (UPPS-P) and the results showed no significance.	Good
Shahrajabian et al. (55)	Iran	N = 36 (69.45% female)	Problematic use of the Internet.	Emotional working memory	Impulsivity and compulsivity	A positive effect was seen on the ability to inhibit impulsivity. - Time: p <.001; n2 = .78	Good

(Continued)

TABLE 2 Continued

Reference	Location	Sample (proportion of women)	Type of problem	Type of treatment	Behavior/ trait addressed	Results	Quality score
				training (eWMT)		- Group: p <.001; n2 = .58 - Time x group: p <.001; n2 = .71.	
Siste et al. (56)	Indonesia	N = 40 (57.5% women)	Problematic use of the Internet.	Dialectical behavioral therapy	Impulsivity	A very significant decrease in impulsivity was observed. (p <.001).	Good
Zhang et al. (57)	China	N = 18 (66.67% female)	Problematic use of the Internet.	Solution-focused group counseling intervention.	Compulsivity	A significant decrease in compulsivity was observed. (p <.01).	Regular
Zhao & Pan (58)	China	N = 100 (32% women)	Problematic Internet use (referred to in the article as Internet addiction).	Psychosocial intervention.	Compulsivity	Compulsivity decreased significantly, as the scores obtained in the CIAS-R by the experimental group were significantly lower than those obtained by the control group. (p <.05).	Good

behavior (p = .267) (52) and the effect size obtained was small (d = .28). For its part, the study by Müller et al. (45) focused on both compulsive and impulsive behavior. This article was actually a systematic review. Its results indicated that cognitive-behavioral therapy was the treatment of choice for addressing compulsive shopping, producing a reduction in levels of impulsivity (measured with the ICD-SCID) and compulsivity (measured with the Richmond-CBS).

Problematic use of internet/ social networks

Six articles addressing problematic use of the Internet or social networks were included. The first, authored by Na et al. (53) reported significant improvements in impulsivity through intervention with acceptance and commitment therapy (p = .018). The second, focusing on the cognitive-behavioral treatment of impulsivity, found no significant improvements (54). The third, by Shahrajabian et al. (55) analyzed the effect of emotional working memory training (eWMT) treatment on impulsivity and compulsivity. However, significant improvements were only found in impulsivity, a large effect size being observed when both groups were compared with each other (n^2 = .58) and when the same group was compared over time (n^2 = .78). The evolution of both groups over time was analyzed and the effect size was again large (n^2 = .71). The fourth study addressed problematic Internet use through dialectical behavioral therapy (56). In their results, the authors observed a highly significant decrease in impulsivity (p <.001). The fifth article, by Zhang et al. (57), described a solution-focused group counseling intervention resulting in a significant decrease in symptomatology associated with compulsive behavior (p <.01). The last study reported a significant decrease in compulsivity (p <.05) after having carried out a psychosocial intervention consisting of a cognitive-behavioral group therapy lasting three months During that time, group cohesion

and mutual support were promoted as a central pillar for helping members achieve an adequate use of the Internet (58).

Problematic use of online gambling

Only one of the studies included focused on problematic online gambling. In it, the disorder was addressed through the bias modification treatment proposed in the stimulus-response compatibility approach. The results obtained showed no significant differences between the experimental group and the control group after treatment (59).

Discussion

The present systematic review involved a comprehensive literature search and review of the different existing treatments for impulsivity and compulsivity in non-substance addictions. After performing the search, a total of 764 studies were found, of which only 14 met the previously established inclusion and exclusion criteria. Regardless of these criteria, attention should be drawn to the small number of studies that have been published on psychological treatments for non-substance addictions that decrease levels of impulsivity and compulsivity.

The articles identified covered different psychological treatments for impulsivity and/or compulsivity in the following behavioral addictions: compulsive sexual behavior, problematic use of pornography, gambling disorder (pathological gambling), compulsive shopping, excessive/problematic use of the Internet and/or computer gaming, and problematic use of social networks.

Three of the fourteen studies found were systematic reviews that referenced studies into treatment for compulsive sexual behavior and problematic pornography use. They also assessed the effects of treatment on symptom severity and behavioral activation,

systematically evaluated the broader literature on Internet-based interventions targeting behavioral addictions, and provided a systematic update on studies into treatment for compulsive sexual behavior. Overall, the results of these three studies showed reductions in levels of impulsivity and compulsivity through the respective use of cognitive-behavioral therapy, cognitive bias modification and motivational interviewing combined with cognitive-behavioral therapy, and, again, cognitive-behavioral therapy.

The systematic review therefore offers promising results regarding the treatment of impulsivity and/or compulsivity in the following problems: compulsive sexual behavior, problematic use of pornography, gambling disorder, compulsive shopping, problematic use of the Internet and/or social networks, and problematic use of online gambling. According to the data sowed in the articles included in this systematic review, the treatment of choice for compulsive sexual behavior and problematic pornography use would be cognitive-behavioral treatment. For impulsivity in gambling disorder, the treatment with the greatest empirical support would be the use of motivational interviewing together with cognitive-behavioral therapy. For the treatment of compulsive shopping, the results were contradictory: the study by Mestre-Bach et al. (52) found no significant improvements after a cognitive-behavioral intervention, while the review by Müller et al. (45) proposes cognitive-behavioral therapy as the treatment of choice for this problem. In relation to problematic Internet use, the two therapies postulated as the most suitable for treating impulsivity are dialectical behavior therapy and acceptance and commitment therapy, the former being slightly more effective. Emotional working memory training (eWMT), solution-focused group counseling intervention and psychosocial intervention are also postulated in the literature as probably effective. Finally, for problematic online gambling only one study was found that proposed stimulus-response bias modification treatment, a therapy which apparently does not produce significant improvements in either impulsivity or compulsivity.

Additionally, the following findings could be extracted from the literature reviewed: the most analyzed and effective treatment was cognitive-behavioral therapy for all behavioral addictions, being also the treatment that showed controversial results in problematic internet use; the bias modification treatment of the stimulus-response compatibility approach for the problematic use of social networks did not show evidence of effectiveness; the most studied problem was problematic internet use, being addressed by a total of 6 of the 14 articles included. Based on these findings, it would be interesting to investigate other types of treatments that have not yet been sufficiently explored in the field of behavioral addictions such as: brief therapy in primary care and/or family therapy, since most of the patients with problematic internet use, video game addiction or other types of behavioral addictions are young people.

The results detailed in the previous paragraph are consistent with the existing literature on treatments for behavioral addictions (60–62), since they indicate that motivational interviewing together with cognitive-behavioral therapy would be the treatment of choice for different non-substance addictions (47, 51). Surprisingly, however, although cognitive-behavioral therapy appears in the literature as the most effective method for addressing problematic

internet use (63–65), in our review it offers no significant improvements in impulsivity levels (54). In fact, our results postulate third-generation therapies (dialectical behavioral therapy and acceptance and commitment therapy) as preferred options for addressing this trait (53, 56).

It should be noted that this review is not without its limitations. First, the number of studies included was not very high and this may limit the conclusions that can be drawn from the literature. Also, the included studies featured no common assessment measure for both impulsivity and compulsivity, while sample heterogeneity with respect to gender was observed in only half of the studies analyzed. Also, it is important to mention that, although qualitative studies have been excluded in this article, it would also be interesting to examine the existing literature form a nomothetic perspective and consider individual biographies, current circumstances and life projects for personalized treatment. Finally, most of the studies included focused on only one of the two constructs, the exceptions being the two papers mentioned in Table 2, which assess both impulsivity and compulsivity.

This systematic review was conducted in order to determine the treatments for impulsivity and/or compulsivity in non-substance addictions. The results obtained identify cognitive-behavioral therapy as the treatment of choice for most behavioral addictions (compulsive shopping, compulsive sexual behavior, problematic pornography use and gambling disorder). This is in line with what is found in the scientific literature (62). With regard to problematic internet use, however, the therapies that are postulated as effective for reducing impulsivity do not concur with the findings reported in the scientific literature: in this review dialectical behavioral therapy and acceptance and commitment therapy obtained the best results (53, 56). This may suggest that the underlying, explanatory mechanisms of problematic Internet use and the impulsivity associated with it are not the same as those of other, conventional addictions. In fact, the results seem to indicate that this type of problem may be more responsive to transdiagnostic processes such as experiential avoidance (which are mainly addressed by third-generation therapies) as opposed to other types of typical addiction characteristics such as craving. Due to the small number of studies included in this review ($N = 14$), however, further research on these types of problems is needed in order to identify the mechanisms underlying impulsivity and compulsivity and to determine the most effective treatments for these traits.

These results open new horizons for research into treatments for impulsivity and/or compulsivity in non-substance addictions and can also serve as a guide when establishing and proposing future intervention guidelines for use with behavioral addictions.

The authors report no declarations of interest.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

Author contributions

BA-Y: Writing – review & editing, Writing – original draft. YT: Writing – review & editing, Writing – original draft. CH: Writing – review & editing, Writing – original draft. MJP: Writing – review & editing, Writing – original draft. JH: Writing – review & editing, Writing – original draft.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Appendix: Annex I

Access to the checklist criteria of the "Quality Assessment Tool for Cohort and Cross-Sectional Observational Studies" (National Heart, Lung and Blood Institute, 2014). Study Quality Assessment Tools | NHLBI, NIH.

1. Research objective: Was the research question or objective in this paper clearly stated?
2. Study population: Was the study population clearly specified and defined?
3. Participation rate ≥50%: Was the participation rate of eligible persons at least 50%?
4. Recruitment: Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?
5. Sample size: Was a sample size justification, power description, or variance and effect estimates provided?
6. Exposure before outcome: For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?
7. Timeframe: Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?
8. Levels of exposures: For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?
9. Exposure measurement: Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?
10. Exposure assessment in time: Was the exposure(s) assessed more than once over time?
11. Outcome measurement: Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?
12. Blindness: Were the outcome assessors blinded to the exposure status of participants?
13. Loss to follow-up ≤20%: Was loss to follow-up after baseline 20% or less?
14. Confounding: Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?

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Characterizing impulsivity in individuals with methamphetamine and methcathinone use disorders

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Background: Individuals with substance use disorder (SUD) are characterized by loss of control in drug use, such as increased impulsivity. Methamphetamine and methcathinone are psychostimulants, the use of which is accompanied by a high level of impulsivity. Whether individuals with methamphetamine use disorder (MUD) and methcathinone use disorder (MCUD) differ in different aspects of impulsivity is unclear.

Methods: We investigated impulsivity traits and behaviors in individuals with MUD and MCUD. The Barratt Impulsiveness Scale (BIS), Sensation Seeking Scale (SSS), and delay discounting task (DDT) were assessed in individuals with MUD and MCUD and in healthy controls (HCs); then, we performed network-based analysis and computational modeling to understand the potential differences among the three groups.

Results: MUD subjects scored higher than MCUD subjects in terms of motor impulsivity, nonplanning impulsivity, and total BIS scores. The network analysis revealed that there were no significant differences between MUD and MCUD subjects in any centrality indices. The discount rate of MUD and MCUD subjects was significantly greater than that of HCs, whereas there was no difference in the discount rate between the two addiction groups.

Conclusions: These findings suggest that MUD and MCUD participants differ in impulsivity traits but not in impulsive behaviors, implying that impulsive traits and behaviors represent different aspects of impulsivity.

KEYWORDS

methcathinone, methamphetamine, impulsivity, network-based analysis, sensation seeking, delay discounting

1 Introduction

Numerous studies have consistently shown that substance abuse is associated with impairments in cognitive function, such as attention (1), decision making (19), inhibitory control (2, 3), and structural and functional abnormalities in the brain (4, 5). Substance addiction is a periodic or chronic toxic state caused by the continuous use of one substance, and its defining characteristic is compulsive, out-of-control drug use despite serious negative consequences (6). Individuals with substance use disorder (SUD) exhibit characteristics of impulsivity, and impulsive behavior is closely linked to drug use (7, 8). Impulsivity has been defined as "a predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions" (9). It is a multidimensional construct comprising different aspects (7) and is not only an inherent part of standard individual differences in personality but also intersects with more dysfunctional and pathological behaviors (10). Researchers have proposed that impulsivity may serve as both a consequence and a determinant of drug use (11).

Methcathinone is a third-generation drug or a new psychoactive substance that is commonly known as "zombie drug" and is an analog of amphetamine (12). Methcathinone abuse can cause cognitive impairment in users (13, 14). Both methamphetamine and methcathinone have similar molecular structures, and both are psychostimulants (15). However, compared with methamphetamine, methcathinone is more hydrophilic and less likely to penetrate the blood-brain barrier; therefore, higher doses are required to achieve similar effects (16). The intravenous administration of these two drugs has different effects on the brain (54).

Long-term exposure to methamphetamine increases impulsivity in rats (17). Individuals with methamphetamine use disorder (MUD) have higher impulsivity scores than healthy controls (18), show an impulsive decision-making pattern, and tend to prefer small immediate rewards over large, delayed rewards when faced with a choice (19). Brain imaging studies have revealed that the long-term chronic use of methamphetamine can lead to functional disorders in the frontal lobe (20), and frontal lobe damage is significantly related to impulsivity (21).

Previous studies have also suggested that methcathinone abuse is associated with impulsivity. Methcathinone use can induce violent and aggressive behavior (22). Individuals with methcathinone use disorder (MCUD) exhibit personality changes, including increased aggression and destructiveness (23). Studies have shown that aggression is associated with impulsivity (24). Individuals with MCUD have high levels of impulsivity (25). These individuals also have impaired frontal executive function (13, 26), suggesting that they have inhibitory control dysfunction, which means that they cannot suppress impulsive behaviors including drug seeking.

At present, many studies related to methamphetamine exist, whereas few studies have focused on methcathinone. Do they have similar effects on impulsivity? In other words, are there differences in impulsivity between abusers of these two drugs? There are a few studies related to this issue, one of which reported that the

impulsivity of methamphetamine addicts was significantly greater than that of methcathinone addicts (27). However, whether they differ in other aspects of impulsivity is unclear. Since the effects of methcathinone use on individuals' impulsivity have received little attention in the literature, we focused on this group first. Our previous study revealed that MCUD subjects had deficits in problem-solving ability, a high-level executive function, especially under high task difficulty load conditions (28), indicating that individuals with MCUD exhibit abnormal inhibitory control. Therefore, we sought to understand the differences in impulsivity between MUD participants and MCUD participants and whether knowledge of these differences would facilitate precision interventions for different drug users.

Therefore, two separate studies were conducted to assess the differences in impulsivity between individuals with MUD and MCUD. In study 1, the Barratt Impulsiveness Scale (BIS) (29) was used to test the differences in impulsive personality traits between the two addiction groups. Researchers have reported that impulsivity and sensation seeking are correlated dimensions of personality (30). Zuckerman combined sensation seeking and impulsivity into a supertrait called impulsive sensation seeking (31). Sensation seeking is an important personality trait that affects adolescent substance use, and it is closely related to addictive behaviors (32). Therefore, we also tested differences in sensation seeking between the two drug groups via the Sensation Seeking Scale (SSS) (33). Additionally, given the close relationship between impulsivity and sensation seeking, we employed network-based analysis to construct trait impulsivity and sensation seeking networks to characterize the interactions between the two different traits among the three groups. In study 2, the delay discounting task (DDT) (34) was used to investigate the differences in impulsive behaviors between the two addiction groups. According to previous studies, one of the characteristic behaviors of addicted individuals is their inability to adopt adaptive strategies to achieve future positive outcomes. They tend to choose immediate rewards (e.g., drug use) rather than restraining their desires to gain long-term benefits (e.g., good health) (35, 36). Therefore, we believe that impulsive decision-making is an important reflection of their actual behavior.

On the basis of previous studies, we hypothesized that MUD subjects would have higher scores on the impulsive scale and sensation seeking than MCUD subjects and that MUD subjects would exhibit higher levels of impulsive behavior than MCUD subjects.

2 Methods

2.1 Participants

Studies 1 and 2 were approved by the ethics committee of China University of Political Science and Law. All participants in studies 1 and 2 had normal or corrected-to-normal vision, and they all provided informed consent for their voluntary involvement in the study. All procedures adhered to the principles outlined in the Declaration of Helsinki. The demographic information is shown in Table 1.

TABLE 1 Demographic characteristics of the three groups in studies 1 and 2.

		MUD	MCUD	HC	$F(t)$	p	η^2
		M (SD)	M (SD)	M (SD)			
Study 1	Age	33.31 (7.44)	37.48 (6.85)	33.28 (10.59)	16.7	<0.001	0.053
	Education(years)	8.98 (3.10)	8.60 (2.14)	11.24 (4.01)	40.25	<0.001	0.119
	Years of drug use	6.40 (4.60)	3.70 (3.02)	/	6.94	<0.001	0.697
	Dosage of drug use (g/one time)	0.74 (0.68)	0.79 (0.62)	/	0.758	0.449	/
Study 2	Age	32.32 (6.53)	35.43 (6.79)	31.79 (10.01)	2.27	0.108	/
	Education(years)	10.00 (2.95)	9.49 (2.31)	11.03 (3.23)	2.86	0.062	/
	Years of drug use	6.56 (4.57)	4.14 (2.77)	/	2.76	0.007	0.640
	Dosage of drug use (g/one time)	0.87 (0.58)	0.90 (0.62)	/	0.22	0.826	/

2.1.1 Subjects of study 1

A total of 206 MCUD participants (age range: 22–51 years) and 198 MUD participants (age range: 19–56 years) were recruited from the Compulsory Detoxification Center for men in Changzhi, Shanxi Province, China. They were all male, and all had positive results on the urine methamphetamine or methcathinone tests before they entered the center. They had been abstinent for 2–4 months prior to the study. The primary route of administration was snorting, and no one had injected drugs. Their self-reported frequency of drug use was once a week or more 6 months before abstinence. The inclusion criteria were as follows: primary diagnosis of MUD or MCUD, no concurrent neurological or psychiatric disorders, no ongoing psychiatric medications, and no hallucinations or acute withdrawal symptoms. These diagnoses were confirmed by a senior psychiatrist via the Structured Clinical Interview for DSM-5. The police officers at the center communicated with these eligible subjects and asked if they were willing to participate in the study. They were told the study procedure and provided signed informed consent before enrollment in the study.

In total, 210 healthy male controls (HCs) were recruited via advertisements in the local communities of Changzhi, Nanjing, and Beijing. The control group mainly consisted of security guards, drivers, and factory workers. They were also told the study procedure and provided signed informed consent before enrollment in the study. A total of 17 questionnaires were excluded because of careless answers, missing answers, or other reasons. A sample of 193 participants was ultimately included in the analyses (age range: 18–57 years).

2.1.2 Subjects of study 2

A total of 38 MUD participants (age range: 21–48 years) and 38 MCUD participants (age range: 22–46 years) were also recruited from the Compulsory Detoxification Center for men in Changzhi, Shanxi Province. The duration of abstinence of these participants was 2–4 months prior to the study. The primary route of administration was snorting, and no one had injected drugs. The inclusion criteria for the groups were as described in study 1. A total of 40 nonaddicted healthy control subjects (age range: 18–51 years)

were recruited from Changzhi and Beijing. The two addiction groups and the control group were matched in terms of age and length of education. Moreover, 68 subjects in the addiction groups in study 2 also participated in study 1. All of the participants in study 2 were also male.

2.2 Study procedure and task materials

2.2.1 Study 1

The participants in Study 1 were administered questionnaires that included a demographic information questionnaire, the BIS-11, and the SSS.

Barratt Impulsiveness Scale (BIS-11): The Chinese version of this impulsiveness scale, which was translated and revised by the Beijing Psychological Crisis Research and Intervention Center, was used in this study (37). The BIS-11 contains 30 items and is divided into three dimensions: nonplanning, attentional impulsivity, and motor impulsivity. The participants were asked to assess how often each item occurred on a scale ranging from 1 (not at all) to 5 (always). If a participant scores high in nonplanning, it means that he or she lacks planning. High scores in attentional impulsivity represent a tendency to make rapid decisions. High scores in motor impulsivity represent a lack of consideration before taking action. The higher the total score is, the stronger the level of impulsivity. Confirmatory factor analysis revealed that the questionnaire had good structural validity: χ^2/df = 3.59, GFI = 0.86, RMSEA = 0.06. In this study, the Cronbach's α coefficient was 0.927.

Sensation Seeking Scale (SSS): The SSS was first developed by Zuckerman (38). The questionnaire used in this study is the Chinese version of the fifth edition revised by Wang et al. (33). The questionnaire contains 40 items. Each item includes two descriptive sentences. The subjects were asked to choose the one closest to their situation. The questionnaire has four dimensions: thrill and adventure seeking, experience seeking, disinhibition, and boredom susceptibility. Confirmatory factor analysis revealed that the questionnaire had good structural validity: χ^2/df = 2.22, GFI = 0.88, RMSEA = 0.04. In this study, the Cronbach's α coefficient was 0.746.

2.2.2 Study 2

Delay discounting task (DDT): The monetary delay discounting task used in study 2 was administered via a computer. Two types of rewards were presented on the screen: smaller immediate rewards were on the left, and larger delayed rewards were on the right. The subjects were required to make preference judgments between the two hypothetical rewards. The participants were offered two immediate rewards—50 and 100 yuan—as well as eight delayed options spanning from 1 to 360 days—specifically 1, 3, 7, 21, 45, 90, 180, and 360 days. The delayed reward amount was not fixed and varied depending on the subject's response.

In the task, the order of the immediate reward and the order of the delay time for the same immediate reward were randomized for each subject. The specific amount for each delay was determined on the basis of the subject's response. If the subject chose the immediate reward in the current trial, then the amount of the delayed reward in the next trial would be increased. If the subject chose a delayed reward, the amount of the delayed reward in the next trial would be reduced.

The subjects were asked to press the "F" key for selecting the immediate rewards and the "J" key for selecting the delayed rewards. After the subjects understood the instructions, they were required to perform three practice trials first and then perform the formal experiment. The formal experiment included 128 trials.

2.3 Data analysis

2.3.1 Analysis of demographic characteristics and questionnaires

For study 1, the demographics, BIS scores, and SSS scores among the two addiction groups and the control group were compared using ANOVA. Significant differences were observed in both age and years of education among the three groups; thus, the two variables were treated as covariates in the ANOVA for BIS scores and sensation seeking. *Post hoc* comparisons were also conducted to examine which two groups were different (FDR correction). When the assumption of homogeneity of variance was not satisfied, Brown–Forsythe test and Games–Howell tests for multiple comparisons were used. Independent-sample *t*-tests were used to evaluate the differences in the dosage of drug used between MUDs and MCUDs. A correlation analysis was used to test the correlation between the BIS score and sensation seeking among the three groups. For study 2, the demographics of the three groups and the dosage of drug used were compared between the MUD and MCUD groups, as was the case in study 1. The significance level alpha was set to 0.05 (two-tailed).

2.3.2 Network analysis

Network analysis was conducted in R Studio using the bootnet (version 1.5.3), qgraph (version 1.9.5), and NetworkComparisonTest (version 2.2.1) packages. A Gaussian graphical model (GGM) was employed to construct trait impulsivity and sensation seeking networks for each of the three groups in study 1. In these networks, the three

dimensions of the BIS and the four dimensions of the SSS were treated as nodes, with partial correlations between pairs of nodes representing edges. The edges were regularized using the EBICglasso (Extended Bayesian Information Criterion Graphical Lasso, EBICglasso) procedure, which optimizes model sparsity through two key hyperparameters: Lambda (λ), which controls the sparsity of the graphical model, and Gamma (γ), which is set to 0.5 to balance the model's sensitivity and specificity. Lambda was varied across 100 logarithmically spaced values between λ_max (the maximum value where all edges are zero) and $\lambda\_max/100$. The extended Bayesian information criterion (EBIC) was calculated for each network, with the graph having the best EBIC selected. To minimize type I errors, edges with small weights were penalized to zero.

The network structure is characterized by network centrality indices, i.e., strength, closeness, and betweenness (39). Centrality measures the importance of a node in determining the network's structure (40). Strength represents the weighted sum of edges directly connected to a node and measures the importance of a feature in the network. Closeness represents the inverse of the sum of the average shortest path length between a node and all other nodes. It measures the closeness between a feature and other features. Betweenness represents the number of times that the shortest path between any two nodes passes through another node. It measures the importance of the feature in linking to other features. All node centralities were calculated for each of the three networks, and differences in centrality indices (strength, closeness, and betweenness) were compared among the three networks.

The network properties were compared between any two groups using permutation tests with 1,000 iterations (41, 42). The participants in two of these groups were randomly assigned to two groups when the differences between the two groups were compared. The networks were subsequently constructed, estimated, and compared using a bootstrap resampling method, which was repeated 1,000 times to obtain the null distribution of the network differences under the null hypothesis.

2.3.3 Analysis of discount rate (*k*)

The discount rate functions as an indicator of impulsivity, with a higher rate signifying greater impulsivity (34). Delay discounting was estimated by fitting the data to the hyperbolic function equation: $V = A/(1 + kD)$. *A* is the value of the delay reward, and *D* represents the delay days. *V* is the value of amount *A* at delay *D* (in days). *k* stands for the index of delay discounting (discount rate). In this study, *V* was fixed and composed of two amounts (50 and 100 yuan), whereas *D* had eight different numerical values (from 1 day to 360 days). The amount of *A* varied according to the subject's choices. In this way, the parameter *k* was calculated through nonlinear regression. The index of best fit was $R^2 = 0.94$, indicating an ideal fitting effect. Since the distribution of the *k* value did not conform to the normal distribution, a natural logarithmic transformation was applied to the *k* value, resulting in *k*′. The *k*′ value of the two addiction groups and the control group in study 2 were subsequently compared via ANOVA.

3 Results

3.1 Subject demographic characteristics and history of drug use

The demographics and comparisons among the different groups are shown in Table 1. In study 1, significant differences were observed in the age and years of education among the three groups. *Post hoc* analysis showed that the MCUD group was significantly older than both the MUD group ($p < 0.001$) and the HCs ($p < 0.001$). However, age was not different between the MUD group and the HCs. *Post hoc* analysis also revealed that the HC group had significantly more years of education than the two addiction groups ($p < 0.001$), whereas no significant difference was detected between the two addiction groups. Compared with the MCUD group, the MUD group had significantly more years of drug use. No significant difference was found in the one-time dosage of drug used between the /MUD and MCUD groups.

In study 2, as shown in Table 1, no significant differences were observed among the three groups in terms of age or years of education. There was a significant difference in the number of years of drug use between the two addiction groups, but not in the one-time dosage of drug used.

3.2 Differences in the BIS

Owing to the differences among the three groups in terms of age and years of education, these two variables were included as covariates in the ANOVA. The analyses revealed that (as shown in Table 2) significant differences were found among these three groups in nonplanning impulsivity, attentional impulsivity, motor impulsivity, and the total score.

Post hoc comparisons indicated that, for nonplanning impulsivity and total impulsivity, the differences between any two of the three groups were significant (Figure 1). With respect to attentional impulsivity, both the MUD group and the MCUD group had significantly higher scores than the HCs. For motor impulsivity, the MUD group had a significantly higher score than both the HCs and the MCUD group.

3.3 Differences in sensation seeking

For the SSS, owing to one missing data point in each of the HC and MCUD groups, the final participant count was adjusted to 205 in the MCUD group and 192 in the HC group. Age and years of education were also included as covariates in the ANOVA between groups.

The analyses revealed that (as shown in Table 2) significant differences were observed among these three groups in thrill and adventure seeking, experience seeking, disinhibition, and the total score, but not in boredom susceptibility ($p > 0.05$). *Post hoc* comparisons indicated that the MUD group had significantly higher scores in thrill and adventure seeking, experience seeking, disinhibition, and total score than the HCs or the MCUD group (Figure 2). Compared with the HCs, the MCUD group had significantly higher scores for thrill and adventure seeking and for disinhibition.

3.4 Associations between impulsivity and sensation seeking

The correlation analyses revealed significant correlations between sensation seeking and the total BIS score ($r = 0.20$, $p = 0.005$) and motor impulsivity ($r = 0.32$, $p < 0.001$) within the MCUD group. The analyses also revealed significant correlations between sensation seeking and the total BIS score ($r = 0.24$, $p = 0.001$) as well as nonplanning ($r = 0.19$, $p = 0.007$) and motor impulsivity ($r = 0.31$, $p < 0.001$) within the MUD group. Among the HCs, sensation seeking was significantly correlated with the total BIS score ($r = 0.15$, $p = 0.039$) as well as motor impulsivity ($r = 0.25$, $p < 0.001$).

The correlation analyses also revealed that years of drug use were significantly correlated with the total BIS score ($r = 0.19$, $p = 0.006$) and sensation seeking score ($r = 0.17$, $p = 0.018$) within the MCUD group. However, years of drug use were not significantly correlated with the total BIS score or sensation seeking score within the MUD group.

3.5 Network estimation and comparison

The trait impulsivity and sensation seeking networks of the three groups (MUD, MCUD, and HC) are shown in Figure 3. The node centrality indices of the three groups are shown in Figure 4, and the detailed centrality values of the three groups are displayed in Supplementary Table S1. Among both the MUD participants and the MCUD participants, the nonplanning impulsivity (NPI)
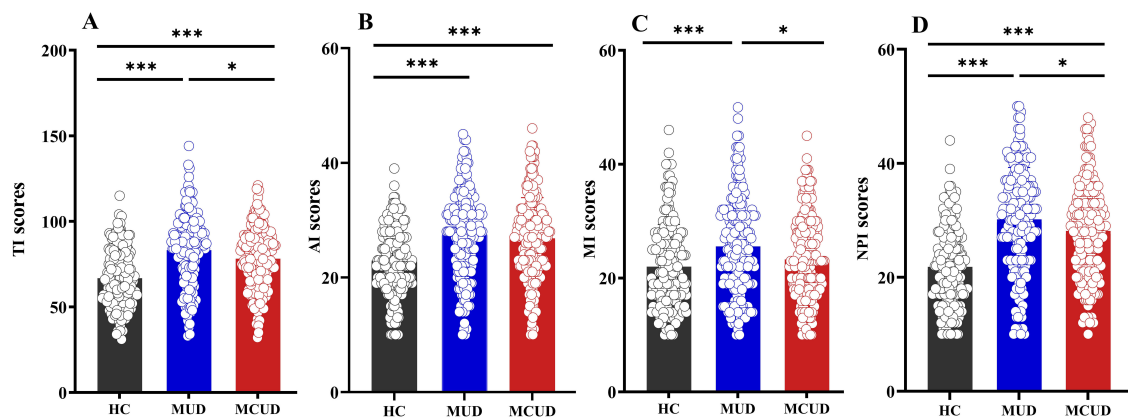
TABLE 2 Comparison of impulsivity and sensation seeking scores among MUD, MCUD, and HC.

	MUD	MCUD	HC	F	η^2
	M (SD)	M (SD)	M (SD)		
AI	27.47 (7.30)	26.80 (7.12)	22.92 (5.88)	18.58***	0.059
MI	25.56 (8.47)	23.29 (7.29)	22.02 (7.38)	8.22***	0.027
NPI	30.14 (9.12)	28.12 (7.98)	21.81 (7.03)	45.97***	0.134
TI	83.17 (20.54)	78.21 (17.33)	66.75 (16.55)	32.86***	0.100
TAS	5.74 (2.47)	5.34 (2.48)	4.68 (2.51)	8.91***	0.029
ES	3.46 (1.68)	2.66 (1.55)	3.60 (2.02)	11.15***	0.036
DIS	5.09 (2.54)	3.55 (2.01)	2.95 (1.78)	49.61***	0.144
BS	2.30 (1.69)	2.03 (1.39)	2.35 (1.86)	1.46	0.005
TS	16.59 (5.18)	13.59 (4.75)	13.58 (5.94)	17.20***	0.055

AI, attentional impulsivity; MI, motor impulsivity; NPI, nonplanning impulsivity; TI, total impulsivity; TAS, thrill and adventure seeking; ES, experience seeking; DIS, disinhibition; BS, boredom susceptibility; TS, total SSS score.
*p < 0.05; **p < 0.01; ***p < 0.001.

FIGURE 1
Differences in BIS among the three groups. **(A)** Comparison of total impulsivity scores among the three groups. **(B)** Comparison of attentional impulsivity scores among the three groups. **(C)** Comparison of motor impulsivity scores among the three groups. **(D)** Comparison of nonplanning impulsivity scores among the three groups. AI, attentional impulsivity; MI, motor impulsivity, NPI, nonplanning impulsivity, TI, total impulsivity. *p<0.05, **p<0.01, ***p<0.001.

exhibited the greatest strength, whereas disinhibition (DIS) presented the greatest closeness. In the MCUD group, DIS displayed the highest level of betweenness. Among the MUD participants, both DIS and NPI showed the highest betweenness.

The pairwise comparison of centrality indices among the three groups revealed that the participants in the HC group presented significantly greater betweenness centrality in the AI compared to those in the MUD group (diff = -5.00, p = 0.007, Bonferroni correction) and significantly higher closeness centrality in the BS compared to those in the MCUD group (diff = -0.011, p = 0.007, Bonferroni correction). Differences were not found in any centrality indices between the MUD and MCUD groups.

3.6 Differences in discount rate (k)

Under the condition of an immediate reward of 50 yuan, k' followed a normal distribution. The homogeneity of variance test

indicated that the variances were homogeneous (p = 0.44). The ANOVA results revealed that the main effect of group was significant [$F(2, 113)$ = 3.656, p = 0.029, η^2 = 0.061]. *Post hoc* analysis showed that the k' values of the MCUD group (M = -0.94, SD = 1.63) and the MUD group (M = -0.96, SD = 1.61) were both significantly greater than those of the HCs (M = -1.82, SD = 1.69; p < 0.05). However, no significant differences were found between the k' values of the MUD group and the MCUD group (see Figure 5).

Under the condition of an immediate reward of 100 yuan, k' also followed a normal distribution. The homogeneity test confirmed variance homogeneity (p = 0.76). The analysis revealed significant differences among the three groups [$F(2, 113)$ = 4.508, p = 0.013, η^2 = 0.074]. *Post hoc* analysis showed that the k' values of the MCUD group (M = -1.34, SD = 1.94) and the MUD group (M = 1.57, SD = 2.00) were both significantly greater than those of the HCs (M = -2.62, SD = 2.08; p < 0.05). The results were similar to those obtained under the condition of 50 yuan (see Figure 6).
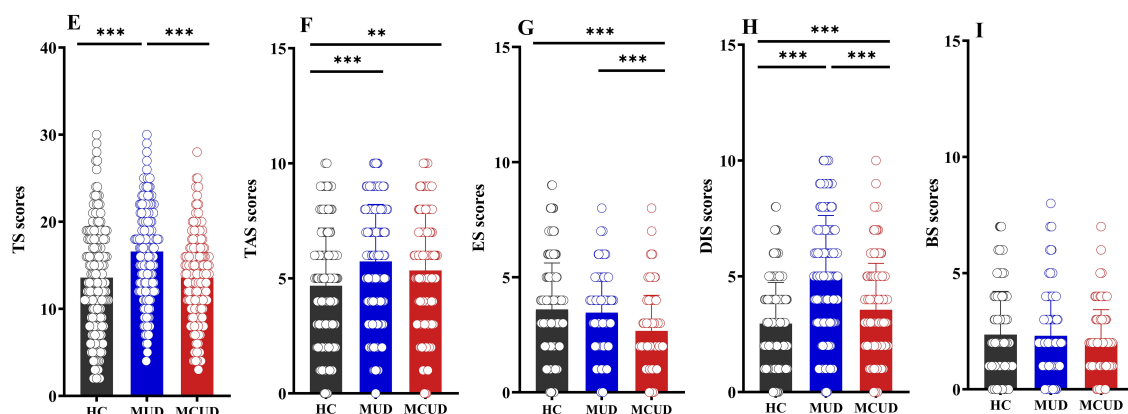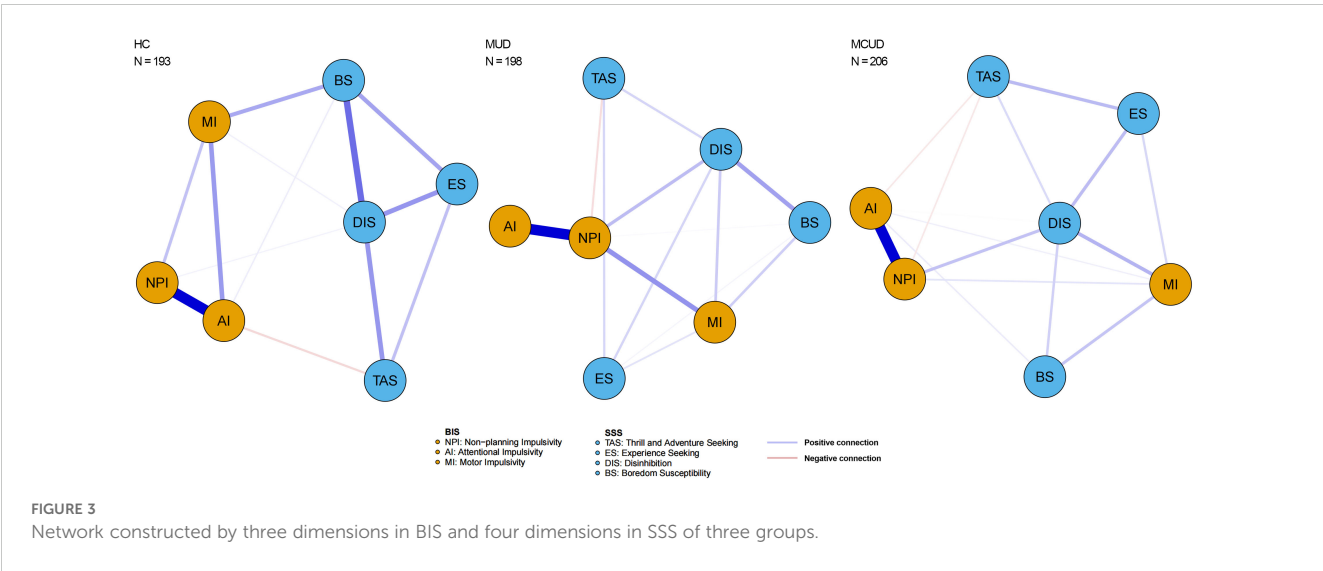

FIGURE 2
Differences in Sensation Seeking Scale among the three groups. **(E)** Comparison of total SSS scores among the three groups. **(F)** Comparison of thrill and adventure seeking scores among the three groups. **(G)** Comparison of experience seeking scores among the three groups. **(H)** Comparison of disinhibition scores among the three groups. **(I)** Comparison of boredom susceptibility scores among the three groups. TAS, thrill and adventure seeking; ES, experience seeking; DIS, disinhibition; BS, boredom susceptibility; TS, total SSS score. *p < 0.05; **p < 0.01; ***p < 0.001.

FIGURE 3

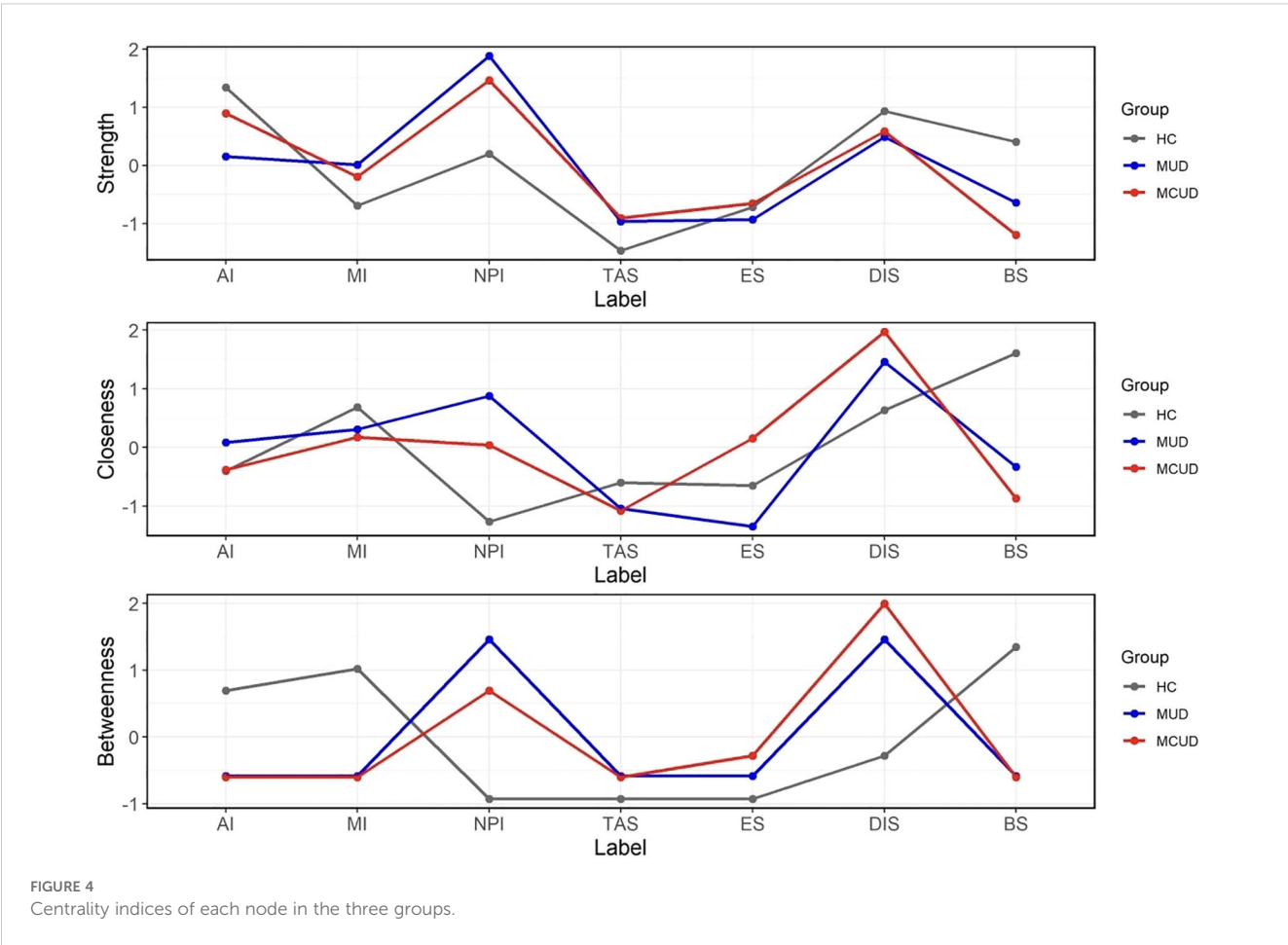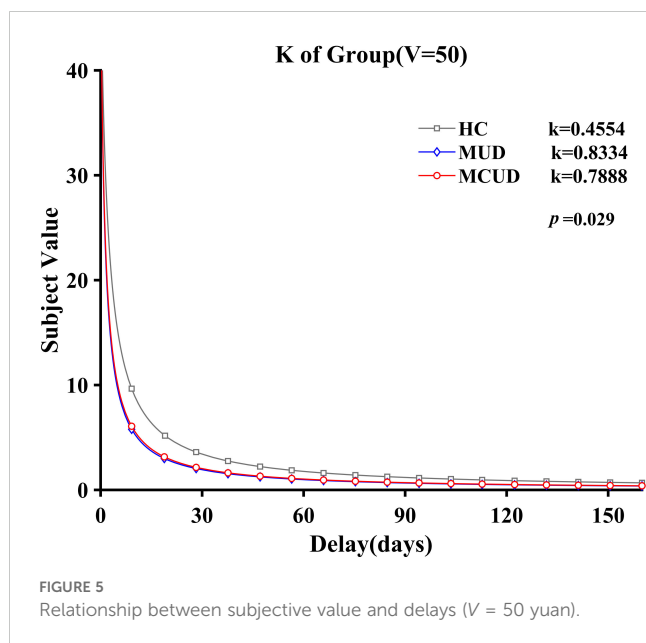Network constructed by three dimensions in BIS and four dimensions in SSS of three groups.

4 Discussion

The present study extensively examined differences in impulsivity between individuals with MUD and MCUD. With respect to impulsive personality traits measured by the BIS, individuals with MUD showed greater impulsivity than those with MCUD. For impulsive behavior measured by the delay discounting task, no significant differences were observed between the two addiction groups. However, they both exhibited greater impulsivity than the HC group. These results partly supported our hypotheses.

Self-reported impulsivity measured by the scale to some degree can reflect one's personality traits and has been found to be

FIGURE 4

Centrality indices of each node in the three groups.

FIGURE 5
Relationship between subjective value and delays (*V* = 50 yuan).

and healthy controls. This underscores the heightened tendency among MUD participants to engage in risky behaviors, distinguishing them from the other two groups, as confirmed in previous studies (46, 47).

The correlation analysis revealed a consistent positive correlation between sensation seeking and the total impulsivity score across all three groups, which was consistent with the findings of previous studies (48). However, across all three groups, we failed to find a significant relationship between sensation seeking and attentional impulsivity. This lack of correlation may have stemmed from the fundamental distinction between the constructs being measured: while the SSS primarily assesses behavioral tendencies toward novelty and excitement (49), attentional impulsivity primarily reflects cognitive impulsivity, which pertains to difficulties in controlling attention and inhibiting inappropriate responses.

To better understand the interplay between the two distinct traits across the three groups, we further conducted a network-based analysis, constructing individualized impulsivity and sensation seeking networks for each group. The strength centrality showed that nonplanning impulsivity (i.e., being unable to make plans before doing things) was the most important feature in both the MUD participants and the MCUD participants. The closeness centrality results revealed that disinhibition was the most important feature in both the MUD participants and the MCUD participants. The betweenness centrality revealed that disinhibition was the most important feature in individuals with MCUD, and both disinhibition and nonplanning impulsivity were the most important features in individuals with MUD. These results suggested that nonplanning and disinhibition were the core features of all the addiction groups—that is, they cannot make plans before acting or doing things as planned. A previous study suggested that disinhibition could be used to search for and identify adolescents with addictive tendencies (50). This finding also indicated that being relatively free from social constraints is a typical feature
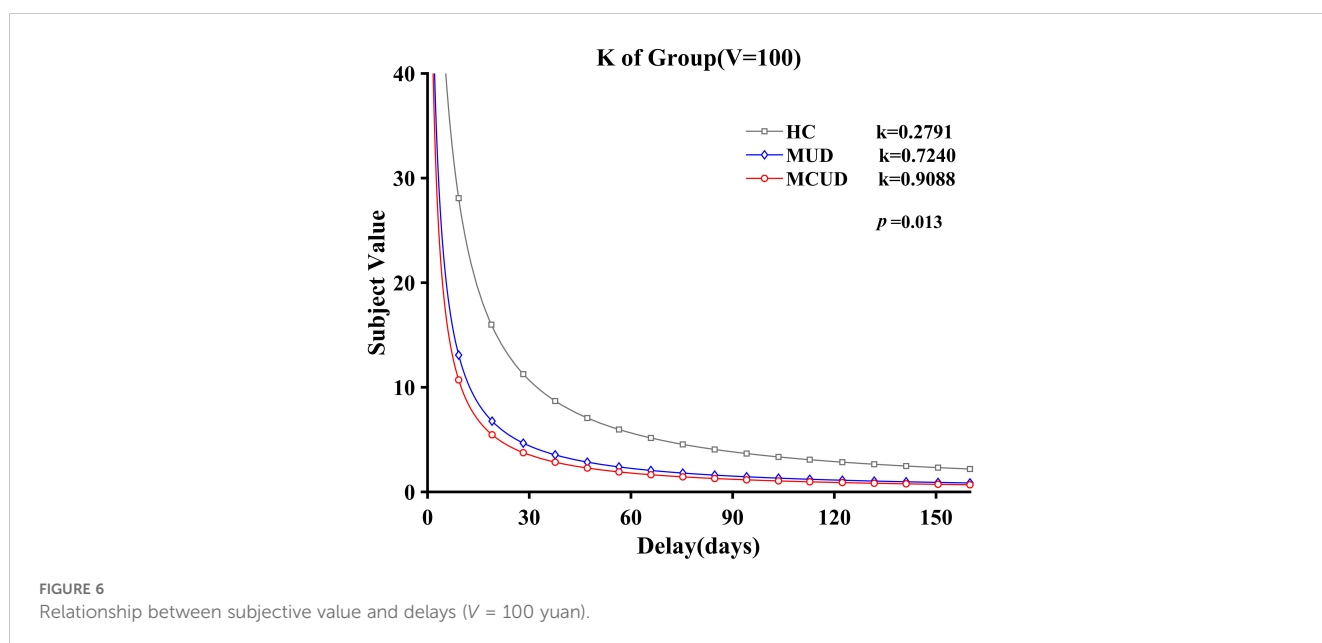
associated with addictive behavior (7, 43, 44). Our results revealed increased impulsivity in individuals with MUD and MCUD compared to those with HCs, which is in accordance with the findings of previous studies (45). In addition, individuals with MUD had greater BIS impulsivity than those with MCUD, which is consistent with the findings of Zhang et al. (27). In fact, all participants in study 2 also completed the BIS. The findings of study 2 regarding impulsivity variations across the three groups replicated those from study 1, with significant differences emerging among the groups.

The SSS measures individuals' risky behaviors. In terms of the total SSS score, individuals with MUD presented significantly greater levels of sensation seeking than both those with MCUD

FIGURE 6
Relationship between subjective value and delays (*V* = 100 yuan).

among addicted individuals. The pairwise comparison of centrality indices revealed that no significant differences were found in any of the centrality indices between the MUD and MCUD participants, but both groups differed significantly from the HCs.

The results of the DDT suggested that the addiction groups displayed impaired impulsive decision-making (significantly higher discount rates than did the healthy group), which is in line with the findings of previous studies (51, 52). The discount rate of MUD participants did not differ significantly from that of MCUD participants, suggesting similar levels of behavioral impulsivity between the two groups, which was inconsistent with the BIS results. Given that previous researchers have suggested that the impulsiveness scale and the DDT test different facets of impulsivity and that these factors are largely unrelated to each other (29, 53), the current findings appear to be both logical and consistent. In addition, we also conducted a correlation analysis between impulsivity and the delay discounting rate and failed to identify any significant correlation within any of the three groups. This result may also indirectly support the aforementioned research findings. However, it should also be noted that the specific setting and state of the participants might have influenced task performance at a particular time.

Overall, the results of this study indicated that both addiction groups exhibited significantly greater impulsivity than the control group, both in terms of trait and behavior. The difference between the MUD and MCUD participants was observed only in trait impulsivity and not in behavior. As a representative new psychoactive substance, methcathinone has many similarities with methamphetamine. As this study revealed, despite the differences in impulsivity questionnaires between individuals with MCUD and MUD, the network analysis showed that the two addiction groups share similar core features. This study further deepens our understanding of the characteristics of methcathinone and provides a reference for precise interventions for different drug users.

However, the current study has several limitations that should be considered. First, our participants were not random samples, and they were all male. Impulsive traits and behavior may differ between men and women; thus, the results of the present study may not necessarily be generalizable to both genders. Second, there were significant differences in the demographic variables among the three groups in the questionnaire study. Even though these variables were included as covariates in the ANOVA, we still cannot eliminate their influence. Third, the sample for the behavioral task was relatively small, which may have led to an insignificant difference between the two addiction groups in the DDT. However, a trend of difference was not observed, and the DDT results were therefore relatively credible. Nevertheless, the results of this study should be extrapolated with caution.

5 Conclusions

In conclusion, we found that the trait impulsivity of individuals with MUD was greater than that of individuals with MCUD. In contrast to our hypotheses, the impulsivity measured by the DDT of individuals with MUD was not greater than that of individuals with MCUD. However, for both measures of impulsivity, the two addiction groups scored higher than the controls. These results suggest that self-reported impulsivity and delay discounting test distinct aspects of impulsivity. The two aspects are interrelated and different. The present study explored differences in impulsivity among different individuals with drug use disorders and also further confirmed and expanded previous research on impulsivity.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors without undue reservation.

Ethics statement

The studies involving humans were approved by the ethics committee at China University of Political Science and Law. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2024.1416342/full#supplementary-material

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A study of impulsivity as a predictor of problematic internet use in university students with disabilities

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Introduction: The role played by impulsivity in problematic internet use (PIU) is the object of much debate among researchers. Some studies emphasize its importance, while others suggest mental distress or personality traits may be more crucial. More research into the issue is clearly needed—especially in at-risk populations like people with disabilities. The objectives of this study were therefore to investigate the relationship between PIU and impulsivity among university students with disabilities, and to develop a specific predictive model for this group that would include psychological and life-functioning variables.

Methods: A cross-sectional design was used with a sample of 240 Spanish university students with disabilities from seven universities. Several instruments were used for data collection: a sociodemographic questionnaire, the Internet Addiction Test (IAT), the Clinical Outcomes in Routine Evaluation-Outcome Measure (CORE-OM), and NEO-FFI-R.

Results: The results indicated that impulsivity is significantly correlated with PIU, as indeed it also is with other factors like conscientiousness and social functioning problems. The study's regression model explained nearly 50% of PIU variance, with impulsivity, personality traits, wellness and health indicators, and social media usage as predictive variables.

Discussion: This suggests that interventions should consider these psychological and lifestyle variables as a means of mitigating PIU risks in students with disabilities. The findings identify a need for further longitudinal studies to understand the causality and develop targeted prevention strategies.

Introduction

Over the last twenty years, interest in problematic internet use (PIU) has grown exponentially, in parallel with the global increase in the use of internet. According to the Digital Report of 2024 (1), internet is now accessed by 62.2% of the population, with percentages rising to almost 100% in some regions. PIU refers to an inability to control the use of the internet resulting in psychological, social, school or work difficulties in a person's life (2, 3). Systematic reviews have already been conducted to explore PIU in relation to different psychological variables, patterns of use and lifestyles (4), and in different populations. Some of these studies have been cross-cultural (5). However, research gaps still persist with regard to potentially more vulnerable groups, such as people with disabilities (6).

When addressing the use of the internet by people with disabilities, two key factors have been identified in the scientific literature: on the one hand, this group's greater vulnerability to the negative consequences of PIU (6), and on the other, internet's ability to mitigate the barriers that hinder the inclusion of people with functional diversity. Online communication seems to be an effective tool for fostering adequate social support and creating conditions that promote psychological health, thus counteracting social interaction difficulties resulting from disability (7–9).

As has been pointed out on several occasions (6, 7, 10), however, the literature on PIU and its impact on people with disabilities remains scarce both in Europe and elsewhere. To date, studies have mainly focused on intellectual disability or cyberbullying, leaving a significant gap in our understanding of the diversity and complexity of the whole disability domain (11). Moreover, although a lower prevalence of PIU has been observed in people with disabilities compared to the general reference population, the negative consequences such people experience in terms of their well-being and psychological health are more severe (6). It has not yet been confirmed, however, whether the PIU risk and vulnerability variables identified in the general population are extrapolatable to people with disabilities.

With regard to PIU risk variables in the population without disabilities, a recent systematic review by Sánchez-Fernández et al. (4) identified 10 predictor variables for PIU. These were classified into three groups: patterns of use, psychological variables, and lifestyles. Among the variables related to patterns of use, time spent online and engagement in online gaming were identified as potential PIU risk factors. Of the psychological variables, depression, negative affect, life stress, maladaptive cognitions, and impulsivity were found to be risk factors, while conscientiousness was a protective factor. Finally, poor sleep quality and substance use (alcohol and drugs) were identified as lifestyle variables that constitute risk factors.

One particular risk variable identified in the literature—impulsivity—has been cited in several of the most important theoretical models that have emerged from research into PIU. These include the I-PACE model (12, 13), Young's internet addiction model (14), and models proposed by Demetrovics et al. (15) and LaRose (16)—self-regulation models which interpret PIU as a self-regulation deficiency problem. This approach is also found

in one of the most recent research developments, known as the behavioral economics model (17–19).

Impulsivity has been defined as a trait characterized by the carrying out of unplanned actions which, although rewarding, are often inappropriate or inordinately risky for the situation at hand and may result in undesired consequences (20, 21). It is recognized as a multidimensional attribute that encompasses five key dimensions: negative and positive urgency (i.e., reacting hastily to intense emotions), lack of premeditation (i.e., acting without contemplating possible consequences); lack of perseverance (difficulty in maintaining concentration in the face of tasks perceived as tedious or complicated), and sensation seeking (the desire to engage in stimulating activities) (22).

On the other hand, researchers like Fineberg et al. (23) and Verdejo-García et al. (24) have identified three essential neurocognitive components of impulsivity: 1) the inability to inhibit dominant motor or cognitive responses, 2) the preference for smaller, immediate rewards over more significant, long-term rewards (reward discounting), and 3) reflective impulsivity, which manifests itself in the difficulty to adequately evaluate options or take reasonable risks and the tendency to ignore relevant information when making decisions, often leading to disadvantageous choices.

The relationship between impulsivity and addictive behaviors has been a subject of study in the fields of both "non-substance" and "substance use" addictions. Although a considerable amount of evidence has accumulated in this regard, results are not consistent and further research is still required to fully understand these dynamics (4, 25).

In the case of substance-related addictions, for example, impulsivity has been linked to early onset of use, transition to abuse and dependence, and to maintenance and relapse (24, 26–28). In behavioral addictions, such as online gambling, problematic internet use, gambling, exercise addiction, and compulsive shopping, higher levels of impulsivity are associated with higher rates of disorders (28–39).

Several studies into PIU have explored the factors influencing this problem, generating findings that highlight the role of impulsivity, although other works minimize its importance. Zhang (40), for example, found that impulsivity mediates the relationship between PIU and neuroticism, suggesting its relevance. Wang et al. (41) found that effortful control and impulsivity were related to PIU severity. Similar conclusions were drawn by Salehi, et al. (42) and Bernal-Ruiz and Rosa-Alcázar (43). However, other findings suggest that impulsivity may not be the main factor in the development of PIU (44, 45). Studies like that of Yücens and Üzer (46) suggest that mental distress may be more important than impulsivity. Others, like that of Zadra et al. (47), conducted using a large community sample, suggest that personality characteristics better explain PIU than impulsivity per se.

In short, more research is needed on the relationship between impulsivity and PIU, especially in populations that may be at risk. People with disabilities, for example, constitute a particularly vulnerable group that has received very little attention in the literature. In normative populations, it has been seen that

university students may also be a group particularly vulnerable to PIU due to their unsupervised access to the internet and responsibility for their own time management. The prevalence of PIU among college students can be high and is associated with a variety of negative consequences, from psychiatric disorders to addictive behaviors such as pathological gambling (20, 23, 48–52).

It is therefore crucial to investigate whether the abovementioned risks are replicated in university students with disabilities, with special attention to the role of impulsivity—a variable which, according to the literature, appears to be closely linked to PIU. Accordingly, the objective of this paper was to investigate the relationship between PIU and impulsivity in university students with disabilities, and to develop a specific predictive model for this group that includes psychological and life-functioning variables.

Materials and methods

Sampling and participants

A sample group comprising a total of 240 Spanish university students with disabilities was selected from the users of the students with disabilities support services of seven universities (UNED–Spain's national distance learning university, University of Valencia, University of Cadiz, University of Malaga, University of Jaen, University of La Laguna and University of Barcelona). In order to make use of these services, students had to have a percentage of disability of more than 33%, accredited by the government's social and health services. 37% of the sample had a motor disability, 19% a sensory disability (auditory or visual), and 44% other disabilities such as chronic illness (excluding intellectual disabilities). 23% were born with a disability and the remaining 77% had an acquired disability, while 55% of the sample were women and 45% were men. The average age was 43.37 years (SD = 12.73) (the average age according to a study conducted throughout Spain by the State Disability Observatory (53) is 38.7; being in males slightly higher 39.7). The sample was recruited by means of an invitation to participate delivered through the services for students with disabilities at the above-cited universities. 90% of the participants were doing bachelor's degrees and 10% master's degrees. 26% were students of Humanities; 40% of Social, Economic and Legal Sciences; and 33% of Health, Sciences and Technologies (ICT).

Instruments

An *ad hoc* questionnaire was developed, containing several instruments.

Sociodemographic and Internet Use Questionnaire: This questionnaire collected information on gender, age, educational background, disability status, and internet usage habits, including the number of hours spent online and the percentage of time allocated to different activities such as leisure, work, and studies.

Internet Addiction Test (IAT): Adapted for Spanish speakers by Carbonell et al. (54) and validated in Spain by Fernández-Villa, et al. (55), this test evaluates the extent to which internet use impacts

different aspects of daily life, such as social interactions, productivity, and emotional well-being. The test consists of 20 items rated on a Likert scale from 0 to 5, with higher scores indicating greater addiction severity. A cutoff score of 40 was used to classify participants as problematic users. The short version of the test, called IAT-12 and developed by Pino et al. (56), was validated for people with disabilities by Pino et al. (10) The internal consistency coefficient (Cronbach's alpha) was close to 0.90.

The Likes Questionnaire: Additional items were included after the IAT to assess the participants' behaviors related to the seeking of validation on social networks. This included things like feelings triggered by not receiving enough "likes" and the frequency with which people checked their follower counts. These items showed a significant correlation with the Addiction to Social Networks Questionnaire (r=.493, p<.001), with an internal consistency (alpha) coefficient of 0.752. The Addiction to Social Networks Questionnaire was validated in Spain by Casas et al. (57).

Clinical Outcomes in Routine Evaluation-Outcome Measure (CORE-OM), by Evans et al. (58), adapted for Spanish populations by Trujillo et al. (59). This is a self-report questionnaire consisting of 34 items that assess the subject's condition based on four dimensions: subjective well-being/discomfort (4 items); problems/symptoms (12 items, measuring anxiety, depression, trauma, and physical symptoms); life functioning (12 items, assessing intimate relationships, social relationships, and levels of daily functioning); and risk (4 items serving as clinical indicators of suicide attempts and self-harm, and 2 items to predict acts of aggression against others). Mean scores below 1 indicate healthy levels, except on the risk scale (<.35). The psychometric properties of this test demonstrated acceptable levels of internal consistency (Cronbach alpha values between 0.75 and 0.90) and sensitivity in the measurements obtained (58). The questionnaire has been used in numerous clinical settings (60, 61) and with university populations (60, 62). In addition, this test has shown convergent validity with the Beck Depression Inventory II (BDI-II) (63) and the Symptom Checklist-90-Revised (SCL90-R) (64).NEO-PIR: NEO Personality Inventory-Revised (NEO PI-R) (65), and its abridged version (NEO-FFI-R). The last test comprises a total of 60 items and has a 5-choice Likert-type response format (1.- strongly disagree and 5.-strongly agree). The questionnaire is based on the Big Five model and considers five main factors: 1) neuroticism (N): identifying individuals prone to psychological distress, unrealistic ideas, excessive cravings or urges and non-adaptive coping responses; 2) extraversion (E): evaluating the amount and intensity of interaction between people, their level of activity, their need for stimuli and their capacity for enjoyment; 3) openness to experience (O): assessing the active seeking and valuing of experience itself, with individuals presenting tolerance and exploration of the unknown; 4) agreeableness (A): assessing the quality of the individual's interpersonal orientation along a continuum from compassion to rivalry of thoughts, feelings, and actions; and 5) conscientiousness (C): assessing the individual's degree of organization, perseverance, and motivation in goal-directed behavior. Impulsivity and sensation seeking were evaluated using the 16 NEO-PIR items (8 for each dimension) that specifically address these dimensions. For example, for impulsivity "I have little difficulty resisting temptation" or "I

rarely give in to momentary impulses", and for sensation seeking "I often seek exciting sensations" or "I love the thrill of roller coasters at amusement parks". The internal consistency alpha index values were acceptable (0.86 to 0.92). In the Spanish version (66), all NEO PIR's core scales achieved excellent reliability coefficients (r ≥ 0.85). The value for the specific scale of "impulsivity" was 0.57 and "sensation seeking" 0.56 (66). Regarding the NEO-FFI-R, this instrument has been validated in Spain by several authors (67–70). The alpha reliability of the NEO-FFI-R in this version were, respectively: Neuroticism (0.90), Extraversion (0.88), Openness (0.88), Responsibility (0.89) and Agreeableness (0.86).

Data collection

The study adhered to the principles outlined in the Declaration of Helsinki and received approval from the Institutional Review Board of the Andalusian Regional Government (Ethics Committee). Following approval, the students with disabilities support services of the participating universities were contacted. These services distributed an email to the individuals listed in their databases containing a link to a website inviting them to participate in research on internet use. In the email and on the first page of the questionnaire it was explicitly stated that participation implied consent for the researchers to use the participants' responses exclusively for research purposes, thus ensuring confidentiality, and that no additional data other than the survey responses would be collected.

Statistical analysis

Pearson correlation coefficients were employed to examine the relationships between impulsivity, internet use, and other variables. Two-way ANOVA tests were used to investigate differences related to type or origin of disability. Prediction of problematic internet use (PIU) was addressed through multiple (forward stepwise) linear regression analysis, with predictors including impulsivity, sensation seeking, the Big Five personality factors (neuroticism, extraversion, openness, agreeableness, conscientiousness), various indicators of wellness and health (anxiety, depression, physical symptoms, traumatic symptoms, problems of daily functioning, problems of social relationship functioning, problems of social support functioning), social media usage (likes), gender and age.

Results

Initially, Pearson correlation coefficients were calculated between PIU (IAT) and impulsivity, with a correlation of 0.378 (p <.001) and each predictor variable. Appendix I shows the correlations matrix, with the values for these variables, encompassing sensation seeking, the Big Five personality factors (neuroticism, extraversion, openness, agreeableness, conscientiousness), various indicators of wellness and health (anxiety, depression, physical symptoms, traumatic symptoms,

daily functioning problems, social relationship functioning problems, social support functioning problems), social media usage (likes), gender and age. With the exception of sensation seeking and openness, all factors displayed significant correlations with PIU, ranging from 0.171 (extraversion) to 0.504. Impulsivity also showed correlation with all factors except openness [ranging from 0.142 to -0.498 (conscientiousness)]. Hereafter, two separate ANOVAs were conducted to explore the relationship between "impulsivity" and "disability", one categorized by type of disability (F[2.223]=1.07; p=.344) and the other by origin (t.[1,209]=.527; p=.468). No statistically significant differences were detected in either case.

The impact of impulsivity on PIU was further examined through multiple linear regression analysis, using scores from the Internet Addiction Test (IAT) as the dependent variable (see Table 1). Here, impulsivity, personality traits, wellness and health indicators, and social media usage were included as predictive variables. A model comprising 7 variables was derived, with impulsivity identified as a risk factor. The beta value for impulsivity was 0.122, indicating a small effect size according to Cohen (71). The R2 value of the model was 0.495 (Adjusted R square=.477), with an estimation standard error of 8.92834, and a Durbin-Watson index of 2.122 (close to 2.000). As established by Cohen (71), R2 values equal to or greater than 0.26 suggest a large effect size. The ANOVA for the model yielded F=28.51; p<.001.

Discussion

The objectives of this study were to investigate the relationship between impulsivity and PIU in university students with disabilities, and to develop a predictive model of PIU, specific to this group, that would include psychological and life functioning variables.

Regarding the first objective, our results indicate that in the university population with disabilities there is a positive relationship of intermediate magnitude between impulsivity and PIU (71) which coincides with that found in students without disabilities. Previous studies, such as the meta-analysis by Koo and Kwon (72), support this association, as do other studies conducted with both normative university populations (42, 43, 45, 73, 74) and non-university students (32, 38, 41). It is therefore important to consider impulsivity as a risk variable for problematic internet use in the university population, and the present study provides new evidence regarding a vulnerable group that has to date been under-researched.

Regarding the second objective, the predictive model for PIU, elaborated using multiple linear regression analysis, was able to explain almost 50% of the variance based on impulsivity, social network use, personality, and life functioning variables. The negative correlation found between PIU and the personality trait "conscientiousness" is in line with other studies in which conscientiousness has been found to be a protective factor against PIU (4, 75–77). In our model, variables related to life functioning also stood out: according to the results obtained, social relationship functioning problems and social support functioning problems both

TABLE 1 Linear multiple (Forward) regression model for Internet Addiction Test (IAT).

Model	Non-Standard-ized Coefficients		Standardized Coefficients			VIF
	B	Standard Error	Beta	t	p	
(Constant)	8.644	2.298		3.762	<.001	
Likes	3.742	.497	.392	7.533	<.001	1,091
Conscientiousness	-5.510	1.103	-.315	-4.996	<.001	1,605
Relationship problems	3.359	1.065	.206	3.154	.002	1,721
Daily functioning problems	-3.994	1.148	-.229	-3.480	<.001	1,751
Openness	2.281	.885	.130	2.577	.011	1,024
Social support problems	2.433	1.025	.162	2.374	.019	1,871
Impulsivity	2.146	1.030	.122	2.084	.038	1,375

Dependent Variable: IAT
VIF, variance inflation factor

act as risk factors for PIU. These results appear to concur with the findings of Weiser (78), who observed that individuals who use the internet to satisfy their social needs or as a means of personal communication are more at risk of developing internet addiction (78).

In our regression model, however, there are two variables—openness and daily functioning—that require a more detailed explanation.

Openness appears as a risk variable in the model, despite not correlating significantly with PIU (see Appendix I). Its inclusion in the model following the multiple regression analysis could indicate that, even though the trait itself does not predict PIU, it does carry weight when accompanied by the other factors in the model, such as impulsivity. That is to say, openness to experience together with impulsivity and low conscientiousness may be better predictors of PIU than openness alone. These results reinforce the idea, put forward by several authors, that it is necessary to study personality traits in relation to PIU as patterns rather than considering each trait in isolation (79, 80).

The regression model also showed daily functioning problems to be a protective factor, even though, again, no positive correlation was found with PIU. While apparently contradictory, this could be understood in the context of the vital functioning of the population with disabilities with whom the study was conducted. At the individual level, this factor presents a positive correlation of moderate magnitude (r=.306; p<.001) with PIU, meaning that problematic internet users tend to have greater problems of daily functioning, just as they have greater problems of social relationships or social support. This concurs with other studies in the literature which report that people with PIU generally present more psychological problems (4). However, when daily functioning skills are considered not in isolation but in interaction with high impulsivity, openness to experience and low conscientiousness, they seem to contribute to a greater tendency to engage in problematic internet use. This could mean that for someone who is impulsive and has low responsibility, that person's ability to achieve

things (daily functioning) may be used to reduce deficits in social interaction and support through internet activities, which are more accessible. In other words, when such a person has problems with social support and relationships, they may seek to escape from that discomfort by engaging in internet activities, and their ability to pursue a goal could thus be used as a mechanism for doing so. Taken together with greater impulsivity and less responsibility, this would lead the person to become increasingly involved in those escape activities, coinciding with their setting of new goals such as getting followers or "likes"—indicated in turn by the "like" factor (another of the risk factors that appear in the model). These results concur with the findings of Pino et al. (10) in that they suggest that college students with disabilities who reported using the internet primarily for social networking and other recreational purposes have a much higher proportion of problematic users than those whose primary use of the internet is for studies and work. In this regard, the results obtained by Herruzo et al. (6) show that people with disabilities who have PIU suffer significantly more subjective distress than those whose use of such technology is more controlled. In the long run, this may lead to greater seclusion, as demonstrated by Duplaga and Sluzc (81), who found that PIU is conducive to isolation.

On the other hand, the results obtained in this study would fit in with what is predicted in the behavioral economics model (17–19), in which the so-called "reinforcer pathology" occurs in the context of diminished reinforcement of alternative activities, resulting in a higher valuation of addictive behavior relative to available alternative activities. The diminished availability of alternative rewards in their environment could thus lead to a higher level of PIU among people with disabilities (82). That is to say, obtaining reinforcement from, for example, social support or intimate relationships in a non-virtual environment entails more effort, time, and resources for persons with disabilities, so they are generally deprived of such reinforcement. As a consequence, PIU may be easier to find in this group, because the internet would provide immediate reinforcement in these areas of life and would facilitate their access to such reinforcement. Under such circumstances, the valuation of the

Internet by students with disabilities would increase due to a change in the cost/benefit ratios of both the internet and its alternatives. PIU is made more problematic for people with disabilities precisely because of the reinforcement-deprived environment associated with the inaccessibility of alternative activities (82). In recent years, Spanish universities have provided counselling and psycho-educational services and programs for students with disabilities, which has led to the inclusion of this group in the academic activities offered by the university. However, very few students with disabilities admit to taking part in social activities or meetings. And it is these kinds of non-instrumental activities that are particularly important for their socialization. University students with disabilities feel that they have more difficulties than their peers in socializing with their peers and feel more comfortable in distance learning, online (83).

Regarding the limitations of the present study, it must be acknowledged that, since it is a cross-sectional study, it is impossible to know the directionality of the relationships or whether a feedback mechanism is produced. Longitudinal studies and more complex analyses would therefore have to be carried out to explore whether impulsivity plays a mediating role in the relationship between PIU and the factors present in our regression model. Another limitation of the study is the size of the sample. It would be interesting to increase the sample size sufficiently to be able to study the differences between the different types of disability in more depth and the protective effect of age. In principle, age seems to act as a protective factor, but this could be a cohort effect due to the lower exposure of older generations or the reduction of impulsivity acquired over time.

With a view to future lines of research, the results obtained in this study could provide a basis from which to explore the generalization of existing findings on impulsivity and addictions to university students with non-intellectual disabilities. Impulsivity has been associated with the onset of any type of addictive behavior, involving as it does difficulties in planning and predicting, reduced perseverance and a high level of desire for immediate gratification (30, 73), so all of these variables should be explored in people with disabilities.

In conclusion, this study has confirmed with university students with disability something that has been found in previous studies with other populations: the need to pay attention to impulsivity as a risk factor for the development of PIU. It also shows that impulsivity, when accompanied by other risk factors such as social isolation, openness, problems in social relationships and low conscientiousness, can predict PIU, explaining 49.5% of variability.

This paper provides a strong argument for taking these risk and protective factors into account when addressing prevention policies for university students with disabilities—a continually growing group of people who often face more environmental challenges than their without disabilities peers (84), and who, although PIU is less prevalent among them than among other university students, are nevertheless more vulnerable to psychological and well-being problems than the latter (56, 85, 86).

Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

Author contributions

MP: Writing – original draft, Writing – review & editing. CH: Writing – original draft, Writing – review & editing. VL: Writing – original draft, Writing – review & editing. YT: Writing – original draft, Writing – review & editing. JH: Writing – original draft, Writing – review & editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Appendix I

Correlation matrix between the study variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	–																			
2	.378**	–																		
3	.078	.142*	–																	
4	.377**	.464**	-.047	–																
5	-.171*	-.198**	.416**	-.499**	–															
6	.041	-.031	.060	-.137*	.206**	–														
7	-.177**	-.256**	-.164*	-.248**	.199**	.127	–													
8	-.471**	-.498**	.080	-.463**	.439**	.097	.324**	–												
9	.504**	.145*	.102	.265**	-.038	-.085	-.034	-.189**	–											
10	.391**	.373**	-.045	.635**	-.361**	-.027	-.125	-.297**	.273**	–										
11	.282**	.374**	-.070	.601**	-,353**	-.044	-.222**	-.355**	.174**	.762**	–									
12	.098	.168*	-.082	.252**	-.216**	.051	.001	-.091	.108	.498**	.500**	–								
13	.335**	.360**	.061	.475**	-.183**	.123	-.228**	-.243**	.193**	.642**	.654**	.358**	–							
14	.221**	.306**	-.068	.586**	-.533**	-.071	-.178**	-.490**	.159*	.532**	.577**	.296**	.369**	–						
15	.342**	.201**	-.076	.604**	-.367**	-.100	-.253**	-.321**	.196**	.547**	.575**	.205**	.493**	.557**	–					
16	.419**	.307**	-.064	.575**	-.400**	-.121	-.266**	-.367**	.243**	.677**	.705**	.348**	.592**	.452**	.589**	–				
17	-.243**	-.121	-.190**	-.175**	.070	.112	.072	.163*	-.227**	-.186**	-.092	.029	-.175**	-.053	-.073	-.152*	–			
18	.060	.004	-.126	-.187**	-.095	.031	.014	-.038	.065	.104	.111	.182**	.035	.052	-.078	.038	-.186**	–		
19	.113	.091	-.026	.171*	-.204**	-.064	-.081	-.131*	.037	.150*	.091	.016	.102	.229**	.151*	.168*	.087	.005	–	
20	-.063	.050	-.087	.037	-.106	-.079	-.018	-.039	-.071	.071	.069	.209**	-.099	.138*	.097	.022	.494**	.021	.260**	–

**. The correlation is significant at the 0.01 level (bilateral).
*. The correlation is significant at the 0.05 level (bilateral).
1= IAT (Internet Addiction Test); 2= Impulsivity (NEO-PI-R); 3= Sensation seeking (NEO-PI-R); 4= Neuroticism (NEO-FFI-R); 5= Extraversion (NEO-FFI-R); 6= Openness (NEO-FFI-R); 7= Agreeableness (NEO-FFI-R); 8= Conscientiousness (NEO-FFI-R); 9= Likes; 10= Anxiety (CORE-OM); 11= Depression (CORE-OM); 12= Physical symptoms (CORE-OM); 13= Trauma symptoms (CORE-OM); 14= Life functioning (CORE-OM); 15= Friendship support functioning (CORE-OM); 16= Social relationship functioning (CORE-OM); 17= Age; 18= Gender; 19= Type of disability; 20= Origin.

Batterer typologies: substance use, impulsivity and results of an IPVAW offender treatment program in Spain

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Introduction: Batterer impulsivity and substance use are relevant factors in the study of gender violence. Impulsivity is defined by the tendency to act suddenly and without forethought. Combined with drunkenness, it can materially increase the likelihood of intimate partner violence.

Methods: The present study examines substance use and impulsivity among a sample of 243 men convicted of IPVAW offences under the Spanish Gender Violence Act (Organic Law 1/2004) in relation to the levels of violence and psychopathologies presented by these perpetrators, in order to understand the results of court-ordered psychological treatments provided under Spain's Gender Violence Offenders Intervention Program. The participants, aged an average 39.1 years, were classified into three types based on demographic factors, substance use and other relevant variables. Meanwhile, the tools used included AUDIT and EuropASI to assess alcohol consumption, CTS2 to measure the frequency and intensity of violent behaviors over the last year, and SCID-II for personality disorders.

Results: Our findings reflected marked improvements in conflict resolution strategies, especially in terms of reduced psychological violence and sexual coercion, but not physical violence. Impulsivity and early-onset alcohol use were identified as key risk factors for violent behavior. Latent class analysis revealed the existence of three sub-types, comprising high-risk batterers displaying high levels of aggression and drinking problems, low-risk batterers displaying high levels of secondary psychopathy, and medium-risk batterers.

Discussion: The study underscores the need for differentiated treatment approaches to address both psychological problems and substance use, while

highlighting the need for personalized interventions to rein in violent behavior and prevent reoffending. We We propose a future longitudinal study to throw light on the subsequent developmental paths taken by IPVAW offenders.

Introduction

Intimate Partner Violence against Women (IPVAW) constitutes an egregious breach of basic human rights, requiring effective measures to protect women and children and advance toward a fairer, more equitable society (1). Violence against women may be psychological, coercive, physical and/or sexual (2, 3), and it is often associated with factors such as cognitive distortion, conflict resolution styles and personality variables.

The primary aim of this study is to throw light on the nature of substance use and impulsivity in different typologies of batterers based on levels of violence and the presence of psychopathologies among men convicted of gender violence offences in Spain. However, we also examine changes in pre- and post-treatment measures of aggression based on batterer profiles.

Efforts to understand intimate partner violence have driven the exploration of different batterer profiles. Despite the abiding consensus that no single, overarching batterer profile can be established (4), researchers have sought to identify the defining characteristics of men who commit IPVAW offences, and so distinguish those who perpetrate acts of violence from those who do not (5), and to identify the salient traits of actual abusers (6, 7).

Holtzworth-Munroe and Stuart (8) proposed a typology based on three dimensions, namely the severity of violence, the generality of violence and batterer psychopathologies. Based on their review of the existing literature, they were able to distinguish three subtypes of batterer based on three dimensions. These are "(a) *the severity of marital physical violence and related abuse, such as frequency of the violence and psychological and sexual abuse*; (b) *the generality of the violence* (i.e., family-only or extrafamilial violence) *and related variables such as criminal behavior and legal involvement*; and (c) *the batterer's psychopathology or personality disorders*." They further hypothesized that research applying these three descriptive dimensions would generally distinguish three main batterer subtypes, namely "(a) *family-only batterers*, (b) *borderline or dysphoric batterers* and (c) *generally violent/antisocial batterers*". This typology has been validated in a range of different contexts (9), supporting the existence of different batterer subtypes each with their own distinctive characteristics.

The reality of intimate partner violence is complex and highly varied. Indeed, the very diversity of batterer characteristics itself suggests that they do not all form part of a single, uniform group.

This heterogeneity has led to a growing awareness of the need to study psychopathological variables such as borderline personality traits (9), antisocial behaviors (10), drinking patterns (11, 12) and impulsivity (13, 14) as predictive factors for intimate partner violence.

Batterer impulsivity and substance abuse have now been recognized as key intensifiers of intimate partner abuse, driving both the frequency and severity of violent episodes (15). Substance-fueled disinhibition and loss of impulse control are associated with a significant increase in the likelihood of violent behaviors (16, 17). This is because substance use lowers the individual's capacity to control his own emotions and actions, facilitating aggressive, impulsive responses in situations of conflict. Meanwhile, impulsivity defined as the tendency to act suddenly without any thought for the consequences only exacerbates violent responses, especially under conditions of stress (18).

It has recently been suggested that new IPVAW offender typologies may be needed to address the risk of violent incidents and the likelihood of recidivism (19), given that impulsivity can trigger physical and emotional violence and is associated with a high probability of repeat incidents, heightening the risk of increasingly devastating outcomes (20). These expanded typologies are differentiated based on the level of risk and provide a more detailed framework within which to understand intimate partner violence and seek solutions to what is a multifaceted problem (6), in particular as regards the risk of violent outbursts and repeat incidents. For example, Cavanaugh and Gelles (19) proposed three differentiated groups of abusers based on the frequency and severity of violence, and the presence of psychopathologies and prior criminal histories. These comprise (a) a *low-risk* group, consisting of offenders who were rarely violent, had committed less severe acts of IPVAW and did not usually present significant psychopathologies or criminal records; (b) a *medium-risk* group of habitually violent offenders responsible for relatively mild acts of aggression, who were likely to present moderate to high levels of psychological disorder; and (c) a *high-risk* group of frequently violent offenders responsible for acts of serious abuse, presenting a range of psychopathologies and a material criminal record. Even so, existing profiles are still unable fully to describe the heterogeneity of batterers or the relationship between offending and known risk variables such as substance use and impulsivity. Further insight will therefore be crucial to the development of effective, specific

interventions to address the needs and risks associated with each subtype of IPVAW offender.

In light of the foregoing, the present study seeks to throw light on the characteristics of substance use and impulsivity among a sample of men convicted of IPVAW offences under the Spanish Gender Violence Act (Organic Law 1/2004) in relation to the levels of violence and psychopathologies presented by these perpetrators. The criteria used in the study to establish the batterer typologies using latent class analysis comprised the frequency and severity of episodes of intimate partner violence, general levels of violence and other associated IPVAW risk factors, such as personality profiles, alcohol abuse, impulsivity and the presence of emotions linked to violent outbursts.

Method

Ethics declaration

This study was approved by the Complutense University of Madrid's Faculty of Psychology Academic Ethics Board on June 7, 2021. The approximate duration of treatments and the purpose and procedures employed in our research were explained to all participants, and their informed consent was obtained in all cases.

Participants

All of the men participating in this study had been convicted of gender violence offences subject to mandatory enrolment in a special program under the oversight of the Spanish courts. The participants had therefore been ordered to follow a course of psychological treatment rather than serving a custodial sentence of less than two years, pursuant to Part IV of the aforementioned Spanish Gender Violence Act, 2004.

The total study sample consisted of 243 men ranging in age between 20 and 80 years (average age = 39.10; SD: 11.1). In terms of academic attainment, 53.90% (n=110) of participants had completed secondary and 23.0% (n=47) primary level education. A further 18.10% (n=37) had attended a university and 4.90% (n=10) had no formal qualifications. In terms of socioeconomic status, meanwhile, 61.90% (n=117) of the sample were classified as middle class and 19.60% (n=37) as lower class. Upper-middle class participants made up 12.20% (n=23) of the participants and 6.30% were upper class. By nationality, the participants were 68.30% (n=157) Spanish, 18.30% (n=42) South American and 8.70% (n=20) from other European countries. Participants of African origin made up 3.90% (n=9) and 0.90% (n=2) were classified as from the "Rest of the World". Finally, 22.20% (n=40) of participants were married or had a stable partner, 27.70% (n=50) were separated or divorced, and 48.30% (n=87) were single.

Procedure

The participants were enrolled in the *Gender Violence Offenders Intervention Program – Alternative Measures* (PRIA-MA) set up

under the aegis of the Spanish Department of Penitentiary Institutions (21), which consists of three phases – *assessment, intervention* and *tracking*. In the first phase, the participants were assessed on all items included in the Measures sections of the self-report questionnaires applied to establish an individual pre-treatment baseline in each case. The intervention phase, meanwhile, comprised 32 weekly sessions lasting two hours each spread over 10 modules. Participants were provided with the informed consent forms in the first session, when the details of the study were explained and all concerns voiced were addressed, including the rules of the program and the reasons why the individual concerned had been included. Upon completing the program, each participant was subjected to a post-treatment assessment using the same questionnaires as applied in the pre-treatment phase in order to re-evaluate the issues addressed. The program ended with the tracking phase, which consists of a final session basically to allow for the clarification of participants' concerns and to review and assess their future plans in order to guarantee lasting results and alignment of the intervention with their future needs.

Measures

Sociodemographic questionnaire

The questionnaire was used to obtain data on the participants' sociodemographic and personal variables, including age, academic attainment, social class, marital status, nationality and occupation.

Severity and frequency of intimate partner violence

These variables were measured using the Revised Conflict Tactics Scale (CTS2; 22; Spanish adaptation by 23), a self-report questionnaire comprising 78 items (39 for perpetration and 39 for victimization) referring to the last year of the subject's relationship. It consists of 5 subscales covering negotiation, psychological violence, physical violence, injury and sexual coercion. According to the scale's authors, the alpha coefficient varied between 0.79 and 0.95. The scales for minor psychological violence (α=0.80), minor physical violence (α=0.59) and minor sexual coercion were obtained in this study. No α was obtained in the latter case because the results did not vary sufficiently.

Substance use

Two tools were used to measure substance use and dependence. Alcohol-related disorders were measured using AUDIT (24–26), and module III of the European Addiction Severity Index (EuropASI) was used to measure consumption of alcohol and drugs (27, 28; Spanish adaptation by 29). The former test, which consists of 10 items, addresses issues related with drinking habits (Direct Score, DS≥9), alcohol dependence (DS≥21) and related outcomes. The test has an internal consistency of α = 0.80 and displays excellent sensitivity and specificity (30). The internal consistency of the test in the present study was α = 0.86. EuropASI consists of a semi-structured clinical interview covering 141 items exploring eight aspects of the dependent individual's

circumstances, a factor which may influence the emergence of substance abuse problems, including a module for alcohol and drug use comprising 28 items to assess consumption of both liquor and other narcotics (heroin, cocaine, amphetamines and cannabis). In addition to establishing individual levels of alcohol consumption, this tool was used to classify all other substances as Central Nervous System (CNS) stimulants or depressants.

Borderline and antisocial personality traits

The Self-Report Assessment of the DSM-IV-R Personality Disorders (SCID-II; 31) was used alongside the Borderline Personality Organization Scale (BPO Scale; 32) to measure both dimensions. Thirty items from the SCID-II borderline personality disorder (BPD) and antisocial personality disorder (APD) scales were used (15 from each with a cut-off threshold of DS≥5 in both cases), because they are both significantly associated with batterers. The original study found a test-retest reliability of 0.84 for antisocial disorder and 0.37 for borderline symptoms. In this study, the tool obtained confidence values of α = 0.89 for both scales.

Psychopathy

The secondary psychopathy subscale of the Levenson Self-Report Psychopathy Scale (LSRP; 33) was used in view of its tried-and-tested psychometric properties (34, 35). This self-report tool contains 26 items addressing issues related with manipulative behaviors, insensitivity and egotistical attitudes (*primary psychopathy;* DS≥20) and antisocial and impulsive behaviors (*secondary psychopathy;* DS≥20). In terms of reliability in the present study, the LSRP scored an alpha of 0.76 on both scales.

General violence and violent emotions

These variables were measured using the Buss-Perry Aggression Questionnaire (AQ; 36; Spanish adaptation by 37) and the State-Trait Anger Expression Inventory (STAXI-2; 38; Spanish adaptation by 39). The AQ contains 29 items distributed across 4 subscales (physical aggression, verbal aggression, anger and hostility). The psychometric properties of the Spanish adaptation of this tool were α = 0.86 for physical aggression, α = 0.68 for verbal aggression, α = 0.77 for anger, and α = 0.79 for hostility. Meanwhile, the scores obtained in the present study were α = 0.81 for physical aggression, α = 0.52 for verbal aggression, α = 0.72 for anger, and α = 0.81 for hostility. STAXI-2 comprises 49 items for both state anger (DS≥21) and trait anger (DS≥18), as well as the different ways in which subjects express and control these feelings. The test scored well in terms of internal consistency, presenting values that ranged from α = 0.89 for state anger to α = 0.64 for the expression of anger in the Spanish adaptation.

Impulsivity

Traits associated with impulsivity were assessed using Plutchik's Impulsivity Scale (40; Spanish validation by 41). This tool contains 15 items measuring the impulsiveness of a subject's actions (DS≥20) distributed in 4 subscales (ability to plan ahead, control of emotional states, control of eating, spending and sexual relations, and control of other behaviors). Prior studies scored α = 0.74 on

internal consistency, but a value of α = 0.73 was obtained for the scale as a whole in this study.

Analysis

We began by performing a descriptive analysis of the variables used in the study to evaluate their distributive properties, including estimates of centrality and dispersion. We then preceded with a Latent Class Analysis (LCA) to discern underlying structures within the data set (see variables in Table 1). This methodological approach, which is anchored in probabilistic principles, facilitated classification of the subjects into homogeneous segments based on observed response patterns, allowing precise identification of latent profiles for violent behaviors. A Repeated Measures Analysis of Variance (ANOVA) was then performed to test the frequency of low-level violence (psychological and physical aggression, and sexual coercion) before and after the intervention, treating the latent classes identified as a secondary factor. This analysis was based on the premise that intra-subject variability in the repeated measures can be explained in part by the classification of the different latent classes identified. We verified the assumptions of normality and homoscedasticity. Finally, we performed descriptive analyses to determine patterns of substance use based on the relative frequency of the behaviors concerned.

From the standpoint of interpretation, we selected the models that best represented the data based on the inherent loss of statistical metrics. To this end we used the loss of verisimilitude in conjunction with the Akaike information criterion (AIC; 42), the

TABLE 1 Descriptive statistics obtained from measurement tools.

Variable	% (n)
General Aggression	
AQ-Physical aggression	31.70% (77)
AQ-Verbal aggression	14.00% (34)
AQ-Anger	25.90% (63)
AQ-Hostility	38.30% (93)
Alcohol use	
AUDIT	19.30% (47)
Psychopathy	
Levenson-secondary	84.40% (205)
Personality	
SCID II-Borderline	38.30% (93)
SCID II-Antisocial	13.60% (33)
Impulsiveness	
Plutchik	8.20% (20)
Anger	
STAXI-Trait anger	26.70% (65)
STAXI- Anger expression and control	17.70% (43)

conditional Akaike information criterion (CAIC; 43), the Bayesian information criterion (BIC; 44) and its sample-size adjusted variant (SABIC; 44, 45) to select the best 6 models in the LCA (1 to 6 classes). Graña et al. (6) provided the theoretical criterion. Meanwhile, we used entropy as the subject classification accuracy indicator, taking scores above 0.8 to show robust class assignation (46). Variables were dichotomized as absent or present based on the criteria obtained from the validation studies for each scale, choosing the highest term in each case. The statistical analyses were run on R (version 4.2.3) using the RStudio interface.

Results

Descriptive statistics

The descriptive results of the study (see Table 1) showed that hostility (AQ) was the commonest measure of aggression, closely followed by physical aggression (AQ). In terms of associated problems, meanwhile, we found a high proportion of subjects with secondary psychopathy in the sample, as well as moderate levels of trait anger and the presence of borderline personality disorders and low levels of antisocial disorder, alcohol use and expression of anger.

The results for pre- and post-treatment violence (CTS) reflected initially lower scores for sexual coercion (M=0.80; SD=5.99) followed by physical aggression (M=2.20; SD=6.09), and higher scores in the sample for psychological aggression (M=8.49; SD=17.30). The lowest level of post-treatment aggression was again found in relation to sexual coercion (M=0.57; SD=3.85), while the physical aggression variable displayed similar mean levels although with higher variability than in the pre-treatment score (M=2.45; SD=11.90). The higher post-treatment aggression scores observed were also found to be present in the case of psychological aggression (M=5.97; SD=13.40).

Latent class analysis

Five latent class models including between 2 and 6 classes were estimated and compared to determine the structure with the best fit to our data from both the statistical and theoretical standpoints. Based on our evaluation of the fit indices for the model data (see Table 2), the three-class model appears to display the best balance in terms of statistical and conceptual fit. This finding is supported by the lower BIC, SABIC and CAIC scores obtained for this model, revealing that the model presents a better fit than the alternatives, whether containing more or less classes. Furthermore, the entropy value of this model is adequate (>0.80) and its smallest class makes up 27% of the sample, preventing problems with very small or unrepresentative classes

The entropy value of the three-class model (0.80) is significant, insofar as it measures the accuracy of the classification of individuals into latent classes. An entropy value above 0.80 is considered a critical threshold, as it ensures that class assignments are clear and well-defined, which improves the validity of the model. Although the four-class model has a slightly higher entropy (0.82), it was decided not to opt for this because its smallest class represents only 11% of the sample, which could compromise its theoretical relevance and representativeness compared to the three-class model, whose smallest class comprises 27% of the sample.

In conceptual terms, the three-class structure offers a better fit both statistically and theoretically, as it more accurately reflects the variability present in our data without becoming over-specified, as occurs in the four- or five-class model, where the smaller classes are likely to be unrepresentative or overly fragmented. In contrast, the two-class model oversimplifies the variability of the data, failing adequately to capture the complexity of the phenomenon analyzed. The three-class structure, then, allows for a more coherent and meaningful classification, with theoretical implications that point to the existence of well-differentiated subgroups within the sample.

Class 3 stood out as presenting the highest probability of violence, specifically in the form of physical aggression (83.40%), verbal aggression (44.71%), irascibility (91.00%) and hostility (83.00%). In comparison with the other classes, the Class 3 participants also display an intermediate probability of presenting serious problems of alcohol abuse (24.00%), borderline personality disorder (BPD 51.10%) and antisocial personality disorder (APD 15.00%), and high levels of trait anger (40.00%), expression of anger (18.00%) and impulsivity (14.00%) However, this class also displays the lowest scores for the secondary psychopathy variable with a 77.80% probability.

Meanwhile, Class 1 scores significantly lower on physical aggression (10.80% probability) and the likelihood of verbal aggression is nugatory, making this the least violent group in these respects. The levels of irascibility (5.04%) and hostility (35.40%) are also low in this class. However, its members display a high probability of secondary psychopathy (86.00%). This class also presents the highest probability of BPD (93.10%) and APD

TABLE 2 Fit parameters of the 2- to 6-class models.

Number of classes	LogLik	BIC	SABIC	AIC	CAIC	Entropy	Smallest class size (%)
2	-1249	2625	2552	2545	2648	0.75	49.00%
3	-1192	2577	2466	2455	2612	0.80	27.00%
4	-1180	2618	2469	2454	2665	0.82	11.00%
5	-1154	2633	2446	2427	2692	0.83	2.00%
6	-1143	2676	2451	2428	2747	0.85	6.20%

LogLik, Log-likelihood; BIC, Bayesian Information Criterion; SABIC, Sample-size Adjusted Bayesian Information Criterion; AIC, Akaike Information Criterion, CAIC, Conditional Akaike Information Criterion.

TABLE 3 Characteristics of IPVAW typologies.

Typologies	Characteristics
Type I: High Risk Violent Offender (Class 3)	Higher values for aggression, irascibility and hostility. Below-the-mean levels of substance use, psychopathologies and factors associated with anger (trait and expression).
Type II: Offender presenting moderate-risk psychopathologies (Class 1)	Higher levels of substance consumption and psychopathologies (impulsive, borderline and marked antisocial traits) with significant anger components (trait and expression).
Type III: Low-risk offender (Class 2)	Low values for physical and verbal aggression. Lower levels of irascibility, hostility, habitual alcohol and other substance use, borderline and antisocial personality characteristics, impulsivity, and factors associated with anger (trait and expression).

Prepared by the authors.

(46.63%), indicating the prevalence of these disorders among participants. These subjects are also the most likely to present impulsivity (18.00%), trait anger (52.70%) and expressions of anger (38.95%).

Class 2 presents a lower probability of physical and verbal aggression (14.30% and 4.52, respectively) than Class 3, but a higher probability than Class 1 in both cases, placing this group on an intermediate level of aggression. The scores for irascibility (5.14%) and hostility (21.80%) are similar. Meanwhile, the 86% probability of secondary psychopathy is the highest of any class, but the probability of BPD (13.80%) and APD (0.88%) are the lowest, suggesting a more stable psychological profile. Impulsivity also scores extremely low (0.69%), as do trait anger (11.80%) and expression of anger (9.43%), reflecting the lowest tendency of any class to engage in impulsive behaviors and express anger.

Finally, Table 3 below summarizes the salient characteristics of the three IPVAW offender typologies considered in this study.

Changes in the treatment of each class and types of substance use

With regard to treatment outcomes relating to each of the three types of violence (psychological and physical violence and sexual

coercion), we observed a significant drop in the frequency of episodes of psychological aggression following treatment (see Table 4). However, this finding was significant only in Class 1 compared to Class 2 with a difference of 8.41 points in the mean score for the former compared to 1.07 for the latter. Statistically changes in frequency were also observed in the case of sexual coercion in Classes 1 and 2, but not in the others. The difference found in Class 1 was 1.68 points and 0.07 in Class 2, and in the latter case the score obtained actually worsened after treatment. No material differences were found in the frequency of incidents involving physical violence before and after treatment.

Turning to the sociodemographic variables (see Table 5), the distribution of average age was found to be fairly homogeneous across the different classes with a mean age of 38.0 in Classes 1 and 3, and 40.5 years in Class 2. The majority nationality in all classes was Spanish, accounting for 75.00% of the participants included in Class 3, 69.00% in Class 2 and 56.80% in Class 1. In the case of educational attainment, meanwhile, Class 3 included the highest percentage of participants with only primary level qualifications (32.00%), while Class 2 had the highest percentage of individuals with university studies (23.50%). Finally, Class 1 stands out in terms of marital status with the highest percentage of single men at 60.60% compared to 45.10% in Class 2 and 48.90% in Class 3.

The substance use variable revealed that 50.0% of the participants classified in Class 1 had consumed alcohol at some time in their lives, compared to 30.37% in Group 2 and 26.67% in Class 3. However, the consumption of alcohol in the last month was markedly lower in Class 2 (15.56%) compared to either Class 1 (41.30%) or Class 3 (16.67%). Meanwhile, the use of stimulants was highest in Class 1 both over participants' lifetimes (30.43%) and in the last month (8.70%). Class 1 also presents greater use of depressant narcotics than the other Groups both over the participants' lifetimes (52.17%) and in the last month (52.17%)

Discussion

This study of impulsivity and substance use among convicted intimate partner violence (IPVAW) offenders reveals that subjects belonging to one of the three typologies of batterers scored better on measures of violence after treatment for both aggression and

TABLE 4 Mean values and changes in the frequency of violent behaviors before and after treatment by class.

	M sample (n=243)		F	M Class 1 (n=47)		M Class 2 (n=135)		M Class 3 (n=61)		F	Bonferroni
	Pre	Post		Pre	Post	Pre	Post	Pre	Post		
Psychological violence	8.42	4.83	14.61***	13.30	4.89	4.82	3.75	7.15	5.18	5.68***	1-2*** 1-3 2-3
Physical violence	2.19	1.82	0.52	4.38	2.70	0.65	1.14	1.15	1.62	1.64	1-2*** 1-3*** 2-3
Sexual Coercion	1.09	0.450	6.87***	2.12	0.44	0.104	0.17	1.04	0.38	4.45**	1-2** 1-3 2-3

**p <.01; ***p < .05.

TABLE 5 Sociodemographic and consumption variables for each class.

	Type II (Class 1)	Type III (Class 2)	Type I (Class 3)
M (SD)			
Age	38.00 (12.15)	40.50 (11.29)	38.00 (9.49)
% (n)			
Nationality			
- Spanish	56.80% (25)	69.00% (87)	75.00% (45)
- Rest of Europe	6.80% (3)	10.30% (13)	6.70% (4)
- Latin America	27.30% (12)	15.90% (20)	16.70% (10)
- Africa	9.10% (4)	3.20% (4)	1.70% (1)
- Rest of the world	0.00% (0)	1.60% (2)	0.00% (0)
Level of education			
- Primary	17.90% (7)	20.90% (24)	32.00% (16)
- Secondary	62.90% (27)	48.70% (56)	54.00% (27)
- University students	10.30% (4)	23.50% (27)	12.00% (6)
- No education	2.60% (1)	7.00% (8)	2.00% (1)
Marital status			
- Married/partnered	12.10% (4)	25.50% (26)	26.70% (12)
- Separated/divorced	27.30% (9)	29.40% (30)	24.40% (11)
- Single	60.60% (20)	45.10% (46)	48.90% (22)
Lifetime alcohol consumption	50.00% (23)	30.37% (41)	26.67% (16)
Lifetime use of stimulants	30.43% (14)	11.85% (16)	20.00% (12)
Lifetime use of other depressant substances	52.17% (24)	21.48% (29)	33.33% (20)
Alcohol consumption in the last month	41.30% (19)	15.56% (21)	16.67% (10)
Stimulant use in the last month	8.70% (4)	5.19% (7)	11.67% (7)
Use of other depressant substances in the past month	52.17% (24)	21.48% (29)	20.00% (12)

substance-use patterns. The Latent Class Analysis performed allowed identification of three subtypes of batterers among a sample of men convicted of gender violence offences in Spain, in line with previous research (6, 8, 19, 47).

Batterer typology and risk factors

Our results support the proposal that batterers can be classified into different subtypes, each with its own definitive characteristics that in turn need to be addressed in the design of interventions. This heterogeneity of batterer profiles is consistent with the existing literature, and it underscores the importance of adopting a differentiated approach to treatment and the prevention of intimate partner violence.

Impulsivity and early-onset drinking emerge as key risk factors for aggression, which is again consistent with the existing literature (48, 49). Defined by a tendency to act suddenly without considering the possible consequences, impulsivity may exacerbate violent responses, especially in situations of conflict or stress. This finding is in line with previous studies, which have identified impulsivity as a robust predictor of intimate partner violence (14, 20).

Meanwhile, early-onset alcohol use can have a long-term impact on neurologic development and on an individual's capacity for emotional control, thereby heightening the risk of violent behaviors in intimate relations. This finding is consistent with other studies, which have shown a strong association between alcohol use and the perpetration of intimate partner violence (11, 12).

Importantly, the relationship between these risks factors and intimate partner violence is neither straightforwardly linear nor causal. Rather, there seems to be a complex interaction between impulsivity, substance use and other contextual and psychological factors involved in violent behavior. This complexity demands the adoption of multidimensional approaches to the prevention and treatment of intimate partner violence.

Treatment results

Our assessment of the PRIA-MA program showed promising results in relation to the use of more adaptive strategies to conflict resolution. This approach was found to produce a significant reduction in psychological violence across the batterer subtypes after treatment, despite marked differences between the different classes. These findings are encouraging and suggest that the program is an effective means of addressing kinds of violence that are often more subtle and difficult to detect but can nevertheless have profound and lasting effects on victims.

The reduction in psychological violence is particularly significant insofar as abuse of this nature often precedes and accompanies more acute manifestations of physical violence. The program's success in mitigating behaviors of this kind suggests that it effectively addresses the underlying thought patterns and attitudes contributing to intimate partner violence.

Another important finding was the reduction in episodes of sexual coercion, a form of violence that is all too often underrepresented in reports though it can have grave consequences for the mental and physical wellbeing of victims. Once again, the program's success in mitigating such behaviors suggests that it effectively addresses beliefs and attitudes related with consent and mutual respect in intimate relations.

Notwithstanding these favorable outcomes, we did not find significant changes in physical violence, suggesting a need to improve the response to this issue in future interventions. Various factors may explain this failure to alter patterns of physical violence. To begin with, it suggests that physically violent behaviors are more change-resistant and may require more intensive or prolonged interventions. Meanwhile, it may also reflect a floor effect if the level of physical violence was already relatively low at the start of treatment, leaving little room for any further improvement.

These findings are consistent with previous studies addressing the results of treatment programs designed to reduce violence and curtail repeat episodes (50, 51). However, the variability observed in subjects' responses to treatment across the different batterer types underscores the need to develop personalized interventions.

Importantly, the results of treatment appear to vary depending on the typology of the batterer. High-risk aggressors (Class 3) displayed greater improvements than those classified in the other groups, suggesting that the PRIA-MA program could be particularly effective in the most severe cases of intimate partner violence. This finding has profound implications for the allocation of resources and the intensity of treatment, if high-risk batterers can in fact benefit from more intensive interventions.

Substance use patterns

Our analysis of substance use patterns revealed material differences between the batterer typologies. Class 1 (Type II), defined as users with medium-risk psychopathologies, displayed high levels of consumption both of alcohol and other substances. This finding suggests that there is a strong correlation between substance use and the presence of impulsive and antisocial psychopathologies (52).

Of particular concern was the high level of alcohol use found among Class 1 participants, 50.0% of whom claimed to have consumed liquor at some time in their lives and 41.30% admitted to doing so in the last month. These levels of consumption not only heighten the risk of intimate partner violence but may also exacerbate existing mental health problems and hamper treatment. Furthermore, consumption of stimulants and depressants in significant quantities among the members of this group suggest a pattern of polyconsumption, further complicating existing clinical symptoms and undermining therapeutic efforts.

A number of psychological and motivational factors may explain the varied substance consumption found in all of the batterer typologies. The individuals included in Class 1 may resort to drugs as a means of handling out-of-control impulses and emotions (53). This pattern of substance use may, then, represent an attempt to self-medicate as a defense against the symptoms of personality disorders and problems of emotional control.

Meanwhile, high-risk batterers (Class 3) may be driven more by the need for control and domination than by impulse, which would explain their lower levels of substance use (54). This finding further suggests that violence may be more instrumental and less reactive in this group. If true, this would have major implications for the design of interventions.

Low-risk batterers (Class 2) displayed lower levels of alcohol and drug use, suggesting that violent behaviors among these individuals are associated with situational factors and/or poor communication and conflict resolution skills rather than substance abuse or severe psychopathologies.

These findings underscore the importance of integrating the treatment of substance abuse into batterer intervention programs, especially in the case of Class 1 subjects. It also suggests that interventions should be tailored to the specific needs of each

batterer typology, so as to address not only substance use but also the underlying psychological and contextual factors contributing to violent outbursts.

Implications in practice

The findings of this study have important implications for both clinical practice and public policy design in the area of IPVAW prevention and treatment. In the first place, they suggest the need to develop differentiated treatment programs addressing both psychological problems and substance use. This kind of combined approach is important to tackle the complex factors involved in intimate partner violence.

In the case of Class 1 batterers displaying high levels of substance use and psychopathologies, it would be helpful to establish a twin-track treatment approach to address both substance abuse and mental health problems in tandem. Such an approach could include specific cognitive-behavioral therapies to help subjects rein in impulsivity and control their emotions, combined with interventions to mitigate drinking and drug-taking.

Interventions targeting high-risk batterers (Class 3) displaying high levels of violence but lower levels of substance use should focus rather on the beliefs and attitudes that uphold the edifice of controlling and dominant behaviors. This might include more intensive work on gender norms, equal relations and empathy-building.

In contrast, low-risk batterers (Class 2) could benefit more from interventions focused on the development of communication and conflict-resolution skills and on stress management. A more educational and prevention-oriented approach may be better suited to this group.

Our results also underscore the importance of implementing exhaustive evaluation procedures to identify individual offenders' typologies and adapt interventions accordingly. This would mean developing and validating assessment tools to allow effective classification of batterers into the three typologies identified in this study.

Furthermore, our findings highlight the need for tight collaboration between the mental health services, addiction treatment practitioners and the providers of batterer intervention programs. Such interdisciplinary cooperation will be essential if we are to offer integrated treatments to address all of the factors concerned in intimate partner violence.

Finally, our findings have implications for the training of professionals working in the field. It is crucial to train therapeutic and other practitioners in the skills they need to recognize and address the diversity of batterer profiles, and to manage the comorbid problems of substance abuse and mental health issues that so often accompany intimate partner violence.

Limitations and future directions

We need to recognize the limitations of this study in order adequately to contextualize our findings and point the way for future research. In the first place, the sample may suffer from selection bias, as it comprises exclusively men convicted of gender

violence offences enrolled in a mandatory treatment program. This limits the generalizability of our findings to other populations, such as batterers who have remained undetected by the authorities and those who voluntarily seek treatment (4).

Meanwhile, the use of self-report tools to measure violence, substance use and other variables can result in bias due to social desirability issues, insofar as participants may understate violent behavior or substance use in order to present themselves in a better light (2). In these circumstances, it will be important to draw on multiple information sources in future studies.

A further limitation is the cross-sectional nature of the study, which prevents us from establishing any kind of causal relations between the variables considered. While we have identified associations between the batterer typologies, substance use and treatment responses, we are unable to infer any kind of causal link based on our data (9).

We suggest the following avenues for future research in order to address the limitations described and shed further light on the phenomenon of intimate partner violence:

1. Prospective longitudinal studies to identify more accurately the developmental routes taken by the different batterer subtypes. These studies could start in adolescence, or even childhood, and would examine the ways in which factors like exposure to violence, early-onset substance use and affective patterns contribute to the development of batterer profiles (55).

2. Use of multiple information sources, including victim and witness data and official registers. This would provide a fuller, more objective picture of the patterns of violence in question and would help overcome the limitations inherent in self-report tools (56).

3. Examination of the stability of the typologies identified over time and in different cultural contexts. This would help determine whether the typologies are universal or vary depending on the sociocultural context (6).

4. In-depth investigation of interactions between substance use, impulsivity and other risk factors involved in intimate partner violence. This could include experimental studies to examine how acute alcohol consumption affects impulsivity and aggression among the different batterer typologies (11, 12).

5. Assessment of the results of personalized interventions based on the typologies identified in this study. This could help with the development and evaluation of treatment programs aligned with the specific needs of each type of batterer (19).

6. Exploration of the role of self-preservation behaviors and resilience as factors that could moderate relationships between risk factors and the perpetration of intimate partner violence. This could provide valuable information for the development of future preventive interventions (48).

7. Investigation of long-term post-treatment paths, including recidivism rates and factors associated with the persistence of behavioral changes (50, 51).

Conclusion

This study makes a significant contribution to our understanding of male batterer typologies and their association with substance abuse and impulsivity. The identification of three different batterer subtypes, each with its own distinct characteristics in terms of the patterns of violence, substance use and treatment response offers a solid basis for the development of more effective, tailored interventions. Our findings underscore the importance of addressing the heterogeneity of batterers in the design of treatment programs and prevention policies. The differential results of the PRIA-MA program depending on the different batterer typologies suggest that a one-size-fits-all approach may not be optimal, and that interventions tailored to the specific needs of each subtype could significantly improve outcomes. Furthermore, our findings in relation to substance use, impulsivity and intimate partner violence underscore the need to address these factors on an integrated basis in intervention programs. The integration of treatments for substance use and the management of impulsivity in batterer programs could improve their overall efficacy. This study also provides an empirical basis for the improvement of risk assessment procedures, allowing professionals more precisely to identify high-risk batterers who may need more intensive intervention measures or closer supervision. Despite the limitations described above, the results of this study open up new avenues for future research and have important implications for clinical practice and the design of public policy. Future studies addressing these limitations and/or exploring the proposed research paths will be crucial to progress in this field and, in the final analysis, to the mitigation of intimate partner violence and its impacts. In short, this study represents an important step toward a more nuanced and complete understanding of the phenomenon of intimate partner violence, providing valuable insight for the design of more effective prevention and intervention strategies aligned with the specific needs of different types of batterers.

Data availability statement

The datasets presented in this article are not readily available due to ethical and data privacy. Requests to access the datasets should be directed to pedrovmf@cop.es.

Ethics statement

Author contributions

PM-F: Conceptualization, Investigation, Writing – original draft, Formal analysis, Methodology, Resources, Validation, Writing – review & editing. IO-S: Data curation, Formal analysis, Methodology, Resources, Software, Writing – review & editing. RR-T: Data

curation, Formal analysis, Software, Visualization, Writing – review & editing. MP-F: Funding acquisition, Writing – original draft, Writing – review & editing, Project administration, Supervision.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2024. 1492218/full#supplementary-material

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Gender differences in ADHD and impulsivity among alcohol or alcohol- and cocaine-dependent patients

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Background: Impulsivity plays a fundamental role in the realm of addiction as is considered a risk factor for addiction. Moreover, it influences the age of onset, severity, and therapeutic management of addictions. The aim of this study was to explore measures of impulsivity in a cohort of male and female diagnosed with Alcohol Use Disorder (AUD) and contrast these findings with those from a group with Alcohol and Cocaine Use Disorder (ACUD).

Methodology: A total of 204 patients (153 men and 51 women) underwent evaluation using Adult ADHD Self-Report Scale (ASRS), Barrat Impulsiveness Scale (BIS-11), Zuckerman-Kuhlman Personality Questionnaire (ZKPQ), Visual Analogue Scale (VAS), Beck Depression Inventory (BDI) and State-Trait Anxiety Inventory (STAI).

Results: A total of 24.6% of the sample (21.9% AUD group and 32.2% ACUD group) screened positive for ADHD. Differences were observed in Total Impulsivity (T(199) =-2.587, p=.010), with the mean score being higher in the ACUD group. Gender differences were noted with ADHD exhibiting a significant explanatory power for impulsivity (greater than 37%) in women compared to men, where its relevance is minimal. Among women, an inverse relationship was found between impulsivity and activity and sociability, in contrast to men, where the inverse relationship was with intolerance to isolation. Both men and women showed associations between ADHD and elevated levels of anxiety and depression. Study limitations and practical implications are discussed.

Conclusions: Although this is an observational study and should be develop a longitudinal study, we detected that the presence of ADHD in addicted women significantly influences impulsivity and should be systematically assessed due to the differences in the clinical approach.

Introduction

Impulsivity is a personality trait defined as a predisposition toward unplanned reactions without regard to the negative consequences of these reactions to the individual or others. Several studies have attempted to explain impulsivity and its association with several psychiatric disorders, including addictive behavior (1–3). A systematic meta-review even points out that impulsivity is an essential part of substance and behavior addictions, rather than a mere consequence of them (4).

Drug use is associated with cognitive and neurological deficiencies, many of which persist after their use is interrupted (5). One aspect of cognition affected by the addiction is the decision-taking process, so that small short-term gains are selected over larger long-term gains. This "impulsive choice" may be associated with an inability to adequately assess the consequences of actions (6). In addition, impulsivity is associated with attention, memory and approach biases in patients with substance use disorders (SUDs) (7). On the other hand, there are studies that have shown that a prolonged use of cocaine increases impulsive behavior (8).

Substance misuse shows differences regarding gender (9, 10). Several researchers have observed that women could be more vulnerable to addiction, with data showing that they increase rapidly the amount they use, as has been described in the case of alcohol, most illegal substances and gambling (11, 12). Gender differences have also been reported among alcohol-dependent patients, including behaviors linked to impulsivity such as suicidal attempts (9).

Other authors have pointed out that men are generally more impulsive than women and have more associated psychiatric disorders (13, 14). Women are more sensitive to punishment, which makes them present less risky behavior (15), while men take greater risks and seek out new sensations (16).

Alcohol consumption has been associated with high levels of impulsivity (17, 18). In this regard, alcohol consumption expectation and impulsivity were the best predictive factors for substance use disorders in both men and women (19). Patients with the greatest impulsivity reported higher levels of intention to drink and alcohol consumption (20). However, some studies show that women with alcohol use disorder present greater impulsivity than men (21). This could be explained by the fact that, compared to men, women are more susceptible to the effects of chronic alcohol consumption, with alterations in the frontal lobe and greater impulsivity after prolonged use (22). The impulsivity levels may also vary based on the substances that have been consumed (23, 24).

Regarding impulsivity in cocaine users, men showed higher scores in the search for emotions than women (25). The association between cocaine consumption and impulsivity is bidirectional. Impulsivity may be a risk factor for cocaine consumption and, in turn, cocaine dependence increases impulsivity (3). In addition, a study has reported that more severe patients with cocaine-induced psychosis show higher levels of impulsivity and a higher prevalence of Attention Deficit Hyperactivity Disorder (ADHD) (3).

ADHD is a disorder that starts in childhood and is associated with multiple disorders (26), including drug use (27) or drug addiction (28). One of the main symptoms of ADHD is impulsivity, which has been associated with an increased use of alcohol and alcohol and substance use disorders (29). Women with ADHD are thought to be less vulnerable than men, but their involvement in drug use is the same (30). Alcohol use itself increases impulsivity, creating a vicious cycle where ADHD-related impulsivity leads to alcohol consumption, which leads to more impulsivity and to binge drinking and loss of control. Furthermore, adolescents with ADHD, especially those who are not being treated, are more vulnerable to the reinforcing effects of alcohol (17, 18).

The concurrence of ADHD and substance use disorder (SUD) is associated with higher levels of impulsivity (3), and an early appearance of the addiction (31), although the direction of causality, the underlying mechanisms, the clinical implications of the strong association between ADHD and SUD and the influence of gender are still unclear.

This article analyzes the influence of gender, impulsivity and ADHD on patients with Alcohol Use Disorder (AUD) and Cocaine Use Disorder (CUD). The hypothesis is that ADHD may have an influence on higher levels of impulsivity for the consumption of cocaine and alcohol, with greater effect on women.

Materials and methods

The study was conducted in the Outpatient Alcohol and cocaine Clinic of the Psychiatry Service of the Salamanca´s University

Hospital in Salamanca. The sample included 204 patients (153 men and 51 women) seeking treatment for Alcohol Use Disorder (AUD) (n=150) and for AUD and Cocaine Use Disorder (CUD) (n=54) according DSM-5 criteria. The proportion of men and women reflected the reality of the outpatient treatment unit where this study took place. The exclusion criterion for patients with severe mental illness (such as psychosis or bipolar disorder) was considered because these patients tend to present more severe psychopathology and specific symptoms of the other mental disorders and a severe organic comorbidity, as well as more medication, which in many cases prevents them from successfully completing the self-administered assessment.

Participants

Data were collected between January 2020 and January 2022. Inclusion criteria were the following; patients must be 18 years or older, AUD with or without CUD, provide signed informed consent, finish the test evaluation process. Exclusion criteria were having previous diagnoses of psychosis or bipolar disease, not having a fluent Spanish expression or comprehension. The study protocol was approved by the Hospital committee (PI 2020 10 603). Patients did not receive monetary compensation for their participation in the study.

Methodology

The assessment was conducted in a single session, during which participants completed a battery of self-report measures. Throughout the evaluation process, participants were accompanied by a trained psychologist to address any questions that might arise while completing the tests. The average time to complete the full battery was approximately one hour. However, there is some variability in participants' completion times (between 1-2 hours). Incomplete tests (>10% of items missing) were excluded from the analysis. Therefore, the degrees of freedom vary between comparisons. For up to 10% missing items, intermediate scores were used. The self-report measures used in this study are as follows.

Adult ADHD Self-Report Scale (ASRS)

The 6-question self-report screening questionnaire ASRS-v1.1 (Adult ADHD Self-Report Scale, available at: http://www.hcp.med.harvard.edu/ncs/asrs.php) was developed jointly by the WHO and doctors Kessler, Adler and Spencer (32). ASRS-v1.1 is a subgroup of the symptom's checklist of the 18-question WHO questionnaire. It is based on the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) of the American Psychiatric Association (33). In Spanish a validated version has been published. It concluded that the ASRS-v.1.1 is an effective tool for the initial screening and that its items measure a nonspecific dimension of compulsiveness/impulsiveness, when it uses the 4-point cut-off. The values obtained for sensitivity (87.5%)

and specificity (68.8) indicate that it is a useful test and that it achieves its objective as a screening tool in a drug-dependent population. It should be mentioned that considering a cut-off equal to or greater than 3 results in greater sensitivity (93.8%), which could be clinically relevant when identifying patients with ADHD under treatment with SUD (34). The variable obtained from the test is the total score, which can range from 0 to 24. The cutoff score to assess a potential ADHD diagnosis is 13 points.

Barrat Impulsiveness Scale (BIS-11)

The Spanish version (35, 36) was completed by all patients. The BIS-11 is a measure of "trait impulsivity". This self-administered questionnaire provides a total score and three subscales' scores. These four scores were used as dependent variables: cognitive impulsivity (tendency to make quick decisions); motor impulsivity (propensity to act solely for the stimulus without thinking of the consequences) and unplanned impulsivity (high interest for the present that the future). All items are measured on a 4-point scale (0 = Rarely/Never; 1= Occasionally; 3= Often; 4= Almost Always/Always). The items are summed and the higher the BIS-11 total score, the higher the impulsiveness level is 12 out of the 30 items are reverse order to avoid response bias. BIS-11 shows high reliability (Cronbach's alpha = .81) in it´s Spanish adaptation.

Zuckerman-Kuhlman Personality Questionnaire (ZKPQ)

The Spanish version (37) of this questionnaire consists of five scales. (1) Neuroticism–Anxiety (N–Anx, 19 items); (2) Activity (Act, 17 items); (3) Sociability (Sy, 17 items); (4) Impulsive Sensation- Seeking (ImpSS, 19 items); and (5) Aggression–Hostility (Agg–Host, 17 items). The ZKPQ also includes an Infrequency scale (Infreq, 10 items). It is answered with True or False, so the maximum score for each scale ranges from 0 to the total number of items in the scale. There are no cutoff points, as it is a test of non-pathological personality traits based on the author's personality theory. Impulsive Sensation-Seeking (ImpSS, 19 items) items involve a lack of planning and the tendency to act without thinking and the seeking of excitement, novel experiences and willingness to take risks for these types of experiences. The ImpSS scale can be separated into two facets: impulsivity (Imp, 8 items) and sensation seeking (SS, 11 items), providing a more conceptually and empirically refined discrimination of drug-dependent patients. The subdivision also applies to Activity scale (General Activity and Working Effort subscales) and Sociability scale (Party and Friends, and Isolation Intolerance subscales).

Visual Analogue Scale (VAS)

A VAS (Visual Analogue Scale) was used at the beginning of treatment to evaluate patients' craving level during the last month. The scale uses a horizontal line without markings where patients

must place a mark indicating the intensity of their craving. A mark at the beginning of the line represents the complete absence of craving, while a mark at the end represents the maximum craving. This line measures 10 cm and uses a scoring scale from 0 to 10.

State-Trait Anxiety Inventory (STAI)

State–Trait Anxiety Inventory (STAI): Self-administered questionnaire that measures the current anxiety symptoms of the patient. Spanish adaptation by Gualberto Buela-Casal, Alejandro Guillén-Riquelme, and Nicolás Seisdedos Cubero was used (38). This self-report consists of 40 questions designed to evaluate the two scales it comprises (20 questions each scale). Each item is answered using a Likert scale from 0 to 3, so the maximum score for each test is 60. The first scale is STAI-State, which refers to the sensations of anxiety experienced by the subject while completing the test. STAI-Feature aims to measure daily anxiety in subjects´ life.

Short form of the Beck depression inventory I and Beck depression inventory II

The assessment protocol initially included the first short form of the Beck Depression Inventory (39). This version includes 13 questions and shows a score between 0 and 39 points. The cutoff points refer to the different levels of depression: absent or minimal depression (0-4), mild depression (8-15), and severe depression (>15). However, it was necessary to change to the Spanish adaptation of the current version; the Beck Depression Inventory II (40). This version includes 21 questions, with a final score between 0 to 63. Although cutoff values change, the levels of depression are the same as in the previous version; absent or minimal (0-13); mild (14-18), moderate (19-27), and severe (28-63). In the analysis of depression as a variable, a value was assigned to each level: absent-minimal (0), mild (1), moderate (2) and severe (3). Therefore, the analysis in this study was conducted by classifying patients into groups with a score of 0-3.

Data analysis

A descriptive analysis of all sample variables was conducted, including measures of mean, median, standard deviation, interquartile range, and normality assessment through skewness and kurtosis. Subsequently, an analysis with two independent samples was performed (Student´s t-test) to determine whether the variables regarding to compulsiveness/impulsiveness (BIS-11) and ADHD (ASRS) were associated with gender. Levene test was used to check homoscedasticity criteria, using a significance of.05. Although they are independent tests, some instruments break down their scores into subscales. In these cases it was applied the False Discovery Rate (FDR), especially used as a correction for Type I Error in cases where multiple analyses are conducted to control the proportion of false positives among the significant results. These are

the cases of BIS-11, ZKPQ Activity, Sociability and Impulsivity, and STAI State and Feature. The analysis of these variables was repeated using the type of drug consumed as the Independent Variable.

Second part of the study involves analyzing the percentage of participants who scored above the cutoff point on the ASRS test. For this analysis, Chi-Square tests were conducted for Gender and Type of Substance. In both tests, the dependent variable was the frequency of participants scoring above the cutoff point (13 or higher), and the independent variable was the substance use group (alcohol vs. alcohol and cocaine). The third part on the analysis consisted on exploring the relationship between ADHD (measured with ASRS) and impulsiveness (BIS-11). It was also explored the relationship between ADHD and variables measured with ZKPQ. For this purpose, Pearson correlation was applied. FDR was also calculated in those correlations p, in order to statistically control multiple analysis in the same test.

All analyses were conducted in SPSS v. 28.0.1.1, except for FDR, which was calculated using the Benjamini-Hochberg formula.

Results

Independent sample T test reported (see Table 1) significant differences in Neuroticism by male and female, t(200)=-2,382, p=,018, 95% C.I. (-3,383/-,319). Female are drawing on an average higher neuroticism (M=11,75, SD=5,023) as compared to male (M=9,89, SD=2,720). Working Effort as subscale from Activity reported differences between male and females, but when FDR correction was applied, differences show to be not significant. The same occurred with Search of Sensation as subscale from Impulsivity. Craving for cocaine reported significant differences by male and female, t(165,24)=2,292, p=,023, 95% C.I. (,891/1,976). In this case women show on average less craving for cocaine (M=,320, SD=1,316) than men (M=,963, SD=2,573). STAI-Feature showed, on average, higher levels on women (M=32,10, SD=13,02) than men (M=27,08, SD=12,82).

Independent T test comparing substances groups revealed significant differences in age by Alcohol and Alcohol and Cocaine Use Disorder, t(210)=3,537, p=<,001, 95% C.I. (2,654/9,340). In average, Alcohol Use patients are older (M=49,56, SD=11,27) than Alcohol and Cocaine patients (M=43,56, SD=9,40). *Total BIS-11*, [t (199)=-2,587, p=,005, 95% C.I. (-8,001/-1,080)], as well as *Motor Impulsivity* [t(199)=-2,644, p=,004, 95% C.I. (-3,470/-,505)] and *Unplanned impulsivity* [t(199)=-2,720, p=,004, 95% C.I. (-3,654/-,577)] showed statistically significant differences, even when correction with FDR. Average punctuation tends to be higher on Alcohol and Cocaine compared to Alcohol group (Mean and Standard Deviations can be consulted on Table 2).

Comparing the percentage of men (22,3%) and women (34%) scoring above the cutoff point on the ASRS, no significant differences were found, Chi Square(1)=2,911, p=,088. Same analysis comparing Alcohol (21,9%) and Alcohol and Cocaine (32,2%) also did not report significant differences, Chi Square(1) =2,509, p=,113.

The correlation between the ASRS test score and the main scale of the BIS-11, as well as its subscales, shows relation (see Table 3)

TABLE 1 Mean scores between men and women for the main tests applied.

	Mean (S.d)			p	FDR
	Total (n=204)	Men (n=153)	Women (n=51)		
AGE	48,00 (11,11)	47,74(11,09)	48,79 (11,24)	,553	–
TOTAL BIS-11	69,59 (11,18)	69,57 (11,19)	69,38 (11,21)	,919	,919
Cognitive Impulsivity	20,63 (3,82)	20,69 (3,60)	20,34 (4,41)	,579	1,152
Motor Impulsivity	22,06 (4,79)	21,96 (4,66)	22,10 (4,87)	,856	1,141
No planeada Impulsivity	27,22 (4,93)	27,42 (4,62)	26,76 (5,74)	,413	1,653
ASRS	10,44 (5,72)	10,34 (5,97)	10,49 (4,58)	,869	–
ZKPQ NEUROTICISM	10,42 (4,87)	**9,89 (4,72)**	**11,75 (5,02)**	**,018***	-
ZKPQ ACTIVITY	8,77 (3,51)	8,88 (3,58)	8,41 (3,32)	,411	,616
General Activity	5,13 (2,20)	5,09 (2,19)	5,22 (2,28)	,718	,718
Working Effort	3,65 (1,83)	**3,8 (1,87)**	**3,20 (1,65)**	**,041***	,123
ZKPQ SOCIABILITY	6,00 (3,56)	5,97 (3,73)	5,98 (3,08)	,991	,991
Party and Friends	2,71 (1,96)	2,77 (2,04)	2,43 (1,65)	,287	,861
Isolation Intolerance	3,30 (2,24)	3,21 (2,24)	3,55 (2,17)	,342	,342
ZKPQ IMPULSIVITY	8,70 (4,07)	8,97 (4,16)	8,05 (3,33)	,096	,144
Impulsivity	3,73 (1,91)	3,71 (1,97)	3,78 (1,66)	,784	,784
Search of sensations	4,98 (3,01)	**5,26 (3,00)**	**4,16 (2,89)**	**,023***	,069
ZKPQ AGGRESSIVESNESS	7,53 (3,24)	7,48 (3,14)	7,57 (3,52)	,871	–
ZKPQ INACCURACY	2,25 (1,72)	2,32 (1,72)	2,04 (1,62)	,314	–
Analogue Evaluation Alcohol	2,86 (3,32)	2,960 (3,31)	2,674 (3,39)	,600	–
Analogue Evaluation Cocaine	,795 (2,32)	**,963 (2,57)**	**,320 (1,31)**	**,023***	-
STAI-State	23,90 (13,77)	23,11 (13,91)	26,30 (13,35)	,157	,157
STAI-Feature	28,41 (13,04)	**27,08 (12,82)**	**32,10 (13,02)**	**,018***	**,036***
BDI	1,61 (1,19)	1,31 (1,14)	1,51 (1,12)	,142	–

The mean score between men and women are represented along the s.d (between brackets). When significant differences exist between groups, they were signed in bold Font and (*). FDR, False Discovery Rate was calculated in those dependent variables with subscales.

for the total sample. These results maintain a correlation when the analyses are conducted using only women's group (p between 0.000 and 0.004). In men, the main scale and the *Motor Impulsivity* subscale do not show significant relationships.

When correlating the remaining variables with the ASRS, it was found that in the total study sample, there is a statistically significant relationship between ADHD scores and most of the clinical and personality variables analyzed in this study.

TABLE 2 Mean scores between Alcohol Use Disorder (AUD) and Alcohol and Cocaine Use Disorder (ACUD) for age, BIS-11 and ASRS tests.

	AUD (n=153)	ACUD (n=51)	*p*	FDR
AGE	**49,56 (11,27)**	**43,56 (9,40)**	**,010***	-
TOTAL BIS-11	**68,37 (10,98)**	**72,91 (11,16)**	**,005***	**,02***
Cognitive Impulsivity	20,42 (3,87)	21,19 (3,65)	,105	,105
Motor Impulsivity	**21,53 (4,88)**	**23,52 (4,25)**	**,009***	**,012***
Unplanned impulsivity	**26,66 (4,81)**	**28,76 (4,95)**	**,007***	**,014***
ASRS	10,16 (5,96)	11,20 (4,98)	,126	–

The mean score between groups are represented along the s.d (between brackets). When significant differences exist between groups, they were signed in bold Font and (*). FDR: False Discovery Rate was calculated in those dependent variables with subscales.

When conducting the analysis by separating men and women, we found several differences between the two groups. Given the number of variables considered, we suggest using Table 4 as a reference to facilitate clearer interpretation.

Discussion

Greater Total, Motor and Non-planning Impulsivity were registered (according to BIS-11's scale) in the group with Alcohol and Cocaine Use Disorder than in the group with Alcohol Use Disorder. We have confirmed that there is a strong association of ADHD with substance misuse and impulsivity. From a gender perspective, ADHD has been found to have greater association for impulsivity among women. In the group of women, we observed that greater impulsivity involved less sociability and participation in activities. Both men and women present a direct association between impulsivity and alcohol craving, as well as with neuroticism, sensation seeking, impulsivity and aggression-hostility; and an inverse association with work energy and infrequency. In the group of men, impulsivity was associated with lower intolerance to isolation and cocaine craving. In the affective sphere, high levels of impulsivity were associated with anxiety (measured with the STAI) and depression criteria (BDI) in both men and women.

The high levels of impulsivity found across the entire sample agree with the literature, because among the general population, motor impulsivity (propensity to react rapidly to a stimulus without considering the consequences) has been associated with drug use (4, 41). There are statistically significant differences regarding total impulsivity between the group of patients with alcohol and cocaine use disorder and those who only had alcohol use disorder. This was also observed in the subscales of motor and non-planning impulsivity. Impulsivity has been associated with the use of drugs (42), and particularly with cocaine (3, 8, 24).

With regard to gender, total impulsivity and its different subtypes were similar in men and women in the population of our study. This is different from what has been observed in the general population, in which men show greater impulsivity (13). In our sample, impulsivity was the same in both groups, and this could be due to the frequency of ADHD and alcohol use, because women have been reported to present more impulsivity, particularly after prolonged alcohol consumption (43).

The association between impulsivity and craving also presents differences regarding gender. Both women and men present a direct association between impulsivity and alcohol craving, but men also present an association with cocaine craving. Preclinical studies have analyzed the differences in alcohol craving between genders (44) and exposure to drugs has been reported to have different effects depending on gender (45). After consumption, women report a stronger feeling of stress and higher levels of craving (46). However, further studies should be conducted on impulsivity and craving according to gender, because this is an essential aspect in the relapse process that may involve a poor evolution (47).

At an affective level, high levels of impulsivity have been associated with anxiety and depression criteria in both men and women. However, gender differences have been reported in the neuroendocrine adaptation to stress and reward systems that may mediate women's susceptibility to the use of drugs and relapses (48), and to mood and anxiety disorders throughout life, which are significantly higher among women than among men, both with and without substance use disorders (49). The similarities between genders observed in our study could be associated with the severity of the disorders in our sample.

We have confirmed a strong association between ADHD and substance addiction and impulsivity. The highest scores in the ADHD self-report were associated with higher impulsivity scores in both drug use groups, and this confirms previous findings of a high coexistence of alcohol and cocaine use disorders and ADHD (17, 28, 31, 50).

No differences were observed regarding the ASRS and impulsivity between the ACUD and the AUD groups. It had previously been reported that no differences had been found comparing patients who used cocaine, cannabis, or both (51). This suggests that there are factors, other than impulsivity and ADHD, which have an influence on the choice of the main substances of addiction.

With regard to gender, the presence of ADHD in women is directly associated with total impulsivity and all impulsivity subscales. However, in men an association was only found with the subscales of motor and non-planning impulsivity.

Since the scores were similar for both genders, it could be suggested that in women with ADHD impulsivity levels increase more than in men, due to a ceiling effect for men, in which the presence of ADHD barely affects impulsivity, which already presents high levels. This would explain why ADHD has greater explanatory power for impulsivity in women, and why their levels

TABLE 3 Correlation between the ASRS test about ADHD screening and impulsivity.

	Total			Men			Women		
	R	p	FDR	R	p	FDR	R	p	FDR
TOTAL BIS-11	,160	,024*	,024*	,034	,676	,676	**,609**	**,000***	**,000***
Cognitive impulsivity	,236	,001*	,001*	,151	,066	,088	**,483**	**,000***	**,000***
Motor impulsivity	,303	,000*	,000*	**,249**	**,002***	**,02***	**,399**	**,004***	**,004***
Unplanned impulsivity	,247	,000*	,000*	**,210**	**,010***	**,008***	**,480**	**,000***	**,000***

The first part of the table represents the correlation for all the sample and in the second part the sample was divided in Men, Women before we made that correlation. When significant differences exist between groups, they were signed in bold Font and (*). R, R Pearson correlation: unilateral signification. FDR, False Discovery Rate was calculated in those dependent variables with subscales.

TABLE 4 Relation between impulsitiv(Barrat) and other variables, according to gender.

	Total			Men			Women		
	R	p	FDR	R	p	FDR	R	P	FDR
ZKPQ NEUROTICISM	,360	**,000***	–	,294	**,000***	-	,547	**,000***	–
ZKPQ ACTIVITY	-,181	**,010***	**,015***	-,140	,089	,133	-,314	**,002***	**,007***
ZKPQ general activity	-,098	,165	,165	-,059	,478	,478	-,214	,136	,136
ZKPQ working effort	,227	**,001***	**,003***	-,196	**,016***	**,048***	-,344	**,014***	**,021***
ZKPQ SOCIABILITY	-,154	**,030***	**,045***	-,129	,116	,174	**-,280**	**,049***	,147
ZKPQ party and friends	-,073	,302	,302	-,043	,602	,602	-,196	,172	,172
ZKPQ isolation intolerance	-1,181	**,010***	**,030***	-,176	**,032***	,096	-,247	,083	,124
ZKPQ IMPULSIVITY	,327	**,000***	**,000***	,369	**,000***	**,000***	,249	,082	,123
ZKPQ impulsivity	,428	**,000***	**,000***	,443	**,000***	**,000***	,434	**,002***	**,006***
ZKPQ sensations search	,174	**,014***	**,014***	,222	**,006***	**,000***	,067	,642	,642
ZKPQ AGRESIVITY-HOSTILITY	,338	**,000***	–	,318	**,000***	–	,393	**,005***	–
ZKPQ INFREQUENCY	-,142	**,045***	–	-,042	**,613**	–	-,437	**,002***	–
Stai-State	,395	**,000***	**,000***	,391	**,000***	**,000***	,426	**,002***	**,002***
Stai-Feature	,484	**,000***	**,000***	,470	**,000***	**,000***	,544	**,000***	**,000***
Eva: Cocaine	,184	**,009***	–	,230	**,005***	–	-,032	,826	–
Eva: ALCOHOL	,313	**,000***	–	,283	**,000***	–	,430	**,002***	–
BDI	,454	**,000***	–	,450	**,000***	-	,393	**,019***	–

When significant differences exist between groups, they were signed in bold Font and (*). R: R Pearson correlation: unilateral signification. FDR: False Discovery Rate was calculated in those dependent variables with subscales.

are similar to those observed in men. This reveals the significance of early assessment and detection of this disorder in women. In this sense, significant sex-by-symptom interactions between diagnostic and treatment status for hyperactivity/impulsivity and behavior problems had already been described (52). One possible reason could be that drug use may affect the brain of men and women differently, and this could explain the higher impulsivity in women than in men (53) and the fact that in our sample levels were similar to those observed in men.

Gender differences were also observed in the accompanying psychopathology, because women with ADHD are more likely to present borderline personality disorder, which may account for the drug use. Men, on the other hand, have a greater risk of developing antisocial personality disorder associated with drug use (54). Similarities between genders have been found in ADHD with behavioral disorders, depression, bipolar disorder and schizophrenia, in which men and women have an increased risk of SUD. However, a reduced risk was found for men with autism spectrum disorder (30).

Finally, SUD in ADHD patients has been associated with symptoms of hyperactivity-impulsivity and emotional dysregulation. Self-medication for ADHD via drug use has been put forward as a potential explanation, and early diagnosis and treatment of ADHD have been suggested as a preventive strategy against drug use (31).

Considering the results from the ZKPQ, both genders present a similar direct association between impulsivity and neuroticism, sensation seeking, impulsivity and aggression-hostility, and an inverse association with work energy and infrequency. However, women with higher impulsivity presented lower sociability and activity participation, while in men the inverse association was found with isolation intolerance. Interpreting these differences is complex because there are very few studies that assess the gender differences for personality traits based on the presence of impulsivity. There are studies that have found an association between traits such as neuroticism and aggression-hostility with a greater severity of the addiction and the presence of psychotic symptoms (55, 56), and between impulsivity and ADHD (3). What seems evident is that the presence of impulsivity creates opposite effects: it decreases sociability and activity in women, which is associated to greater isolation, whereas in men it could be associated with lower isolation tolerance. This suggests that different approaches are required for each group.

Even though there is an increasing amount of evidence for the need to create specific adaptations to treatments depending on gender due to structural and neurochemical differences (45, 46, 57), to date, most treatment models for substance use disorder have been designed primarily for men, and they are mainly based on their symptoms and consumption patterns. Consequently, women with ADHD may be more easily missed in the ADHD diagnostic

process and treatment unless they have prominent externalizing problems (52). In this sense, being aware of the drug use patterns in women may be useful to detect dual pathologies earlier and to implement specific gender-based interventions aimed at providing adapted information and services that meet their needs in areas such as child rearing, domestic violence, sexual trauma and psychiatric comorbidities.

Our results allow us to draw some clinical implications, because psychoeducation could be used to understand the influence of ADHD and of impulsivity and isolation, as well as the role they play in cocaine and alcohol use. In addition, behavioral techniques could be implemented to approach delay of drug use, distress tolerance and emotion regulation (58). In women, this could improve the capacity to identify internal and external signals that appear before prior to the risk of impulsive behavior. That is, it would make it easier to know the role of impulsivity and sensation-seeking while providing therapeutic tools to manage these impulses in a wider therapeutic context.

With regard to limitations, our study was conducted in only one site, the University city of Salamanca; therefore, the sociodemographic and cultural characteristic of the population under study may not be generalizable to other places. However, women in studies such as this are often underrepresented given that, in clinical settings, the number of women is usually lower (3, 56). Also, we did not employ neurobiological investigations, such as neuroimaging, to establish the links between our findings and brain functions. Furthermore, we did not include patients with comorbid severe mental disorders, such as schizophrenia or bipolar disorder; thus, our work may need to be replicated with other, more severe, clinical groups. However, our study was carried out with a homogeneous clinical sample attending an outpatient clinic; therefore, the results are representative of routine, real-world clinical practice. In fact, our findings emphasize the consequences of having a diagnosis of ADHD for women also suffering from an addiction, and the importance of its early detection and treatment. Studies with focus on the causal mechanisms (and associated gender differences) between suffering ADHD and the development of alcohol and/or cocaine dependence are still warranted.

However, the study was conducted in a homogeneous sample of patients who are alcohol-dependent or alcohol- and cocaine-dependent in an outpatient treatment center, which means that data are representative of routine clinical practice. Consequently, the results are representative of the clinical activity in a real clinical setting. and could help to emphasize the relevance of ADHD in the severity of women suffering addiction and point out the relevance of including the early detection and its treatment in the clinical protocols.

We may conclude that there are differences regarding total impulsivity depending on the substance of addiction, with higher levels of impulsivity in the cocaine and alcohol group. A strong association was observed between ADHD and substance use disorders. Even though no gender differences were found for impulsivity, there are differences regarding the influence of ADHD on impulsivity, which is more relevant among women.

ASRS has a clearly higher explanatory power for impulsivity in the group of women who are drug users. In addition, some personality traits and craving seem to present different patterns depending on gender and impulsivity.

The relevance of ADHD in women is key to understand the presence of impulsivity and the complications associated with it, which means that it must be studied and explored systematically. In the future, follow-up studies should be conducted that include the relevance of and relationships between ADHD and gender and relapses among AUD and CUD in patients seeking treatment.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by ethical committee Salamanca University care complex. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

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Conflict of interest

CR has received fees to give lectures for Janssen-Cilag, MSD, Exceltis, Abbvie, Takeda, Casein-Recordati, Carnot, Angellini, Camurus, Esteve, Tecno Quimica and Viatris. He has received financial compensation for his participation as consultant or a board member of Lundbeck, Gilead, MSD, INDIVIOR, Exceltis, Camurus, Abbvie, Idorsia, Rovi and Recordati board. He has carried out the PROTEUS project, which was funded by a grant from Indivior and the COSTEDOPIA project, which was funded by INDIVIOR. He received two medical education grants by Gilead and medical writing support from Abbvie. BV-H has received fees to give lectures for Viatris. RFP-A has received speaker honorariums from Angelini, Casen Recordati, Exeltis, Lundbeck, MSD, Mundipharma, Rubió, Servier, and Takeda. LG-L has be received funded Research from Casen Recordati and has received fees to give lectures for Idorsia and Esteve, JP has been advisor for Lundbeck Ltd, Otsuka Pharmaceuticals UK, Recordati, Eli Lilly and co., AstraZeneca and F. Hoffmann-La Roche; and speaker for Lundbeck Ltd, Otsuka Pharmaceuticals UK, Eli Lilly and co., F. Hoffmann-La Roche, AstraZeneca and Janssen-Cilag, LA has received fees to give lectures for Casein-Recordati.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The author(s) declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

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Case Report: Cannabis and kratom-induced self-amputation of ears and penis

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This report describes the case of a 31-year-old male lumberjack with severe self-inflicted injuries, including the amputation of both auricles and the penis, under the influence of cannabinoids, mitragynine, and 7-hydroxymitragynine. Emergency surgery was performed, and psychiatric evaluation revealed substance-induced psychosis. The patient's motivation for reconstructive penile surgery led to abstinence from the substance use and cooperation with treatment. Five months after hospitalization, successful penile reconstruction was completed. The patient remained abstinent and was engaged in regular psychiatric follow-ups, showing no signs of acute psychopathology. This case underscores the importance of using a multidisciplinary approach to manage severe self-harm behaviors, and highlights the critical role of patient motivation in achieving positive outcomes.

KEYWORDS

case report, substance-induced psychosis, self-inflicted injuries, self-amputation, cannabinoids, kratom, psychotic episodes, paranoia

1 Introduction

Self-inflicted injuries are rare but severe manifestations of psychiatric and substance use disorders. These behaviors range from superficial cuts to more extreme forms including self-amputation of body parts. This case report describes a rare instance of self-inflicted ear and penile amputation in a 31-year-old man who was under the influence of multiple psychoactive substances, including cannabinoids, mitragynine, and 7-hydroxymitragynine.

Psychotic episodes induced by drug use may lead to severe self-harm including genital mutilation (1). These behaviors are often associated with psychosis, where individuals may experience delusions or hallucinations that drive them to harm themselves (2). The involvement of substances, such as mitragynine and 7-hydroxymitragynine, which are compounds found in kratom, adds a unique aspect to this case, highlighting the potential psychiatric risks associated with their use.

Self-harm involves deliberately causing harm to one's own body as a way to cope with overwhelming emotions or psychological pain. Common forms of self-harm include cutting, burning, scratching, or hitting oneself, although it can also manifest in more indirect behaviors such as reckless substance use or other high-risk activities. In psychiatry, self-harm often coexists with conditions like depression, borderline personality disorder, or acute stress reactions, and serves as a maladaptive coping mechanism for emotional regulation. Substance abuse can exacerbate the risk of self-harm by impairing judgment, increasing impulsivity, or intensifying emotional distress, thereby lowering the threshold for self-injurious behavior.

This case report was prepared according to the CARE Guidelines (3, 4). The report aims to provide a detailed account of the patient's presentation, clinical management, psychiatric evaluation, and follow-up, emphasizing the importance of recognizing and addressing the psychiatric dimensions of substance-induced psychosis and self-harm.

2 Case description

2.1 Patient information

The patient was a 31-year-old Caucasian man who was employed as a lumberjack. He presented with severe self-inflicted injuries, including the amputation of his penis and both auricles, multiple lacerations on his forearms, and frostbite on his feet and toes. The injuries were sustained under the influence of multiple psychoactive substances.

2.1.1 Medical history

The patient had a history of substance abuse, including regular consumption of approximately 1.5 L of beer every other day, daily marijuana use (approximately 1 g/day, which had been reduced to every other day over the preceding 2 years), and occasional use of methamphetamine and psilocybin mushrooms. He had previously experienced psychotic episodes associated with his substance abuse. The patient did not take any prescribed medications and was not being treated for any chronic conditions. He had recently been diagnosed with prediabetes.

The patient's first contact with alcohol occurred around the age of 15. He reports never consuming alcohol in the morning, but mentions episodes of short-term memory lapses ("blackouts") following hard liquor. He started using THC (cannabis) at about 17 years of age; currently, he states that over the past two years he has reduced his use to approximately one "joint" every other day,

primarily in the evening before bedtime (previously it could be one or two joints daily). He first tried methamphetamine (pervitin) at 19 but only on two or three occasions in total. He denies any intravenous use. He used hallucinogenic mushrooms (psilocybin) for the first time at 18, with an estimated total of about 10 episodes (most frequently in the fall). He also reports occasional use of other hallucinogens, such as LSD at music festivals, but cannot specify frequency or exact timing. He first tried kratom about a year ago and finds it difficult to specify how often he has used it. The patient acknowledges frequent combination of alcohol with other substances; due to recurring memory lapses, he often cannot be certain which substances he consumed or in what quantity.

For most substances (THC, hallucinogens, kratom), the patient describes oral or inhalation routes. He explicitly denies intravenous use (e.g., of methamphetamine). There is no record of formal, extended abstinence periods; the patient only mentions occasional "breaks" in cannabis and alcohol use in the past, without formal treatment or therapy.

Medical records indicate that the patient engaged in self-harm in the context of mixed intoxication (alcohol, cannabis, psilocybin) in 2018. He was hospitalized following an episode of aggressive outburst and self-harm behavior, Documentation from this hospitalization mentions, among other findings, vulnera scissa in the thoracic and abdominal wall regions, a frontal hematoma, and bite wounds to the lips and tongue.

During the aforementioned hospitalization, no florid psychotic symptoms persisted once acute intoxication resolved. Consequently, there was no specific psychiatric treatment for psychosis, and the patient was discharged without antipsychotic medication. No further specialized psychiatric treatment for drug-induced psychotic symptoms is noted in the available documentation.

The patient had his first more serious relationship in high school, followed by several long-term relationships in adulthood (lasting 4, 5, 3, and 0.5 years). The most recent relationship ended about a year ago due to long-distance issues. He reports first sexual intercourse around the age of 17.

2.1.2 Family history

Both the patient's parents had a history of nicotine dependence and alcohol abuse. No other notable family medical conditions were reported by the patient.

2.1.3 Psychiatric history

During this episode, the patient experienced significant psychomotor agitation and paranoid delusions. His emotional response to his injuries and situation was inappropriate, indicating a lack of interest in the treatment or consequences. Psychosocial examinations revealed low intellectual performance, impaired social judgment, and an inability to control emotions. He denied regular use of other substances but admitted to the recent use of multiple drugs.

The patient had been hospitalized previously because of aggressive behavior and self-harm associated with substance use. These interventions included psychiatric evaluation and treatment, which led to temporary stabilization. However, he had not

maintained long-term follow-up or adhered to any prescribed psychiatric or medical treatment, which resulted in recurrent episodes of substance-induced psychosis and self-harm.

2.2 Clinical findings

On admission, the patient underwent a comprehensive diagnostic assessment. Physical examination revealed severe self-inflicted injuries, including the amputation of both the auricles and penis, multiple lacerations on the forearms, and frostbite on the feet and toes. He was hemodynamically stable and exhibited no signs of acute distress other than the visible injuries. This self-inflicted injury occurred in January when it was freezing and temperatures reached minus 7 degrees Celsius, leading to frostbite of the lower extremities. We do not know the time interval after the patient was found after the automutilization, but apparently due to the freezing weather there was no massive bleeding and death. He was conscious, but displayed significant psychomotor agitation and paranoia. Despite cooperating during the physical examination, he lacked awareness of the severity of his injuries.

Initial laboratory tests were conducted to evaluate the patient's overall health status and detect any potential infections. Toxicological screening confirmed the presence of cannabinoids, mitragynine, 7-hydroxymitragynine, and other compounds. Imaging studies included computed tomography (CT) of the head and abdomen, which ruled out intracranial bleeding and intra-abdominal injuries, and indicated no acute abnormalities.

According to the available toxicological findings immunochemical testing of the urine detected the presence of cannabinoids as a group (without specifying the exact derivative). Subsequent mass spectrometry explicitly confirmed morphine, mitragynine, and 7-hydroxymitragynin, but it did not provide detailed quantification or identification of the specific cannabinoid. In standard toxicological practice, this typically indicates the detection of THC metabolites (especially 11-nor-9-carboxy-THC), although in this instance, the mass spectrometry did not specify which particular cannabinoid was found.

2.3 Diagnostic assessment and diagnosis

The patient underwent detailed psychiatric evaluation, which revealed significant psychomotor agitation and paranoia. He was cooperative during the examination but lacked awareness of the severity of his injuries. The results of the comprehensive psychological examination indicated low intellectual performance, impaired social judgment, and an inability to control emotions. The patient also displayed negative self-assessment and had difficulty identifying and fulfilling his own needs. He did not provide insights into his psychological or somatic state, or substance use.

As part of a comprehensive clinical evaluation, psychological screening was conducted using both standard observation and interview techniques as well as specific psychodiagnostic methods. The following tools were used: observation and clinical interview,

WAIS-III (Wechsler Adult Intelligence Scale, 3rd edition), ROCFT (Rey–Osterrieth Complex Figure Test), TMT (Trail Making Test), VF (Verbal Fluency), ROR (Rorschach Test), Baumtest (Tree Drawing Test) and Human Figure Drawing. All these instruments contributed to assessing the patient's cognitive performance, executive functions, emotional experience, and personality traits. Based on the findings, the patient demonstrates below-average intellectual performance (not reaching the threshold of mental retardation), impaired social judgment, and reduced verbal and mental flexibility. Although there are no signs of a florid psychotic disorder, discrete perceptual and thought disturbances, difficulties with affect control, and a lack of insight into both his substance use and current psychological state are evident. A sexological evaluation was performed, during which the patient expressed acceptance of his condition and identified himself firmly as a male with no desire to change gender. He reported several long-term relationships with women and denied any homosexual encounters, although he acknowledged the difficulty of remembering all past experiences.

The differential diagnosis was substance-induced psychosis, given the patient's history of substance abuse and the presence of multiple psychoactive substances. A diagnosis of F19.5 psychotic disorder owing to multiple substance use was established. This was supported by the temporal relationship between substance use and the onset of psychotic symptoms as well as the patient's history of similar episodes. At the age of 24, the patient had experienced a similar episode in which he became aggressive and self-harmed by cutting his chest after using alcohol, marijuana, and psilocybin mushrooms. The psychotic symptoms had resolved after detoxification, and the patient was discharged after several days.

Primary psychotic disorders, such as schizophrenia, were also considered but deemed less likely due to the temporal relationship between the substance use and the onset of psychotic symptoms. Organic causes were ruled out on the basis of negative CT imaging results and normal laboratory findings. Given the history of substance abuse, the diagnosis of an acute psychotic disorder (F23.x) was also considered, but was less likely. However, the patient's sensitivity to the development of psychotic processes indicated a potential risk of future schizophrenic spectrum disorders if substance use continued.

The ultimate primary diagnosis was substance-induced psychosis with severe self-harm. It was supported by the patient's history of similar episodes of substance use. Prognostically, patient recovery depends on their ability to abstain from substance use, adhere to psychiatric follow-up, and undergo successful surgical and rehabilitative interventions for their physical injuries.

2.4 Patient case timeline

The patient case timeline is presented in Table 1. The patient was hospitalized for a total of 31 days, broken down as follows: 2 days in the urology department and 29 days in the psychiatric ward (including 12 days in a psychiatric detox bed – ICU). The entire hospitalization was involuntary and was reported to the court in accordance with the relevant legal framework.

Day	Event
0	Self-inflicted injuries (amputation of penis, auricles, forearm lacerations)
1	Admitted to the emergency department in Most
1	Epicystostomy, revision of penile stump and auricle amputation defects
1	Psychiatric consultation - diagnosed with psychosis
1	Involuntarily transferred to Psychiatric Clinic
16	Underwent sexological and psychological evaluations
19	Subsidence of psychosis symptoms, voluntary admission, increased cooperation
21	Consultation with a plastic surgeon
28	Discharged for regular outpatient psychiatric care
71	Outpatient consultation with plastic surgeon
151	Admitted for penile reconstructive surgery
170	Discharged post-surgery

2.5 Therapeutic interventions

On admission, emergency surgery was performed to manage the amputation of the penis and both auricles. The procedure included hemostasis and wound debridement. Because the amputated parts were not recovered, replantation was not possible. Broad-spectrum antibiotics were administered to prevent infection, analgesics were administered for pain management, and sedatives were used to control psychomotor agitation and paranoia.

Detailed psychiatric evaluation revealed significant psychomotor agitation and paranoia. Treatment with olanzapine (10 mg/day) was initiated to manage the psychotic symptoms and diazepam (5 mg as needed, up to 30 mg/day) for the anxiety and agitation. Owing to the patient's psychotic behavior, initial sedation with standard doses was insufficient. The olanzapine dosage was consequently increased to 15 mg/day, and the diazepam dosage was adjusted to ensure adequate sedation and psychotic symptom control.

During the hospital stay, the patient developed frostbite on his feet and toes. Conservative management, including wound care and monitoring for signs of infection or necrosis, was performed. The patient's psychiatric medications were regularly reviewed and adjusted based on his response to treatment, leading to gradual stabilization of his mental state. The patient was presented to a plastic surgeon and informed of the possibility of surgical penile and auricular reconstruction. However, reconstruction was contingent on patient cooperation and full abstinence from substance use.

A mental capacity assessment was conducted. This evaluation included a comprehensive psychological examination using the WAIS-III scale, which indicated that the patient's current intellectual performance is in the below-average range (with no signs of mental retardation). The individual indices (Verbal Comprehension, Perceptual Organization, Working Memory) also fall within the below-average range, while only Processing Speed lies on the borderline between average and below average.

Moreover, the patient exhibits significantly impaired social judgment, limited knowledge of common behavioral norms, and reduced judgment in practical social situations. The weighted scores across both verbal and performance subtests predominantly fall into the below-average range. Based on these findings, the patient demonstrates reduced cognitive abilities in several areas, which may affect his capacity to adequately assess his actions and make decisions; however, a formal conclusion regarding legal capacity would require a comprehensive evaluation and potential further legal assessment by the court.

2.6 Follow-up and outcomes

Throughout the patient's hospital stay and subsequent follow-up, both clinician- and patient-assessed outcomes were closely monitored. The patient's physical condition, including the surgical sites for the amputations and frostbite on the feet and toes, was regularly evaluated for signs of infection and healing progress. Psychiatric evaluations were conducted to manage the psychomotor agitation and paranoia, leading to necessary medication adjustments.

The patient was initially compliant with treatment using olanzapine and diazepam, which helped stabilize his psychiatric symptoms. However, he refused institutional treatment for substance abuse, thus minimizing its significance. Despite the resolution of psychotic symptoms, he did not gain complete insight into his condition. He was discharged on the 29th day of psychiatric hospitalization with an outpatient follow-up plan.

Five months after the initial hospitalization, the patient underwent reconstructive penile surgery. He was highly motivated and involved in the planning of the surgery; he showed a strong desire for reconstruction and cooperated closely with the medical team. During his hospital stay, a psychiatrist assessed his mental state. The patient denied the use of any addictive substances, as proven by blood tests and reported no psychological issues. He stated that he had adhered to his medication regimen after discharge and had only recently discontinued antipsychotics. He also mentioned that he regularly attended psychiatric check-ups to regain his driver's license. The patient showed no signs of acute psychopathology.

Given the patient's refusal to undergo substance abuse treatment and psychiatric follow-up, a coordinated approach involving social services and outpatient psychiatric care was recommended to support his post-discharge transition. The patient was informed of the critical importance of adhering to the medical and psychiatric advice to prevent the recurrence of severe psychotic episodes and self-harm.

The available information suggests that abstinence began after the patient's discharge into outpatient psychiatric care; however, the exact date and the duration of abstinence are not precisely documented. During this period, abstinence was monitored primarily through clinical examination, the patient's own reports, and bedside saliva screening tests. There is no specific data regarding any blood test that may have been used; therefore, it is

not possible to state which particular blood screening test was employed in this case.

The patient was offered psychosocial support by the local community mental health center team, which he declined, as well as recommended outpatient addiction treatment, which he also refused. Currently, he only attends appointments with an outpatient psychiatrist.

3 Patient perspective

"Looking back on that night, in January 2024, I felt completely overwhelmed and acted on a sudden urge to hurt myself. I ended up severely injuring myself by cutting off parts of my body. The next thing I remember is being rushed to the hospital, where doctors performed several procedures to treat my injuries. Later, I was told that I had experienced a psychotic episode and was moved to a psychiatric clinic. The first few days were a blur of medical tests and assessments. Gradually, with the help of the medical team, I began to feel more connected to reality. By early February, I started feeling better and agreed to participate in my treatment. This included meetings with a plastic surgeon and receiving regular psychiatric care. Before my reconstructive surgery in June, I struggled with epicystostomies. This made it impossible for me to work in the forest, and I lost my job because of it. The surgery was a major step in my recovery. Now I'm out of hospital and getting regular outpatient care. I have also decided to stop using drugs, as I know they contributed to my breakdown. I'm working on getting my driver's license back so that I can regain my independence and function better in daily life. I feel more hopeful and committed to my mental health journey."

4 Discussion

This case report illustrates the complex interplay between substance-induced psychosis and severe self-harming behaviors, highlighting the necessity for a multidisciplinary approach to both acute and long-term management. A significant strength of this case was the rapid and coordinated surgical intervention to manage the severe self-inflicted injuries and prevent life-threatening complications. Comprehensive psychiatric and psychological evaluations provided critical insights into the patient's mental state and guided subsequent treatment. However, a major limitation was the patient's refusal to engage in substance abuse treatment and non-compliance with psychiatric follow-up, which significantly affected his prognosis.

The use of psychoactive substances has increased significantly worldwide. New substances emerge almost daily, contributing to a broader spectrum of behavioral disorders and acute psychopathology than traditional drugs. With the development of designer and synthetic drugs, an increase in problems associated with their abuse can be anticipated (5).

Substance-induced psychosis leading to self-mutilation has been well documented. Khan et al. (6) presented a case of self-amputation of the penis owing to cannabis-induced psychosis, highlighting the severe self-harming behaviors associated with substance use disorders. Jones (7) reported cases of self-enucleation in patients with drug-induced psychosis and schizophrenia, underscoring the psychiatric complexities involved. Other notable cases include a report on radical facial self-mutilation, by Scheftel et al. (8), which highlighted unprecedented self-harming behaviors. Coons et al. (9) documented the self-amputation of the female breast, demonstrating the severity of self-inflicted injuries in psychotic patients.

The case reported by Koops and Püschel (10) involved a patient with paranoid-hallucinatory schizophrenia who self-amputated both auricles and the glans of the penis and ingested the amputated parts. This is the only other published case in which both the auricles and the penis were amputated. In this case, the patient consumed the amputated parts, and the injury led to severe blood loss and death. The auricles and penis are highly vascularized, making these injuries life-threatening, owing to potentially significant blood loss. Fortunately, our patient survived, probably because of vasoconstriction from the cold, and timely medical intervention.

The primary diagnosis of substance-induced psychosis was supported by the temporal relationship between the substance use and the onset of psychotic symptoms, as well as the patient's history of similar episodes. Refusal to engage in substance abuse treatment and psychiatric follow-up posed significant challenges, highlighting the need for a more integrated approach involving social services and continuous psychiatric care. Interestingly, the possibility of penile reconstruction and the aim of regaining a driver's license served as strong motivations for the patient to maintain abstinence during the follow-up period. His intense involvement and cooperation in the planning of the reconstructive surgery contributed significantly to the positive outcome, demonstrating that patient motivation could be a critical factor in treatment success.

Cannabis, particularly in high-THC formulations, can contribute to acute psychosis through dysregulation of dopaminergic signaling in brain regions associated with reward and cognition (e.g., the mesolimbic pathway). Tetrahydrocannabinol (THC) acts as a partial agonist at cannabinoid CB1 receptors, which can secondarily increase dopaminergic release, potentially exacerbating paranoid thinking, delusional ideation, and risk of self-harm in susceptible individuals. This effect is further influenced by genetic predispositions, baseline mental health status, and environmental stressors (11).

Kratom's primary alkaloids—mitragynine and 7-hydroxy-mitragynine—exhibit partial agonism at μ-opioid receptors and may modulate other neurotransmitter systems (e.g., adrenergic, dopaminergic). In higher doses or in individuals with certain vulnerabilities, the resulting neurochemical imbalance can provoke mood dysregulation, impaired judgment, and—in rare cases—acute psychotic features. Although psychotic reactions to kratom are less well-characterized than those to cannabis, potential mechanisms include opioid receptor-mediated changes in dopamine turnover and heightened stress responses, creating a fertile ground for hallucinations, delusional thinking, and self-harm behaviors (12).

Precise data on acute psychosis or delusional states specifically leading to self-harm after cannabis or kratom use are lacking. For

cannabis, some registries estimate around 1–5 cases of acute psychosis per 100,000 population per year, but direct links to self-harm within these episodes remain unclear. For kratom, robust incidence rates do not exist due to scarce epidemiological research and reliance on isolated case reports (13).

Emerging evidence underscores that while acute psychosis and self-harm can occur with either substance, no clear, universally accepted incidence rate exists due to methodological limitations and a lack of large-scale prospective studies. As a result, clinicians and public health professionals typically rely on case reports, smaller observational studies, and anecdotal evidence when assessing risk. (14)

Continuous follow-ups and adherence to psychiatric treatment are essential to prevent the recurrence of psychotic episodes and ensure long-term recovery. The control of substance abuse is crucial for the management of substance-induced psychosis in order to reduce the risk of severe self-harming behaviors.

5 Conclusion

This case highlights the severe implications of substance-induced psychosis, including extreme self-harm behaviors such as self-amputation of the auricles and penis. The successful management of this patient underscores the need for a multidisciplinary approach involving surgical, psychiatric, and psychological interventions. The patient's strong motivation for penile reconstruction played a pivotal role in his adherence to treatment and abstinence from substance use, ultimately contributing to positive outcomes. Continuous follow-up and comprehensive care are essential to address the psychiatric and substance abuse dimensions of such complex cases, ensure long-term recovery, and prevent recurrence.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

Ethics statement

Written informed consent was obtained from the participant/patient(s) for the publication of this case report.

Author contributions

MB: Investigation, Methodology, Project administration, Supervision, Validation, Writing – original draft, Writing – review & editing. XR: Investigation, Writing – review & editing. AB: Data curation, Investigation, Project administration, Visualization, Writing – review & editing, Writing – original draft. JK: Investigation, Writing – review & editing. DK: Investigation, Writing – review & editing. ZS: Investigation, Writing – review & editing. JA: Investigation, Methodology, Supervision, Validation, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that this study was conducted in the absence of any commercial or financial relationships that could be construed as potential conflicts of interest.

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Check for updates

Classification of intrusive thought patterns based on differences in the mechanisms of occurrence and persistence

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Introduction: Intrusive thoughts occurring independently of intention are symptoms of obsessive-compulsive disorders (OCD). However, they also appear in various other disorders, including substance use disorders, depression, post-traumatic stress disorder, and anxiety disorders, as well as in healthy individuals. Despite this, the diversity of intrusive thoughts remains largely unexplored. In this study, we aimed to (1) classify the factors causing intrusive thoughts as identified in previous research and (2) elucidate differences in the psychological states of intrusive thoughts.

Methods: We investigated 298 participants over 20 years old using a questionnaire that includes scales such as "obsessive-compulsive belief," "stress responses," "thought suppression," and "evaluation of intrusive thoughts." To analyze data, we applied co-clustering, a machine-learning technique, to the data obtained from the investigation.

Results: We identified three factors that affect the occurrence of intrusive thoughts: "Negative Evaluation of Intrusive Thoughts," "Stress Responses," and "Excessive Control of Intrusive Thoughts." Furthermore, based on the scoring patterns of these three factors, participants were classified into five subtypes characterized by their degree of OCD tendencies. Further analysis revealed that the three factors could not be explained by OCD tendencies. Additionally, it was found that the five subtypes employed different coping strategies.

Discussion: These findings suggest that intrusive thoughts cannot be fully explained solely by the degree of OCD tendencies, which could provide valuable insights into cognitive-behavioral support targeting the various psychological states associated with intrusive thoughts.

1 Introduction

Intrusive thoughts are defined as "thoughts that arise independently of intention and are difficult to control (1)". These have mainly been recognized as a feature of obsessive-compulsive disorder (OCD). Nevertheless, it is also observed in various other disorders, including substance use disorders, depression, post-traumatic stress disorder, and anxiety disorders (2, 3). Furthermore, intrusive thoughts are commonly seen even in healthy individuals (4–7). Given this, examining why intrusive thoughts are broadly observed across diverse populations, including healthy individuals and patients with disorders other than OCD, could prove beneficial in treating OCD, which can be treatment-resistant and is known to co-occur with various other disorders. However, as previous research has largely focused on their relationship with OCD, there is still an insufficient understanding of these questions.

Generally, when a symptom is observed in a wide range of populations, it is essential to assume that diverse factors contribute to its occurrence and persistence. In this context, the cognitive-behavioral theory provides a valuable perspective. Based on this theory, intrusive thoughts are presumed to occur and are maintained by irrational cognitions and maladaptive behaviors and are exacerbated through interactions with environmental factors, such as stress (8–10). Within this framework, cognitive factors, such as "cognitive beliefs," "cognitive evaluations," and "thought suppression," as well as environmental factors such as "stress states," have been implicated in the occurrence of intrusive thoughts, alongside everyday behavioral factors such as "stress-coping strategies," which are not necessarily specific to OCD (11–17). For example, a positive correlation exists between the occurrence of intrusive thoughts and stress. It has been suggested that a complex process underlies this relationship, in which increased stress triggers thought suppression and inhibits cognitive reappraisal (17). However, cognitive evaluation of events can also trigger stress responses. For instance, presumably having a complex causal relationship: evaluating intrusive thoughts as ego-dystonic can increase stress, and coping strategies for alleviating stress can lead to compulsive behaviors (11, 12).

Drawing from this evidence, clearly the mechanisms underlying intrusive thoughts are quite complex and their occurrence is not attributed to a single cause but rather to an interaction of various factors. Further, how these factors maintain intrusive thoughts in everyday contexts needs to be investigated. Although approaches that focus on the characteristics of intrusive thoughts within individual disorders acknowledge their presence across different conditions, they do not fully capture the interrelated factors that contribute to the occurrence and persistence of these thoughts (18). Consequently, there has been insufficient insight into why intrusive thoughts are observed across various populations beyond OCD.

Here, we attempted to gain a deeper understanding of the diversity of intrusive thoughts by investigating how the combination of factors, as examined within cognitive-behavioral theory, contributes to their occurrence and persistence of intrusive thoughts. To that end, we conducted a questionnaire-based analog survey targeting healthy individuals and analyzed the data using a data-driven method called co-clustering (19). Unlike traditional clustering methods (single-sided clustering), co-clustering can simultaneously classify both the similarity of the participants and the scales. For instance, when considering the relationship between the factors related to intrusive thought occurrence (i.e., obsessive beliefs, thought suppression, and stress responses), traditional clustering classifies participants based on the similarity of their scores. In contrast, co-clustering categorizes not only the participants, but also the factors contributing to the occurrence of intrusive thoughts. This approach also allows factors to be classified, such as obsessions occurring with thought suppression but not with stress, and participants are categorized into multiple subtypes based on the scoring patterns of these factors. That is, co-clustering allows for the exploration of which participant subtypes (participant clusters) have high scores for which factors influence the occurrence of intrusive thoughts (scale cluster)," while considering the relationships between these two factors.

In this study, we aimed to (1) clarify the differences among participant subtypes associated with intrusive thoughts by examining the complex co-occurrence relationships among the factors influencing the occurrence of intrusive thoughts according to cognitive-behavioral theories. Furthermore (2), we seek to elucidate the differences in factors that contribute to maintaining intrusive thoughts in each identified participant subtype, which will shed light on the varying adaptive strategies used in everyday

contexts. Finally (3), by investigating the relationships among the factors associated with intrusive thoughts, participant subtypes, and obsessive-compulsive tendencies, we aimed to determine which aspects of intrusive thoughts show continuity with OCD. This study will provide further insights into the diversity of intrusive thoughts, which cannot be fully explained by OCD. Using co-clustering, we can effectively distinguish unique factors shared across participants and those that are individual-specific, thereby providing a structured framework for understanding the complex interactions underlying intrusive thoughts. This approach overcomes limitations in previous studies that either focus solely on relationships between factors (i.e., scale clusters only) or describe them exclusively by individual disorders (i.e., participant subtypes only). Consequently, this will provide foundational knowledge for developing support tailored to specific psychological states associated with intrusive thoughts.

2 Materials and methods

2.1 Scale selection

To provide an overview of the mechanisms underlying intrusive thoughts, we conducted a literature search using various databases and the search terms "Intrusive thought" AND "Obsessive-Compulsive Disorder OR Obsession OR OCD". This search yielded 58 articles from Web of Science and an additional six articles from CiNii, a Japanese literature search engine (as of June 2018). From these articles, 31 scales related to intrusive thoughts were extracted from 42 studies (Supplementary Figures 1, 2). Following discussions between the first and second authors, who are both licensed clinical psychologists, these scales were categorized into six conceptual categories: "obsessive beliefs," "stress states," "thought suppression," "evaluation of intrusive thoughts," "coping strategies," and "obsessive-compulsive tendencies" (see Supplementary Figures 1, 2). We examined the relationship between these six concepts using the Japanese measures described in the following sections.

2.2 Measures

2.2.1 Obsessive beliefs

The Japanese version of the Obsessive Beliefs Questionnaire-44 (OBQ-44) was used (20). The OBQ-44 consists of three factors: "responsibility/threat estimation," "perfectionism/certainty," and "importance/control of thoughts," comprising 44 items. Each item is rated on a seven-point Likert scale.

2.2.2 Stress states

The Psychological Stress Response Scale (SRS-18) was used (21). The SRS-18 includes three factors: "depression/anxiety," "irritability/anger," and "hopelessness," comprising 18 items in total. Participants rated each item on a four-point scale based on their feelings or behaviors over the past 2–3 days.

2.2.3 Thought suppression

The Japanese version of the White Bear Suppression Inventory (WBSI) was used (1). The WBSI includes three factors: "thought suppression," "unwanted intrusive thoughts," and "self-distraction," comprising 15 items in total. Participants rated the extent to which each item was applied on a five-point scale.

2.2.4 Evaluation of intrusive thoughts

The Japanese Version of the Ego Dystonicity Questionnaire (EDQ-J) was used (22). The EDQ-J includes four factors: "irrationality," "inconsistency with morals," "implications of thought for personality," and "repugnance," comprising 16 items in total. Participants rated the extent to which each item applied to their recent experiences with intrusive thoughts on a six-point scale.

2.2.5 Coping strategies

Coping strategies were assessed using the Tri-axial Coping Scale 24 (TAC-24) (23). The TAC-24 consists of eight factors: "getting information," "giving up," "evading one's responsibility," "plan drafting," "positive interpretation," "avoidance-like thinking," "distractive recreation," and "catharsis," comprising 24 items in total. Participants rated the applicability of each item to their experiences in difficult situations on a five-point scale.

2.2.6 Obsessive-compulsive tendencies

The Japanese version of the Maudsley Obsessive-Compulsive Inventory was used (24). The MOCI includes four factors: "checking," "cleanliness," "indecisiveness," and "doubt," comprising 30 items in total. Each item is rated on a three-point scale, based on the extent to which it is representative of typical thoughts and feelings.

2.3 Sample and procedure

A cross-sectional online survey was conducted among 302 participants aged 20 years and older through Rakuten Insight Inc. The questionnaire included free-text responses describing recent intrusive thoughts as well as standardized scales such as the OBQ-44, SRS-18, WBSI, EDQ-J, MOCI, and TAC-24. Participants were informed that their responses would remain anonymous and that their participation would be voluntary. Participants were instructed to respond only if they agreed to participate. Of the 302 participants, four who did not provide free-text responses were excluded, resulting in a final sample of 298 individuals (159 men and 139 women, with a mean age of 44.4 years ± 12.0). This study was approved by the Ethics Committee on Research with Humans as Subjects at Waseda University (Approval No. 2018-107).

2.4 Analytical procedure

Standard subscale scores were calculated for (1) obsessive beliefs (OBQ-44) (2), stress states (SRS-18) (3), thought suppression (WBSI), and (4) evaluation of intrusive thoughts (EDQ-J). Co-
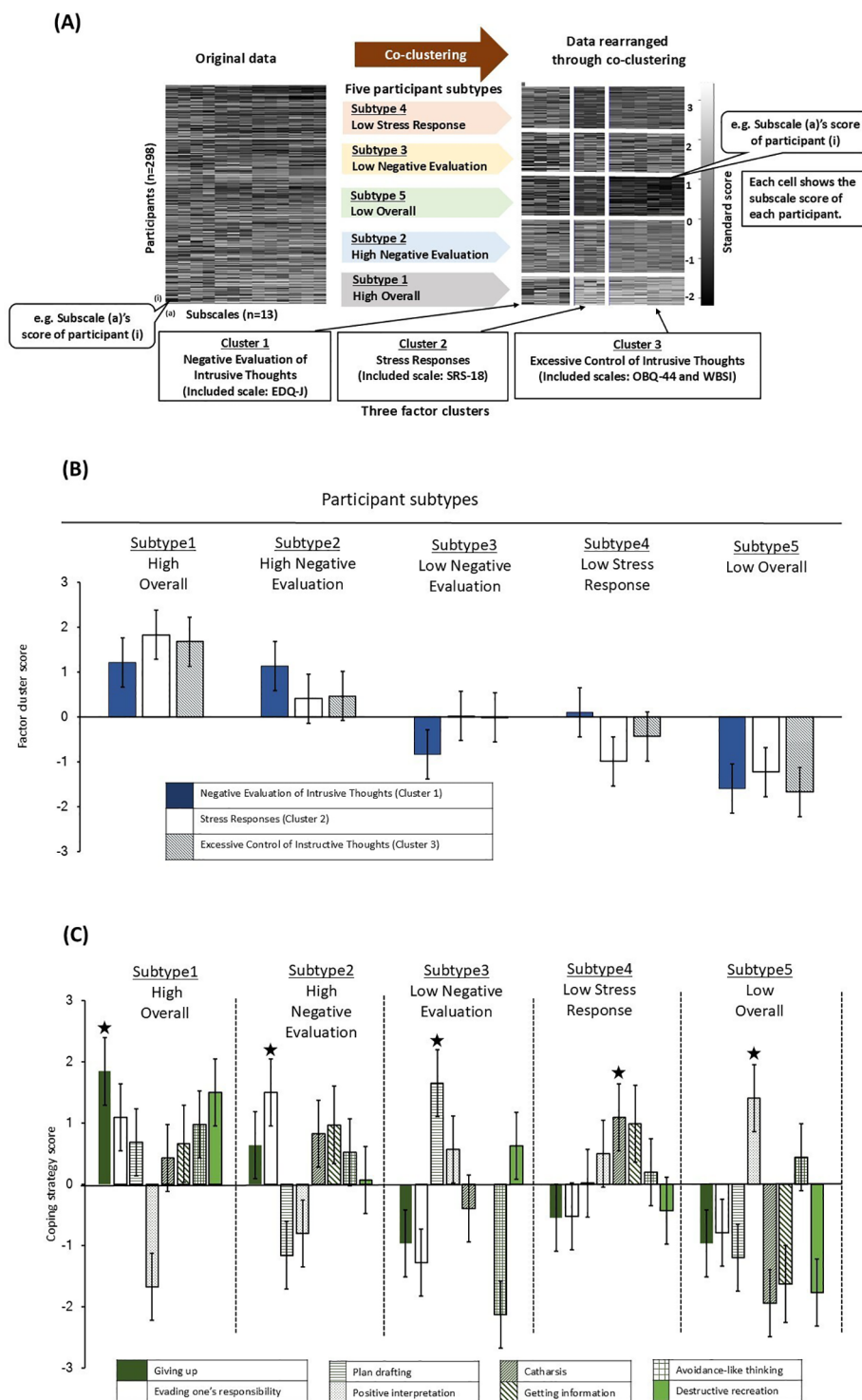
FIGURE 1
Co-clustering results and characteristics of each participant subtype. **(A)** Comparison of data distribution between original data and processed data by co-clustering. In raw data and data processed through co-clustering, each cell indicates the questionnaire standard score, with white and black color gradients indicating higher and lower scores (i.e., 3 − -2), respectively. In the data processed through co-clustering, rows indicate five subject subtypes and columns indicate three factorial clusters. 1) - 3) indicate cluster 1 − 3 and their titles, which we assigned what is represented; parentheses indicate subject scales used to categorize clusters. **(B)** Factor cluster scores of clusters 1 − 3 in five participant subtypes. Factor cluster scores regarding Cluster 1 − 3 (bar patterns corresponding to these clusters shown under the bar graph) in the indicated five subject subtypes are shown as bar graphs. Data are shown as mean values and vertical lines in the bars represent standard errors. **(C)** Coping strategy scores of five participant subtypes. We analyzed coping strategies used in the indicated five subject subtypes. Eight coping strategies corresponding to bar patterns are shown in the tables under bar graphs. Data are shown as mean values and vertical lines in the bars represent standard errors. (★) indicates the coping strategy with the highest score in each subject subtypes.

clustering was then applied to classify the co-occurrence relationships among the factors contributing to intrusive thoughts and to categorize them into different participant subtypes.

Co-clustering is a method that enables the simultaneous clustering of both rows and columns in data represented in matrix form while considering their relationships. For example, in the data obtained in this study, the columns represent participants, the rows represent scales, and each score in the matrix indicates the score of each participant on each scale (Figure 1A, left). In this way, it was possible to classify both the "co-occurrence relationships of intrusive thought factors (scale clusters)" and "participant state classifications (participant subtypes)" simultaneously, while considering their interrelations (Figure 1A, right). In this study, up to seven classifications for scale clusters and up to seven classifications for participant subtypes—resulting in a maximum of 49 data classifications—were permitted for co-clustering. Integrated Complete-data Likelihood (ICL) value was chosen as an indicator of goodness of fit for the co-clustering. The classification pattern with the highest ICL value was selected and interpreted (Supplementary Figure 3). However, classification patterns with fewer than 40 participants in any subtype were excluded for interpretability and their ICL values were not calculated. The choice of seven as the maximum number of classifications for both scales and participants was based on the fact that the goodness of fit for co-clustering tends to be higher when the classification aligns closely with the original data structure. Therefore, an upper limit was established in advance.

To understand the characteristics of each participant subtype, comparisons of the scores for the factors contributing to intrusive thoughts (scale cluster scores) (5), factors maintaining intrusive thoughts (TAC-24), and (6) obsessive-compulsive tendencies (MOCI) were conducted among participant subtypes using a one-way Analysis of Variance (ANOVA) followed by *post-hoc* comparisons. Additionally, one-sample t-tests were used to compare the scale cluster scores for factors contributing to intrusive thoughts across participant subtypes against the overall sample means. Bonferroni correction was applied to adjust p-values for multiple comparisons. The significance level was set at 5% and the trend significance level was set at 10% (25). Analyses were conducted using R (version 3.5.1), specifically employing the block-cluster package for co-clustering.

3 Results

3.1 Results of co-clustering

Standard scores for the subscales of participants' obsessive beliefs (OBQ-44), stress state (SRS-18), thought suppression (WBSI), and evaluation of intrusive thoughts (EDQ-J) were calculated and co-clustering was performed. The scales were categorized into three clusters, and the participants were classified into five subtypes (Figure 1A; ICL value = -1163.3, pseudo-likelihood = -1025.4).

TABLE 1 Subscales included in each cluster.

Cluster	Scales included in the cluster	Subscales included in the cluster
[Cluster 1] Negative evaluation of intrusive thoughts	Evaluation of intrusive thoughts (EDQ-J)	"irrationality" "inconsistency with morals" "implications of thought for personality" "repugnance"
[Cluster 2] Stress response	Stress state (SRS-18)	"depression/anxiety" "irritability/ anger" "hopelessness"
[Cluster3] Excessive control of intrusive thoughts	Obsessive beliefs (OBQ-44) and thought suppression (WBSI)	"responsibility/threat estimation" (OBQ-44) "perfectionism/certainty" (OBQ-44) "importance/control of thoughts" (OBQ-44) "thought suppression" (WBSI) "unwanted intrusive thoughts" (WBSI) "self-distraction" (WBSI)

3.2 Interpretation of the classified factors of intrusive thoughts

An overview of the clusters obtained from co-clustering (Figure 1A, right) reveals that Cluster 1 includes the subscales of evaluation of intrusive thoughts (EDQ-J), Cluster 2 comprises subscales of stress state (SRS-18), and Cluster 3 contains the subscales of obsessive beliefs (OBQ-44) and thought suppression (WBSI) (Table 1). These results indicate that three distinct co-occurrence relationships regarding causative factors contribute to intrusive thoughts. Accordingly, Cluster 1 was named "Negative Evaluation of Intrusive Thoughts," Cluster 2 as "Stress Responses," and Cluster 3 as "Excessive Control of Intrusive Thoughts" as it appears to be related to the control of intrusive thoughts.

3.3 Interpretation of the participant state classifications (participant subtypes)

3.3.1 Differences in factors contributing to each participant subtypes

Participants were classified into five subtypes based on the differences in scoring patterns among the three clusters (Figure 1A, right). An overview of the results for each participant subtype, based on a series of statistical significance tests conducted in this study, is presented in Table 2.

To understand the characteristics of each subtype, one-sample t-tests were conducted to examine how each subtype's scale cluster scores deviated from the overall mean value of the sample (Figure 1B). The results indicated that participants in Subtype 3 had significantly lower scores only in the "Negative Evaluation of Intrusive Thoughts" (t (76) = 6.12, p <.05), while Subtype 4 exhibited lower scores in both "Stress Responses" (t (65) = -13.26, p <.001) and "Excessive Control of Intrusive Thoughts" (t (65) = -7.79, p <.001) compared to the overall sample mean value.

TABLE 2 High/low/medium classification and coping strategies with the highest use scores among five participant subtypes.

	Items	Subject subtypes				
		Subtype 1 High Overall (n = 40)	Subtype 2 High Negative Evaluation (n = 77)	Subtype 3 Low Negative Evaluation (n = 59)	Subtype 4 Low Stress Response (n = 66)	Subtype 5 Low Overall Group (n = 56)
High/low/ medium classification	Obsessive-compulsive tendencies	high	middle	middle	middle	low
	Negative evaluation of intrusive thoughts (Cluster 1)	high	high	low	middle	low
	Stress response (Cluster 2)	high	middle	middle	low	low
	Excessive control of intrusive thoughts (Cluster 3)	high	middle	middle	middle	low
	Coping strategies with the highest use scores	Giving up	Evading one's responsibility	Plan drafting	Catharsis	Positive interpretation

Light gray (High) – high obsessive-compulsive tendencies, negative evaluation, stress responses, or control; Dark gray (Middle) – moderate level; No shading (Low) – low level.

Subtypes 1 and 2 exhibited scores across all scale clusters that were higher than the overall mean value, whereas Subtype 5 demonstrated consistently lower scores than the mean value across all clusters (all ps <.001).

For further interpretation, scale cluster scores among subtypes were compared (Figure 1B). Significant main effects of subtype were observed for all scale cluster scores (Table 3, Figure 1B; "Negative Evaluation of Intrusive Thoughts," F (4, 293) = 15.15, p <.001; "Stress Responses," F (4, 293) = 109.3, p <.001; "Excessive Control of Intrusive Thoughts," F (4, 293) = 251.5, p <.001). *Post-hoc* multiple comparisons revealed significant differences in "Negative Evaluation of Intrusive Thoughts" scores between Subtypes 1 and 3, 1 and 5, 2 and 3, 2 and 5, and 4 and 5 (all ps <.001), with an inversion observed in scores between Subtypes 3 and 4. Conversely, "Stress Responses" showed significant differences between Subtypes 2 and 3, and between 4 and 5, but not among the other subtypes (p (Subtype2-3) = .050, p(Subtype4-5) = .487, all other ps <.001), while significant differences were noted for "Excessive Control of Intrusive Thoughts," across all subtypes (p(Subtype3-4) <.05, all other ps <.001), with no inversions in scores (Table 3).

Consequently, regarding the three factors contributing to intrusive thoughts (i.e., "Negative Evaluation of Intrusive Thoughts," "Stress Responses," and "Excessive Control of Intrusive Thoughts"), Subtype 1 exhibited high scores across all measures, Subtype 2 had high scores only in "Negative Evaluation of Intrusive Thoughts," Subtype 3 showed low scores only in "Negative Evaluation of Intrusive Thoughts," Subtype 4 had low scores only in "Stress Responses," and Subtype 5 had low scores across all measures (Figure 1B). Based on these scoring patterns, the subtypes were labeled as "High Overall Group" (Subtype 1),

"High Negative Evaluation Group" (Subtype 2), "Low Negative Evaluation Group" (Subtype 3), "Low Stress Response Group" (Subtype 4), and "Low Overall Group" (Subtype 5).

3.3.2 Differences in maintaining factors among participants state classifications (participant subtypes)

Next, we examined the daily stress-coping strategies for each participant subtype. A distinctive result was observed: the highest-scoring coping strategy varied across participant subtypes. Specifically, the "High Overall Group" (Subtype 1) utilized "giving up," the "High Negative Evaluation Group" (Subtype 2) relied on "evading one's responsibility," the "Low Negative Evaluation Group" (Subtype 3) favored "plan drafting," the "Low Stress Response Group" (Subtype 4) used "catharsis," and the "Low Overall Group" (Subtype 5) used "positive interpretation" as their most effective coping strategy (marked with ★ in Figure 1C).

Further investigation showed that significant main effects were observed for "getting information," "giving up," "evading one's responsibility," and "positive interpretation," while a trend toward significance was observed for "catharsis." Specifically, the "High Overall Group" demonstrated significantly higher scores for "giving up." The "High Negative Evaluation Group" exhibited a significantly higher score for "evading one's responsibility," The "Low Negative Evaluation Group" displayed significantly higher scores for "catharsis." and the "Low Overall Group" showed significantly higher scores for "positive interpretation" compared to at least one other participant subtypes (Table 3). However, no significant trend was observed for "planning" within the "Low Negative Evaluation Group," when compared to the other participant subtypes (Table 3).

TABLE 3 Comparison of cluster and coping strategy scores among five subject subtypes.

		Subtype 1	Subtype 2	Subtype 3	Subtype 4	Subtype 5	Main effects of groups	Multiple comparisons
		Mean values (SD)						
Cluster score	Obsessive-compulsive tendencies	75.10 (8.802)	70.83 (5.720)	67.29 (7.409)	66.00 (6.617)	59.89 (8.950)	$F(4, 293)= 30.11$, $p <.001$	(1)> (2)≒ (3)≒ (4) > (5)
	Cluster 1	0.467 (1.076)	0.431 (0.618)	-0.328 (1.217)	0.035 (0.673)	-0.621 (1.021)	$F(4, 293)= 15.15$, $p <.001$	(1)≒ (2)> (4)≒ (3) > (5)
	Cluster 2	1.502 (0.778)	0.392 (0.679)	0.089 (0.826)	-0.697 (0.427)	-0.885 (0.416)	$F(4, 293)= 109.30$, $p <.001$	(1)> (2)≒ (3)> (4)≒ (5)
	Cluster 3	1.531 (0.650)	0.423 (0.274)	0.141 (0.662)	-0.338 (0.351)	-1.426 (0.454)	$F(4, 293)= 251.50$, $p <.001$	(1)> (2)> (3)> (4) > (5)
Coping strategy score	Giving up	0.573 (1.120)	0.217 (0.831)	-0.265 (0.981)	-0.138 (0.819)	-0.266 (1.136)	$F(4, 293)= 7.04$, $p <.001$	(1)> (4) (1),>(3), (1)> (5), (2)>(3), (2)>(5)
	Evading one's responsibility	0.283 (1.021)	0.387 (0.962)	-0.340 (0.880)	-0.141 (0.814)	-0.210 (1.157)	$F(4, 293)= 6.80$, $p <.001$	(2)>(1), (2)>(5), (2) >(3)
	Plan drafting	0.068 (1.043)	-0.090 (0.885)	0.150 (1.173)	0.009 (0.748)	-0.094 (1.186)	$F(4, 293)= 0.66$, $p = .624$	n.s.
	Positive interpretation	-0.341 (1.024)	-0.167 (0.865)	0.100 (1.064)	0.089 (0.937)	0.264 (1.093)	$F(4, 293)= 3.02$, $p = .018$	(5)>(1)
	Catharsis	0.057 (1.169)	0.120 (0.902)	-0.073 (1.089)	0.162 (0.888)	-0.319 (0.990)	$F(4, 293)= 2.28$, $p = .061$	(2)>(5), (4)>(5)
	Getting information	0.104 (1.244)	0.156 (0.846)	-0.179 (1.051)	0.160 (0.900)	-0.289 (1.008)	$F(4, 293)= 2.69$, $p = .030$	(2)>(5)
	Avoidance-like thinking	0.088 (1.064)	0.050 (0.917)	-0.186 (1.063)	0.019 (0.805)	0.042 (1.203)	$F(4, 293)= 0.66$, $p = .621$	n.s.
	Distractive recreation	0.229 (1.166)	0.022 (0.897)	0.105 (1.007)	-0.049 (0.792)	-0.247 (1.191)	$F(4, 293)= 1.60$, $p = .175$	n.s.
	Highest coping strategies	Giving up	Evading one's responsibility	Plan drafting	Catharsis	Positive interpretation		

(>), significant difference or significant trend; (≒), no significant difference or trend; (n.s.), no significant difference. The significance level (<5%) and the trend (<10%). Values represent the mean (standard deviation). Scores for obsessive-compulsive tendencies are original scores; other scores are z scores.

Overall, these findings suggest that the coping strategies used by each participant subtype differ and that the factors that maintain intrusive thoughts are unique to each subtype.

3.3.3 Differences in the degree of obsessive-compulsive tendencies among participants state classifications (participant subtypes)

Finally, we calculated the degree of obsessive-compulsive tendencies (MOCI scores) for each subtype and examined the differences in obsessive-compulsive tendencies among the participant subtypes. The results indicated a significant main effect for subtype ($F (4, 293) = 30.11$, $p <.001$). *Post-hoc* comparisons revealed that both the "High Overall Group" and "Low Overall Group" (Subtypes 1 and 5) had significantly higher or lower scores than all other subtypes (all ps <.05). In contrast, the "Low Negative Evaluation Group" (Subtype 3) exhibited obsessive-compulsive tendency levels comparable to those of the "High Negative Evaluation Group" (Subtype 2) and "Low Stress Response Group" (Subtype 4) (p(Subtype2-3) = .059, p(Subtype3-4) = 1.000).

In summary, the participant subtypes can be understood as follows: the "High Overall Group" (Subtype 1) exhibited a high degree of obsessive-compulsive tendencies, the "High Negative Evaluation Group" (Subtype 2), "Low Negative Evaluation Group" (Subtype 3), and "Low Stress Response Group" (Subtype 4) demonstrated moderate levels, while the "Low Overall Group" (Subtype 5) showed low levels of obsessive-compulsive tendencies (Table 2).

4 Discussion

In this study, we examined the differences in patterns of intrusive thoughts based on a classification of the factors contributing to the occurrence of intrusive thoughts. Through the co-clustering analysis, we found that three key factors (i.e., "Negative Evaluation of Intrusive Thoughts," "Stress Responses," and "Excessive Control of Intrusive Thoughts") are involved in the occurrence of intrusive thoughts. Furthermore, differences in

scoring patterns among these factors allowed us to classify intrusive thoughts into five distinct subtypes. Specifically, the "High Overall Group" (Subtype 1) and "Low Overall Group" (Subtype 5) were identified, confirming that they corresponded to participants with high and low levels of obsessive-compulsive tendencies, respectively. Conversely, participants with moderate obsessive-compulsive tendencies were classified into three subtypes: "High Negative Evaluation Group" (Subtype 2), "Low Negative Evaluation Group" (Subtype 3), and "Low Stress Response Group" (Subtype 4). These findings suggest that intrusive thoughts cannot be fully explained by the degree of obsessive-compulsive tendencies, and may provide important insights various states of intrusive thoughts not limited to OCD.

Notably, by comparing the "High Negative Evaluation Group" (Subtype 2), "Low Negative Evaluation Group" (Subtype 3), and "Low Stress Response Group" (Subtype 4), it became evident that the occurrence of intrusive thoughts could not be explained solely by the severity of obsessive-compulsive tendencies. For instance, when comparing the "High Negative Evaluation Group" (Subtype 2) and the "Low Negative Evaluation Group" (Subtype 3), the primary difference lay in the degree of "Negative Evaluation of Intrusive Thoughts," This suggests that while "Negative Evaluation of Intrusive Thoughts" contribute to their occurrence, it does not necessarily correlate with the severity of obsessive-compulsive tendencies. In fact, intrusive thoughts have been documented in other disorders such as substance use disorders, depression, post-traumatic stress disorder, and anxiety disorders, where the negative evaluation of thoughts as ego-dystonic is understood as a common pathology (24). Thus, intrusive thoughts may be explained by factors independent of OCD, which may account for the observation of intrusive thoughts in diverse populations.

Similarly, by comparing the "Low Negative Evaluation Group" (Subtype 3) and "Low Stress Response Group" (Subtype 4), the complex interactions of the factors contributing to the occurrence of intrusive thoughts were further confirmed. Given that "Negative Evaluation of Intrusive Thoughts" is independent of obsessive-compulsive tendencies, the "Low Stress Response Group" (Subtype 4) was predicted to have lower obsessive-compulsive scores than the "Low Negative Evaluation Group" (Subtype 3). This is because the "Low Stress Response Group" (Subtype 4) showed opposite scores for "Negative Evaluation of Intrusive Thoughts" and "Stress Responses" compared to the "Low Negative Evaluation Group" (Subtype 3), while displaying "Stress Responses" similar to those of the "Low Overall Group" (Subtype 5). However, as mentioned previously, no significant differences were found in the severity of obsessive-compulsive tendencies between the two groups. These findings suggested that "Stress Responses" do not directly influence the severity of obsessive-compulsive tendencies, but rather has an indirect effect on these obsessive-compulsive tendencies influencing the levels of other factors. Previous research has indicated that stress responses serve as moderating factors that control the severity of intrusive thoughts (23). The present results suggest that intrusive thoughts should be considered based on the variations in subtypes, which are characterized by interrelationships among multiple factors.

Finally, when comparing the "High Negative Evaluation Group" (Subtype 2) and the "Low Stress Response Group" (Subtype 4), differences were found in scores for "Stress Responses," and "Excessive Control of Intrusive Thoughts," as well as in the obsessive-compulsive tendencies. This suggests that the higher the scores for "Stress Responses," and "Excessive Control of Intrusive Thoughts," the stronger the obsessive-compulsive tendencies become. These tendencies appear to be consistent across all participant subtypes. Therefore, these results suggest that intrusive thoughts occur from the interaction between the cognitive factor of "Excessive Control of Intrusive Thoughts" and the environmental factor of "Stress Responses," providing a theoretical basis to explain the continuity of intrusive thoughts between OCD patients and healthy individuals. Indeed, previous studies have pointed out that in patients with OCD, higher levels of perceived stress increase intrusive thoughts, and attempts to control intrusive thoughts paradoxically lead to their increase (16, 26).

However, the persistence of intrusive thoughts has been examined in previous studies from the perspective of interactions with daily behaviors such as "stress-coping strategies" (27, 28). Therefore, in this study, we also examined the differences in coping strategies among participant subtypes and, as a result, more clearly demonstrated the diversity in intrusive thoughts. Specifically, each participant subtype used different coping strategies: the "High Overall Group" (Subtype 1) tended to use "giving up," the "High Negative Evaluation Group" (Subtype 2) "evading one's responsibility,"' the "Low Negative Evaluation Group" (Subtype 3) "plan drafting," the "Low Stress Response Group" (Subtype 4) "catharsis," and the "Low Overall Group" (Subtype 5) "positive interpretation." According to the interpretation of TAC-24, "giving up" is classified as "avoidance/problem focus/cognitive type," "evading one's responsibility"' as "avoidance/problem focus/behavioral type," "plan drafting" as "encounter/problem focus/cognitive type," "catharsis" as "encounter/emotion focus/behavioral type," and "positive interpretation" as "encounter/emotion focused/cognitive type (29)." Therefore, a moderate relationship was observed, indicating that participant subtypes with higher scores on "Stress Responses," and "Excessive Control of Intrusive Thoughts" tend to employ more avoidant and problem-focused coping strategies. However, the specific coping strategies unique to each participant subtype could not be predicted based on factor scores related to the occurrence of intrusive thoughts. Therefore, classifying participant subtypes using co-clustering was particularly useful for examining the complex interactions between factors associated with both the occurrence and persistence of intrusive thoughts. This highlights the added value of the co-clustering approach, which enabled simultaneous classification of participant subtypes and scale clusters. By considering their interactions, co-clustering revealed unique coping strategies characteristic of each subtype, providing insights that traditional scale classification methods could not obtain.

The co-clustering approach provides a valuable framework for personalizing treatments and advancing our understanding of the mechanisms underlying intrusive thoughts. Our findings underscore the necessity of personalized approaches in understanding and addressing intrusive thoughts. For example, the "High Negative Evaluation Group" (Subtype 2) exhibited high

scores on "Negative Evaluation of Intrusive Thoughts". Cognitive interventions should be prioritized for this group, with additional adjustments made according to individual needs. Meanwhile, the "Low Negative Evaluation Group" (Subtype 3), characterized by heightened stress responses and control of intrusive thoughts, may benefit from stress management programs alongside cognitive-behavioral therapy. On the other hand, individuals in Subtype 4 have low stress levels but high negative evaluations and excessive control of intrusive thoughts. This group might benefit from mindfulness interventions that train them to distance themselves from their thoughts, thereby fundamentally changing the way they interact with their thoughts. Additionally, given the interactions between cognitive and environmental factors observed in this study, daily coping strategies are likely to evolve with appropriate interventions. This highlights the importance of incorporating intervention strategies that address both situational and individual factors.

This study has several limitations. First, the participants state classifications and interpretations adopted in this study are not the only possibilities. If other scales were added to those used in this study, or if the scales analyzed through co-clustering changed, different results could be obtained. However, the scales used in this study were carefully selected to avoid conceptual overlap based on the literature review, and the attempt to divide them into factors associated with the occurrence of intrusive thoughts and factors associated with persistence of intrusive thoughts was grounded in previous studies. The interpretation of data-driven analysis results is a general issue when applying machine-learning methods, and this should continue to be discussed in the future. Second, as is evident from the score relationships of the factors associated with the occurrence of intrusive thoughts, a moderate correlation was between participant subtypes. These results suggest that understanding intrusive thoughts from a trait-based perspective is more important than from a typological perspective. Therefore, we avoided treating each participant subtype as qualitatively distinct, which limited our ability to compare the subtypes. Despite the limitations of this discussion, our findings provide strong evidence that the psychological states associated with intrusive thoughts are not homogeneous and are significantly diverse. This issue can be addressed by expanding the scale and exploring a wider range of factors related to intrusive thoughts. Third, the selection of the number of clusters in this study, while guided by goodness-of-fit indicators, involves a certain degree of arbitrariness. In the field of machine learning, techniques such as cross-validation have been used to examine the accuracy of classification and number of clusters. This study did not conduct validation of clustering accuracy in line with existing research in the clinical field that uses clustering. However, future studies should examine the accuracy of clustering by increasing the amount of available data. Fourth, there was a limitation in that the alignment of scale clusters with the original subscale classifications appeared to restrict novelty. However, the co-clustering approach provided unique value by uncovering complex interactions between factors related to the occurrence and persistence of intrusive thoughts. This approach enabled us to identify participant clustering results and coping strategies that would not have been visible through conventional classification methods. Fifth, although this study

suggests a relationship between intrusive thoughts and obsessive-compulsive tendencies, the absence of detailed assessments of anxiety and depression levels limits our ability to account for potential confounding effects. Including appropriate measures in future studies could further clarify the relationships between these psychological states and intrusive thoughts. For example, scales specific to depressive or anxiety-related intrusive thoughts might reveal additional clusters or more nuanced patterns of interaction between factors. This remains an important direction for future research.

Despite these limitations, this study highlights the differences in the patterns of factors influencing the occurrence of intrusive thoughts, emphasizing the diversity of psychological state differences in intrusive thoughts, which have previously been examined primarily as symptoms of OCD. Notably, we found that coping strategies for intrusive thoughts cannot be fully explained by OCD tendencies alone. Therefore, to approach these coping strategies, it is crucial to identify and understand the complex interactions among the factors contributing to the occurrence of intrusive thoughts that influence these coping strategies. These finding provides robust support for the hypotheses of continuity and diversity in intrusive thought from a data-driven perspective and provides a clear explanation as to why these thoughts are not disease-specific, which had not been clarified in previous research. In the future, more comprehensive assessments of the scale related to occurrence and persistence factors should be conducted with a larger population; by performing big data analysis, clearer and more fully interpretable characteristics of intrusive thoughts will be elucidated.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the Ethics Committee on Research with Humans as Subjects at Waseda University (Approval No. 2018-107). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

SH: Conceptualization, Data curation, Investigation, Visualization, Writing – original draft, Writing – review & editing. HO: Conceptualization, Funding acquisition, Writing – original draft, Writing – review & editing. HS: Conceptualization, Project administration, Supervision, Writing – review & editing. YT: Supervision, Writing – review & editing. MO: Conceptualization, Supervision, Writing – review & editing. CM:

Supervision, Writing – review & editing. SO: Supervision, Writing – review & editing.

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Conflict of interest

Generative AI statement

The author(s) declare that no Generative AI was used in the creation of this manuscript.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2025.1520496/full#supplementary-material

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