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GLP-1R drugs and alcohol use disorder: A definitive therapeutic solution or just another unfulfilled promise?

Fármacos GLP1AR y trastorno por consumo de alcohol. ¿Representan una solución terapéutica definitiva o solo otra promesa incumplida?

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Approximately 1.5% of the Spanish population over the age of 15 suffer from an alcohol use disorder (AUD), a figure that increases significantly in primary care settings, where it can be up to 1.6 times higher. This high prevalence is linked to the clinical impact of alcohol, which contributes to or exacerbates more than 200 medical conditions and results in the loss of nearly 600,000 Disability-Adjusted Life Years (DALYs) in Spain. Age-adjusted alcohol-attributable mortality stands at 17.1 per 100,000 inhabitants (Manthey et al., 2016; World Health Organization, 2025), equivalent to around 8,200 deaths annually in the country.

Despite the availability of effective psychological treatments (such as cognitive-behavioral therapy, group therapy, etc.) and pharmacological options—both approved (naltrexone, disulfiram, acamprosate, nalmefene) and off-label (gabapentin, topiramate, baclofen) (Lohoff, 2022)—their clinical effectiveness remains limited, especially in more severe or comorbid cases (Agabio et al., 2024). It is estimated that 35% of patients with AUD continue to suffer

from the disorder one year after treatment, and up to 60% engage in high-risk drinking three years later (Witkiewitz et al., 2019). Factors such as tobacco use, depression, lack of social support, or greater psychopathological burden are associated with poorer outcomes (Witkiewitz et al., 2019).

The lack of therapeutic response, along with the presence of physical and psychiatric comorbidities (Castillo-Carniglia et al., 2019; Holst et al., 2017; Onyeka et al., 2019; Puddephatt et al., 2022; Schoepf & Heun, 2015; Witkiewitz et al., 2019), socioeconomic status, gender, and other contextual factors also influence prognosis (Abebe et al., 2021; Skarstein et al., 2023). The term “treatment-resistant alcohol use disorder” may be applied here, as has been done for other conditions such as depression, and some authors have already begun to use it for AUD (Patterson Silver Wolf et al., 2022). We can even go a step further and consider it a “high-complexity AUD” (severe comorbidities, treatment resistance, intrinsic severity, etc.), similar to the concept of complex post-traumatic stress disorder. Complexity from a multidimensional perspective

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or due to comorbidities has been linked to greater disorder severity (Bailey et al., 2022; Mannes et al., 2021; Sugiyama et al., 2020; Witkiewitz et al., 2019). However, in contrast to complex PTSD (Maercker et al., 2022), there is no literature that clearly defines complex AUD. In any case, whether we use the concept of treatment-resistant AUD or complex AUD, both lack therapeutic options, as most clinical trials exclude this patient profile.

Access rates to treatment remain low: only 17% of patients with AUD receive specialized care (Mekonen et al., 2021). While stigma and contextual barriers partially explain the gap (Hammarlund et al., 2018), the lack of perceived effective therapeutic alternatives also plays a role, especially for more complex patients.

In this context, the search for new pharmacological strategies has focused on glucagon-like peptide-1 receptor agonists (GLP-1RAs), drugs initially developed for type 2 diabetes and obesity. In recent years, these medications have gained attention for their potential effects on neurobiological circuits involved in addiction, mood, and motivation. This article reviews the emerging evidence on the use of GLP-1RAs in addictions and other mental health disorders, analyzing preclinical studies, preliminary clinical findings, and their therapeutic implications.

How Do GLP-1RA Drugs Work?

GLP-1 receptor agonists (GLP-1RAs) are medications originally developed for the treatment of type 2 diabetes. Their effectiveness in managing this condition and obesity has driven their clinical use and sparked interest in their potential applications in other fields, including addiction (Ma et al., 2023; Ren et al., 2025).

These drugs enhance insulin secretion, inhibit glucagon release, delay gastric emptying, and reduce appetite by acting on the central nervous system. This latter effect is possible due to their ability to cross the blood-brain barrier, allowing GLP-1RAs to activate satiety-promoting neurons (POMC/CART) and inhibit hunger-inducing neurons (NPY/AgRP) in the hypothalamus (Ren et al., 2025).

Beyond appetite regulation, this mechanism also appears to modulate brain circuits involved in reward. Elevated expression of GLP-1 receptors has been identified in the nucleus accumbens of animals with high alcohol consumption, and direct administration of GLP-1RAs into key areas such as the ventral and dorsolateral tegmental area, nucleus accumbens, dorsal hippocampus, and lateral hypothalamus has been shown to reduce alcohol intake (Kruse Klausen et al., 2022). Preliminary evidence suggests these effects may be explained by reduced dopamine release in the nucleus accumbens (Aranäs et al., 2023) and other possible pathways such as GABAergic modulation (Chuong et al., 2023).

A systematic review of 19 preclinical studies found that GLP-1RA drugs decreased alcohol-related behaviors, with

exenatide showing a dose-dependent effect. However, the review also warned that the effect might be transient (Zheng et al., 2025), highlighting the need for further research into their applicability in humans.

Observational Studies and Other Indirect Evidence

Several observational studies have explored the potential beneficial effects of GLP-1RAs in patients with addictive disorders. In a multicenter retrospective cohort study that included data from 136 US healthcare systems—covering over 500,000 patients with opioid use disorder and 800,000 patients with alcohol use disorder—treatment with GLP-1RAs was associated with improved outcomes in terms of opioid overdose and alcohol intoxication. Beyond their efforts to control for confounding factors, the authors also acknowledge the inherent limitations of the study design and caution against direct causal interpretation (Qeadan et al., 2025).

Another prospective case-control observational study, focused on more than 8,000 patients with risky alcohol use, found that GLP-1RA use was associated with lower scores on the AUDIT-C scale, reduced mortality, and fewer alcohol-related liver complications (John et al., 2025). Additional retrospective cohorts have identified similar outcomes, particularly among patients meeting diagnostic criteria for alcohol use disorder. For example, a Swedish cohort reported a lower incidence of hospital admissions among AUD patients treated with GLP-1RAs (Farokhnia et al., 2025; Lähtenvuo et al., 2025).

Indirect evidence has also emerged from social media content analysis. A qualitative study based on more than 5,800 Reddit posts between 2019 and 2023 found that 29.75% of comments related to alcohol, 22.22% to caffeine, and 23.08% to nicotine reported achieving abstinence after starting GLP-1RA treatment. Another similar study identified positive effects on AUD-related dimensions such as craving and stimulus reactivity (anticraving/antipriming) (Arillotta et al., 2024; Bremmer & Hendershot, 2024). The combination of social media analysis with prospective cohorts has reinforced these findings, showing reductions in frequency, intensity of use, and desire to drink in most cases analyzed (Quddos et al., 2023).

For a more comprehensive review of these observational studies, it is recommended to consult the work of Subhani et al. (2024).

Clinical Trials Including Ongoing Studies

Although observational and preclinical evidence is promising, clinical trials investigating GLP-1 receptor agonists (GLP-1RAs) for the treatment of alcohol use disorder (AUD) remain limited. This article does not constitute a systematic review, but Table 1 summarizes the four clinical trials identified to date, including their main findings.

Overall, initial clinical findings suggest a potential benefit of GLP-1 receptor agonists (GLP-1RAs) in reducing alcohol consumption, particularly in subgroups such as individuals with obesity or high comorbidity. However, the effects are not consistent across all studies and are not always observed in primary outcomes.

Currently, ten clinical trials investigating GLP-1RAs for alcohol use disorder (AUD) are registered on clinicaltrials.gov, either in the recruitment phase or earlier.

Table 1
Clinical Trials with GLP-1RA Drugs

Authors	Population	Intervention	Control	Primary Outcomes	Secondary Outcomes
Hendershot C et al. (2025)	Adults with AUD, not actively seeking treatment (n=48)	Weekly semaglutide (0.25–1.0 mg) for 9 weeks	Placebo	↓ alcohol consumption in lab (p=0.01); ↓ BrAC (p=0.03)	↓ craving (p=0.01), ↓ cigarettes/day (p=0.005); no serious adverse events
Klausen MK et al. (2022)	Adults with AUD in treatment (n=127)	Weekly exenatide 2 mg + CBT for 26 weeks	Placebo + CBT	No overall differences; in BMI >30: ↓ risky drinking days (p=0.034)	↓ brain reactivity to alcohol; ↓ DAT in SPECT; ↓ weight and HbA1c; ↑ oxidative stress
Probst L (2023)	Smokers with high dependence and alcohol use (n=151)	Weekly dulaglutide (0.75–1.5 mg) for 12 weeks	Placebo + TAU for tobacco	↓ 29% in weekly alcohol consumption (p=0.04); 36% adjusted for education (p=0.004)	No effect on smoking cessation or other drugs; mild and transient GI side effects
Jensen ME (2025)	Adults with AUD and obesity (n=30)	Weekly exenatide 2 mg for 26 weeks	Placebo	↓ PEth at week 26 (p=0.03); correlation with self-reported consumption	Sensitivity analysis confirms effect (p=0.009); no age or sex effect

Note. AUD: Alcohol Use Disorder; BrAC: Breath Alcohol Concentration; CBT: Cognitive Behavioral Therapy; DAT: Dopamine Transporter; SPECT: Single Photon Emission Computed Tomography; HbA1c: Glycated Hemoglobin; PEth: Phosphatidylethanol; GI AE: Gastrointestinal Adverse Events; TAU: Treatment As Usual.

Table 2
Ongoing Clinical Trials with GLP-1RA Drugs (clinicaltrials.gov)

Study Design	Trial Number	Drug	Population
Randomized double-blind clinical trial	NCT06409130	GLP-1RA*	Alcohol use disorder and liver disease
Open-label clinical trial	NCT06546384	Semaglutide	Obesity and risky alcohol use
Open-label clinical trial	NCT07040592	GLP-1RA*	Alcohol use disorder and HIV
Randomized double-blind clinical trial	NCT05891587	Semaglutide	Alcohol use disorder
Randomized double-blind clinical trial	NCT05892432	Semaglutide	Alcohol use disorder
Randomized double-blind clinical trial	NCT06015893	Semaglutide	Alcohol use disorder (NIDA-sponsored, USA)
Randomized double-blind clinical trial	NCT06939088	Tirzepatide	Alcohol use disorder in patients with schizophrenia
Randomized double-blind clinical trial	NCT06987513	Pemvidutide	Alcohol use disorder in patients with obesity
Randomized double-blind clinical trial	NCT06994338	Tirzepatide	Alcohol use disorder in patients with obesity or overweight
Randomized double-blind clinical trial	NCT05895643	Semaglutide	Alcohol use disorder in patients with obesity

Note. *GLP-1RA refers to various or unspecified GLP-1 receptor agonists. It is worth noting that this group of drugs is also being considered for other addictive disorders such as nicotine, cocaine, and cannabis use disorders (Martinelli et al., 2024; Wang et al., 2024).

Alcohol-Related Diseases and GLP-1RA Drugs: The Example of Alcohol-Associated Fatty Liver Disease With or Without Predominant Metabolic Alterations

Another potential indication for GLP-1RAs is the treatment of metabolic dysfunction-associated steatotic liver disease (MASLD). Recently, the US Food and Drug Administration approved semaglutide for fatty liver disease of metabolic origin (associated with obesity and diabetes) (US Food and Drug Administration, n.d.), based on a recent study showing a reduction in steatohepatitis without worsening fibrosis in 63% of the treatment group compared to 34% in the placebo group, and a reduction in fibrosis without worsening steatohepatitis in 37% versus 22% (Sanyal et al., 2025).

Although the etiology and pathogenesis of alcohol-related liver disease and MASLD differ, they share certain features that have drawn researchers' attention to the potential efficacy of GLP-1RA drugs in alcohol-related liver conditions. For example, a cohort of patients with AUD treated with GLP-1RAs had a lower likelihood of developing liver disease and lower mortality compared to those treated with dipeptidyl peptidase-4 inhibitors. In the same study, patients with established alcohol-related liver disease experienced fewer decompensations and lower mortality (Kuo et al., 2025). A meta-analysis of clinical and observational studies showed that patients taking GLP-1RAs had a reduced risk of alcohol-related events, including liver-related complications (de Faria Moraes et al., 2025).

These preliminary findings highlight the potential of GLP-1RAs not only to treat AUD but also to address highly prevalent medical comorbidities in these patients, while also suggesting their possible safety in individuals with liver damage, who often have limited pharmacological options.

Given that semaglutide has beneficial effects in treating both obesity and AUD, it appears to be an ideal candidate for managing steatotic liver disease of mixed etiology (MetALD). Clinical trials are currently underway to evaluate its efficacy in this patient population.

GLP-1RA and Mental Health

Beyond their well-established role in metabolic control, GLP-1RAs are being investigated as potential treatments for various psychiatric disorders beyond addiction. Both preclinical and clinical studies have shown that these drugs may influence neurobiological mechanisms involved in depression, anxiety, and psychotic disorders. Their action appears to be mediated by improvements in neuroplasticity, reductions in oxidative stress and neurogenic inflammation, and modulation of neural circuits related to emotional regulation and motivation (Meshkat et al., 2025).

In the case of depression and anxiety, activation of GLP-1 receptors in key brain regions such as the hippocampus

and prefrontal cortex has demonstrated anxiolytic and antidepressant effects in animal models. Clinically, patients with diabetes treated with GLP-1RAs have reported improvements in depressive symptoms and quality of life, although the available evidence remains preliminary and inconclusive for their use in psychiatric disorders without metabolic comorbidity. Similarly, emerging studies suggest that GLP-1RAs may have a modulatory effect in schizophrenia—a disorder where neuroinflammation and oxidative stress play a significant role. However, further clinical research is needed to confirm these findings (Meshkat et al., 2025).

In summary, current evidence indicates that GLP-1RAs hold promising therapeutic potential across various mental health disorders, acting on fundamental neurobiological processes. Nonetheless, their clinical application still requires dedicated controlled trials to more definitively establish their efficacy and safety in these indications.

Caution: A Drug With Relevant Adverse Effects

Although GLP-1RAs generally show a favorable safety profile in individuals with type 2 diabetes and obesity, their use in mental health and addiction contexts requires caution due to conflicting data regarding a possible increase in suicidal ideation and depressive symptoms (Carminati et al., 2025; Chen et al., 2023; McIntyre et al., 2025).

The most common adverse effects are gastrointestinal in nature—nausea, vomiting, diarrhea, or constipation—especially during the first weeks of treatment or with rapid dose escalation. The treatment discontinuation rate due to adverse effects is around 8–10% (Sharma et al., 2024). Less frequent but clinically relevant adverse effects have also been reported, including delayed gastric emptying (which may interfere with the absorption of other medications), gallstones associated with rapid weight loss, and, in rare cases, acute pancreatitis. Some studies have raised concerns about suicidal ideation in individual cases, although current evidence does not establish a clear causal relationship, and studies in psychiatric populations remain limited (Ghushn & Hurtado, 2024).

Post-marketing pharmacovigilance studies have reported neurological adverse effects such as dizziness, tremors, dysgeusia, lethargy, taste disturbances, presyncope, parosmia, allodynia, vision problems, and loss of consciousness due to hypoglycemia (Chen et al., 2025; Kim et al., 2025b).

In individuals with severe psychiatric disorders or those on multiple medications, a cautious approach is recommended. Potential interactions with antipsychotics, mood stabilizers, or other commonly used treatments have not yet been sufficiently evaluated. Additionally, the metabolic profile of some patients may influence the pharmacokinetics of GLP-1RAs, increasing the risk of adverse effects or reducing efficacy.

Despite these precautions, the potential benefits of GLP-1RAs in the presence of comorbidities—and even their possible positive effects on these conditions (such as liver disease or comorbid addictive and mental disorders)—make them an especially attractive option for addressing complex and treatment-resistant cases.

Combining GLP-1RAs With Other Promising or Current Treatments

The development of new pharmacological treatments for alcohol use disorder and other addictions has expanded the therapeutic landscape beyond currently approved compounds. Emerging drugs with promising preliminary results include agents such as doxazosin, zonisamide, apremilast, ibudilast, ivermectin, tolcapone, mifepristone, suvorexant, as well as increasingly studied compounds like ketamine, psilocybin, oxytocin, and cannabidiol. In particular, research on psychedelics has gained significant momentum, both in the field of addiction and in other areas of mental health (Gomez-Escolar et al., 2024; Köhne et al., 2024; Miller et al., 2025).

Innovative biological treatments are also being explored, such as fetal microbiota transplantation and non-invasive brain stimulation techniques, which may modulate dysfunctional brain networks involved in addiction (Kim et al., 2025a; Wolstenholme et al., 2024).

In this expanding therapeutic landscape, a new clinical challenge arises: how to safely and effectively integrate emerging treatments—including GLP-1RAs—with existing pharmacological interventions, psychological approaches, and psychosocial strategies. Key questions guiding this integration remain under debate: What should be the relative weight of each type of intervention for each patient? How can combinations be selected to act synergistically on different biological targets without increasing the risk of adverse effects?

Addressing these questions will require well-designed clinical trials that explore combined treatment models, as well as implementation studies in real-world clinical settings.

From an Individualist Model Based on Effort and Free Will to an Individualist Model Based on Biological Hard Determinism: Where Is the Context?

The parallel between obesity and addiction, which becomes evident when considering the effects of GLP-1RA agonists, also reflects a deeper similarity in how both conditions have been socially and medically understood. For decades, both obesity and addictions have been

conceptualized under an individualist model focused on personal effort and willpower. This approach places almost exclusive responsibility on the individual, who is implicitly or explicitly blamed for their condition. The classic “if you want it, you can do it” narrative has dominated the discourse, ignoring external, structural, and social factors that influence behavior and health (Ringel & Ditto, 2019; Rise & Halkjelsvik, 2019).

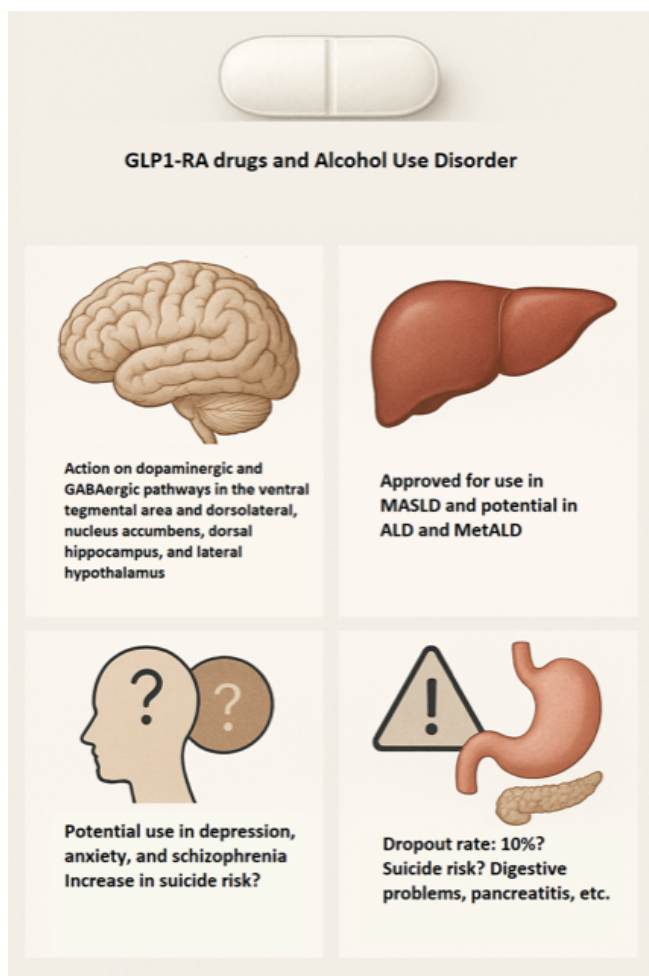
In contrast to this notion of absolute free will, an opposing model has emerged: biological determinism. In this view, both addiction and obesity are interpreted as brain diseases, determined by neurobiological alterations such as neurotransmitter dysfunction, neuroinflammation, or disruption of reward circuits. While this perspective has helped reduce stigma and spurred the development of innovative pharmacological treatments, it also risks completely shifting attention away from context, attributing behavior to an allegedly innate and unchangeable dysfunction in the individual (Bora & Fissette, 2023; MacKay et al., 2022; Scientists Propose Obesity Is a Neurodevelopmental Disorder | BCM, n.d.; Shefer et al., 2013).

Biopsychosocial models offer a more balanced approach, integrating biology, psychology, and context. They recognize that social and commercial determinants—such as gender, poverty, chronic stress, and the food and advertising environment—interact with an individual’s biological vulnerability, shaping their choices and health outcomes (Griffiths, 2005; Griffiths, 2008). These models do not deny the capacity for change or the importance of neurobiology, but they frame it within a more complex system.

Among the most influential contextual factors are the commercial determinants of health. The experience with tobacco has shown that public policies such as taxation, advertising restrictions, and limited access can have a significant impact. However, in the case of alcohol and ultra-processed foods, regulation remains insufficient. Continuous exposure to advertising stimuli, high availability, and low cost of these products undermine any prevention strategy based solely on individual behavior change (Chavez-Ugalde et al., 2021; Commercial Determinants of Health, n.d.).

Attempting to reduce the harms associated with alcohol or obesity without addressing these hypermotivating environments is therefore unrealistic. Effective intervention must include both access to medical treatments and public policies that regulate exposure and access to these products (Pastor et al., 2022; Villalbí et al., 2019).

Figure 1
GLP1-RA drugs and Alcohol Use Disorder



Conclusions and Future Perspectives

Currently, the evidence does not support the use of GLP-1RA agonists for alcohol use disorder. Although they show promising potential—especially in resistant or complex cases—the available data are still preliminary, and their safety profile, while acceptable, is not without risks (such as gastrointestinal effects, pancreatitis, or depressive symptoms). With several clinical trials underway, this situation may change in the coming years. However, no drug alone will solve such a multifactorial disorder.

The approach to AUD must remain comprehensive, combining pharmacological, psychological, and social interventions, and incorporating both biological dimensions and contextual factors, including public health policies. Without this broader perspective, GLP-1RAs risk becoming yet another unfulfilled promise.

Conflict of Interest (Last 3 Years)

HLP has received funding for training from Lundbeck, and for lectures or similar activities from Chiesi and Advanz.

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ORIGINAL

ALCO-VR Project: A randomized clinical trial evaluating virtual reality cue-exposure Therapy for Treatment-Resistant Alcohol Use Disorder patients

Proyecto ALCO-VR: Un ensayo clínico aleatorizado para la evaluación de la eficacia de la Terapia de Exposición a Señales con Realidad Virtual en pacientes resistentes al tratamiento diagnosticados con trastorno por uso de alcohol

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Abstract

The management of “treatment-resistant” alcohol use disorder (AUD) often presents significant challenges. Virtual reality (VR) applications, specifically VR cue exposure therapy (VR-CET), offer a potentially complementary approach to the standard treatment (TAU). This randomized clinical trial (RCT) aimed to assess VR-CET’s effectiveness when added to TAU, compared to TAU alone, in reducing alcohol craving and anxiety among individuals with treatment-resistant AUD. The study also sought to determine anxiety and craving levels during VR-CET sessions and to explore long-term effects.

Eighty-five AUD patients from the Clinic Hospital of Barcelona participated. They were randomly assigned to either an experimental group (EG), receiving VR-CET plus TAU, or a control group (CG), receiving TAU alone. The EG completed six VR-CET sessions alongside TAU, while the CG continued with only TAU. Alcohol craving and anxiety were assessed before and after treatment for both groups, and during VR-CET sessions for the EG. Relapses were monitored at 3-, 6-, and 12-months post-treatment. Results indicated no significant main effects of “type of treatment” (EG vs. CG) on craving or anxiety. However, a significant “time” factor was observed, showing reductions in craving and anxiety from pre-test to post-test, regardless of the treatment type. Within VR-CET sessions, EG participants reported minimal anxiety and craving by the end of the therapy. Importantly, no statistically significant differences in relapse rates were found between the EG and CG at any follow-up period (3, 6, 12 months). The clinical implications of the study, limitations, and research directions are further discussed.

Keywords: alcohol use disorder, alcohol craving, anxiety, virtual reality, cue-exposure therapy, clinical trial

Resumen

El manejo del trastorno por consumo de alcohol (TCA) resistente al tratamiento presenta desafíos. La terapia de exposición a señales con realidad virtual (TES-RV) es un enfoque complementario al tratamiento estándar (TE). Este ensayo clínico aleatorizado (ECA) evaluó la eficacia de TES-RV con TE, comparado con TE solo, para reducir craving y ansiedad por el alcohol en pacientes con TCA resistente. También buscó determinar niveles de craving y ansiedad durante las sesiones de TES-RV y explorar efectos a largo plazo en la abstinencia. Participaron 85 pacientes con TCA del Hospital Clínic de Barcelona. Fueron asignados aleatoriamente a un grupo experimental (GE), con TES-RV más TE, o a un grupo control (GC), solo con TE. El GE completó seis sesiones de TES-RV junto con TE; el GC continuó solo con TE. Se evaluaron craving y ansiedad por el alcohol antes y después del tratamiento en ambos grupos, y durante las sesiones de TES-RV en el GE. Las recaídas se monitorizaron a los 3, 6 y 12 meses post-tratamiento. Los resultados no mostraron efectos significativos del tipo de tratamiento (GE vs. GC) sobre craving ni ansiedad. No obstante, un factor temporal significativo indicó reducciones en craving y ansiedad del pretest al posttest, independientemente del tratamiento. Durante las sesiones de TES-RV, los participantes del GE reportaron niveles mínimos de craving y ansiedad al finalizar. No se hallaron diferencias estadísticamente significativas en las tasas de recaída entre el GE y el GC en ningún seguimiento. El estudio discute implicaciones clínicas, limitaciones y futuras líneas de investigación.

Palabras clave: trastorno por consumo de alcohol, deseo por alcohol, ansiedad, realidad virtual, terapia de exposición a señales, ensayo clínico

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Current research indicates that alcohol use disorder (AUD) is a result of a continuous pattern of alcohol misuse (Kranzler & Soyka, 2018; Kuntsche et al., 2017; Morean et al., 2018; Witkiewitz et al., 2017). In addition to the personal circumstances of the individual, several underlying mechanisms facilitate the maintenance of AUD such as the interplay between *affective mechanisms* [e.g., stress and anxiety] (Anker et al., 2018; McCaul et al., 2017) and *alcohol craving*, described as an intense urge to drink alcohol (Bernard et al., 2021; Drummond, 2001; Manchery et al., 2017).

The AUD treatment in public health care settings, known in the literature as treatment as usual (TAU), consists of pharmacological and psychosocial interventions (Mann & Hermann, 2010). Pharmacological interventions include medication such as disulfiram, naltrexone, or acamprosate among others (Kranzler & Soyka, 2018). Psychosocial treatment approaches reflect interventions that address the psychological and social elements that contribute to mental health disorders. Such interventions may include individual therapy and support groups. The psychotherapeutic approach is based on the principles of cognitive-behavioral therapy (CBT) and other interventions related to behavior change such as motivational interviewing (Witkiewitz et al., 2019). However, long-term effect of both pharmacological and psychosocial interventions for AUD is modest. While some studies have shown that TAU can be effective (Naqvi & Morgenstern, 2015), others have found that few patients complete treatment successfully (Patterson Silver Wolf et al., 2021; Patterson Silver Wolf et al., 2019). In this sense, approximately 40% of individuals experience relapse during/after treatment (Andersson et al., 2019). Patients with AUD who experience relapse are often given the same treatment options as before, which leads to a revolving door of treatment (Naqvi & Morgenstern, 2015; Patterson Silver Wolf et al., 2021). Treatment-resistant AUD is a chronic condition characterized by a return to drinking patterns after treatment completion and/or difficulty to complete treatment (Patterson Silver Wolf et al., 2022). Considering the ongoing concern regarding recovery management, new treatment options are the focus of the latest research in AUD.

Virtual reality (VR) technology is increasingly being used to improve the treatment of different disorders, including addictions. In AUD, it has been used primarily as a method of conducting cue-exposure therapy (CET), which involves repeated and prolonged (*in vivo*, imagining or multimedia) exposure to alcohol beverages by presenting alcohol-related cues with the aim to prevent drinking-related behaviors (Ferrer-García et al., 2017). Nonetheless, the effectiveness of CET in addressing AUD remains a topic of contention, as evidenced by studies such as Byrne et al. (2019) and Mellentin et al. (2017). In this context, a recent meta-analysis revealed that CET has a small to moderate impact

on factors such as daily alcohol consumption, total days of drinking, and AUD relapse. However, it is important to note that the quality of evidence supporting these findings is rated as low, as indicated by Kiyak et al. (2023). The VR-based therapeutic approach leverages the fundamental mechanism of CET, which is systematic desensitization, as outlined by Conklin and Tiffany (2002). Its objective is to systematically and gradually expose individuals to decrease their psychophysiological responses to cues related to alcohol (Mellentin et al., 2016).

VR poses several advantages such as digital simulations of real-life situations: VR adds effectiveness to CET because technology enables induction of greater subjective and physiological reactivity (e.g. craving). The user is immersed within the VR-environment, therefore feeling “present” while staying in a safe, secure, yet more flexible approach than those from *in vivo* contexts. VR also allows a greater control of the input variables, thus providing a more ecological approach that eases the generalization of treatment effects to real-world and daily life situations (Ghiță & Gutiérrez-Maldonado, 2018; Hone-Blanchet et al., 2014; Parsons, 2015; Segawa et al., 2020; Simon et al., 2020). This is translated into a recent study indicating that VR-based interventions are effective in preventing smoking relapses (Malbos et al., 2023). Consequently, the combined approach of VR and CET has emerged as VR-CET.

Previous systematic reviews endorse and support the application of VR in alcohol misuse, for both CET and other purposes (i.e., examining relationships between alcohol and neurological activity, or training for healthcare professionals), but the relevance of findings is limited and frequently based on methodological flaws, facts that highlight the importance of further empirical research (Durl et al., 2017; Ghiță & Gutiérrez-Maldonado, 2018; Trahan et al., 2019). Finally, although VR has shown promising short-term results, further longitudinal research is needed to evaluate the effects of CET using VR in patients with AUD (Durl et al., 2017).

The present study is part of a comprehensive project that investigates the use of VR for the treatment of AUD. The software employed in this study, referred to as “ALCO-VR”, was developed based on the findings of earlier research within the project. The initial study in the project aimed to identify alcohol-related cues and contexts that trigger cravings, with the goal of creating virtual environments with clinical relevance (Ghiță et al., 2019a). The study’s results highlighted that the most frequent alcohol-related contexts included bars, restaurants, pubs, and home environments. Patients self-reported a wide range of alcoholic beverages, leading to the development of a library featuring 22 different alcoholic drinks within the VR platform. The second study in the project emphasized the development and validation of the “ALCO-VR” platform (Ghiță et al., 2019b). Data from this study revealed that VR environments

related to alcohol induced greater anxiety and alcohol craving responses among patients with AUD compared to a control group consisting of social drinkers. These studies determined that TAU + VR-CET outweighed TAU alone, and they highlighted a bidirectional relationship between AUD severity, perceived realism of virtual environments and beverages, and alcohol craving.

The main objectives of the current study were: 1) To evaluate the efficacy of VR-CET + TAU (experimental group -EG-) in comparison to TAU alone (control group -CG), in reducing levels of alcohol craving and anxiety after treatment in individuals diagnosed with AUD who were considered resistant to treatment; 2) To analyze momentary levels of alcohol craving and anxiety during VR-CET (intra-session assessment) in the EG; 3) To explore long-term effects of VR-CET versus TAU at follow-up timepoints (3, 6, and 12 months) after treatment completion, in reducing the percentage of relapses.

To address these objectives, the following hypotheses were formulated: 1) The EG will report a greater reduction in anxiety and alcohol craving compared to the CG after treatment; 2) The EG will report a gradual reduction in momentary levels of alcohol craving and anxiety during the VR-CET sessions; 3) EG will report a lower percentage of relapses compared to CG at follow-up timepoints (3, 6, and 12 months) after the treatments.

Methods

Study design

A single center, two-arm, single-blind RCT was conducted with the aim of determining the efficacy of VR-CET + TAU compared to TAU only for the treatment of AUD. Consecutive sampling was employed as the recruitment method for selecting participants in this study. The study was performed in accordance with the Declaration of Helsinki (World Medical Association, 2001). Ethical approval was obtained from the Ethics Committees of both the University of Barcelona and Hospital Clinic of Barcelona, Spain [ethical code number: 0377 (HCB/2017/0377); approval date: 09/2017]. The study protocol identifier on ClinicalTrials.gov is NCT04858061. Deviations with respect to the initial intended research plan were stated, since the follow-up finally consisted solely in requesting the subject on his/her maintenance of abstinence at three different timepoints (3, 6 and 12 months), but no self-report evaluations on alcohol craving and anxiety were collected. Follow-up was hindered by the low adherence obtained across subjects, alongside the outbreak of the Covid-19 pandemics, a fact that induced and led to the development of the follow-up sessions by telephone.

Participants

Considering an effect size of 0.5, alpha set at 0.05, and 0.80 statistical power (Faul et al., 2007), the sample size required was $N = 84$. The predetermined effect size (ES), as assessed by Cohen's d , was set at 0.5. This implies that the difference between the means of the groups is equal to half the standard deviation of the groups. The choice of a pre-established effect size of 0.5 was informed by the typical effect sizes observed in meta-analyses within the field of psychology, which tend to hover around $d = 0.50$ (Bakker et al., 2012; Sullivan & Feinn, 2012). Power size calculation was run with G*Power version 3.1.9.7 (Faul et al., 2007). The recruitment process was extended to reach a total of 100 participants, due to the relatively high dropout rates typically encountered in these studies.

A total of 100 participants were initially assessed for eligibility from the outpatient clinic of the Addictive Behaviors Unit of the Hospital Clinic of Barcelona. The study's inclusion criteria encompassed adults aged 18 and older diagnosed with AUD as per DSM-5 guidelines (American Psychiatric Association, 2013), who had experienced at least one relapse episode within the first six months following a prior hospital treatment and had refrained from alcohol consumption for at least three days preceding the initial session. Exclusion criteria included severe cognitive impairment that could impede study completion, use of anti-craving medication (e.g., naltrexone), severe psychopathological conditions (e.g., major depression, psychosis), epilepsy, pregnancy, or severe visual impairments. Occasional substance use, such as tobacco or cannabis, was permitted. Fifteen participants

did not meet the eligibility criteria and, consequently, were not included in the study. The specific reasons for exclusion were that they declined to participate in the study (13 participants) and had severe visual impairments (2 participants). The remaining participants ($N = 85$, $M_{\text{age}} = 52$, $SD = 9.2$), underwent randomization and were, subsequently, randomly allocated to one of the two groups: EG ($N = 37$) and CG ($N = 48$). Among these, 18 participants completed the EG treatment, while 33 participants completed the CG treatment (Figure 1).

Simple randomization was employed, where each participant was assigned to a treatment group with a known (typically equal) probability, without consideration of the treatment assigned to other participants in the study. This allocation was determined through a coin toss (Kang et al., 2008; Suresh, 2011).

Measures and materials

Alcohol Use Disorder Identification Test (AUDIT) (Contel et al., 1999) was used to determine problematic drinking-behavior patterns. AUDIT consists of 10 items scoring from 0-to-4. The final score ranges from 0 to 40 points. A final score equal to or higher than 8 points is the

cut-off score to indicate hazardous drinking and warrants further assessment for possible AUD. In our study, AUDIT was also used as a severity indicator of AUD, as seen in previous research (Donovan et al., 2006). The psychometric properties of this instrument have been widely validated (Babor et al., 2001).

Multidimensional Alcohol Craving Scale (MACS) (Guardia-Serecigni et al., 2004) was used to detect the intensity of alcohol craving in the past week. MACS consists of 12 Likert-based items with possible scores in a 1-to-5 range (“strongly disagree to strongly agree”). Its outcome categories are non-existent (score 12-19), mild (13-22), moderate (23-40), or intense (>40) craving. An example of an item is “The urge to drink has been very intense”. This scale has demonstrated a strong internal consistency with $\alpha = 0.94$ (Guardia-Serecigni et al., 2004) and a good sensitivity to detect changes in alcohol consumption (Guardia-Serecigni et al., 2006). The internal consistency of the instrument was calculated in our study, displaying Cronbach’s alpha values of 0.869 for the 12-item tool.

Figure 1
Flowchart of the RCT

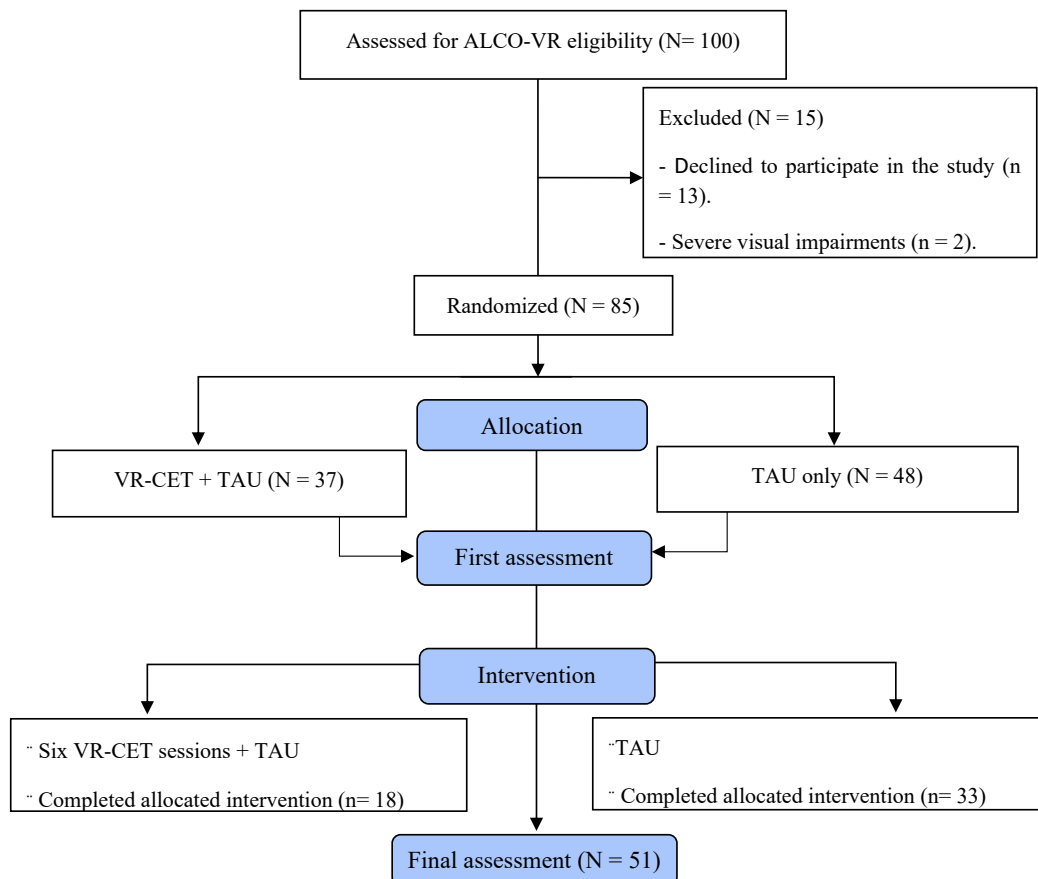
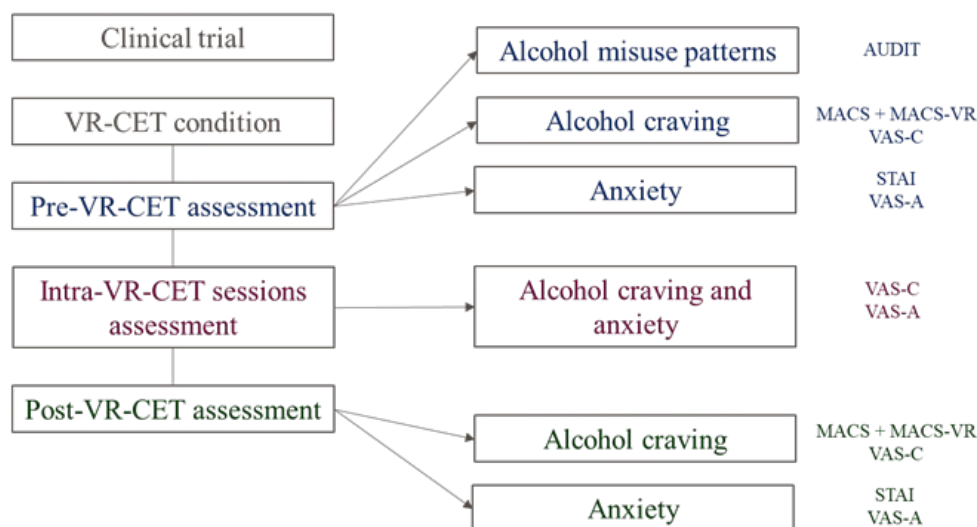


Figure 2
Assessment procedure in the ALCO-VR study



*Note. The initial and final assessment sessions were the same for both groups, however the intra-VR session assessment was conducted only in the EG.

Multidimensional Alcohol Craving Scale – Virtual Reality (MACS-VR) was an ad-hoc modified version of the original MACS (with the same items and outcomes) to assess alcohol craving immediately after VR exposure. The items, the scoring part, and interpretation were the same as in the original MACS. The only modification we made concerned the instructions of the questionnaire. Instead of determining alcohol craving in the *last week* as depicted in the instructions of MACS, the aim of MACS-VR was to report alcohol craving *immediately after exposure to the VR environments*. The internal consistency of the MACS-VR was assessed in the current study, with Cronbach’s alpha values of 0.920 for the aforementioned instrument.

State-Trait Anxiety Inventory (STAI) (Spielberger et al., 1982) cross-cultural research. The State-Trait Anxiety Inventory (Spielberger, et al., 1970) is a self-reported scale with two-subscales (state-anxiety and trait-anxiety) of 20 items each, and scores for each item range from 0 to 3. The psychometric properties have been extensively analyzed in relation to internal consistency, test-retest reliability and obtaining consistent evidence of validity (Bados et al., 2010; Guillén-Riquelme & Buela-Casal, 2011; Mystakidou et al., 2009).

Ad-hoc assessment item of alcohol consumption was created to explore alcohol use (relapse) at 3-, 6-, and 12-month follow-ups. The dichotomous item “*Have you consumed any alcohol since....?*” had two possible answers (yes/no).

Visual Analog Scales (VAS) for craving (**VAS-C**) and anxiety (**VAS-A**) were used to measure momentary levels of alcohol craving and anxiety during VR exposure, with scores ranging from 0 to 100. An example of the VAS-C was “On a scale from 0 to 100, please rate your momentary level of alcohol craving”. A similar item was used to measure anxiety on VAS-A: “On a scale from 0 to 100, please rate your momentary level of anxiety”.

Procedure

Patients were recruited during their participation in TAU at the Addictive Behaviors Unit of the Clinic Hospital of Barcelona (Barcelona, Spain). Written informed consent was obtained before their inclusion in the study. Subsequently, participants were randomly allocated to either the EG, receiving TAU and VR-CET, or the CG, which received only TAU (see Figure 2).

The ALCO-VR software is named after the project itself. Its development (Ghiță et al., 2019a), clinical implications (Ghiță et al., 2019b), and clinical applications (Hernández-Serrano et al., 2020; Hernández-Serrano et al., 2021) have been detailed in other publications. The VR equipment included an Oculus Rift S head-mounted display (HMD), sensors, touch controllers, and a computer compatible with VR technology. The ALCO-VR software encompassed two components: assessment and therapy. Regarding the assessment, all participants underwent

Figure 3

Images of the four alcohol-related VR environments (restaurant, at-home, pub, and bar)



two assessment sessions (prior to and following TAU + VR-CET or TAU protocols). The initial assessment session (pre-treatment) involved a clinical interview, which gathered sociodemographic data, including the patient's AUD history, use of substances other than alcohol, dual diagnosis, and abstinence status. It also included two assessment methods: 1) assessment via the ALCO-VR software (utilizing VAS-C and VAS-A); 2) assessment using paper-and-pencil instruments (comprising AUDIT, STAI-State, STAI-Trait, MACS, MACS-VR, and evaluations of perceived realism during VR assessment). The VR assessment with ALCO-VR software involved establishing a hierarchy of exposure, progressing from the lowest-rated environment with the lowest-rated alcoholic drink to the highest-rated environment and the highest-rated alcoholic drink in terms of alcohol craving. Prior to the VR alcohol-related experience, the software introduced a neutral environment, consisting of a white room with a glass of water, designed to familiarize users with VR technology. The system enabled users to select their preferred alcoholic beverages and create a hierarchy based on their self-ratings of alcoholic drinks and environments. Subsequently, participants were exposed to each of their top five favorite drinks for 20 seconds in each of the four VR environments (bar, pub, restaurant, and at-home settings). The paper-

and-pencil questionnaire assessment included STAI-State and MACS, administered prior to the VR assessment, while STAI-Trait, MACS-VR and perceived levels of realism were completed immediately after the VR assessment. However, AUDIT was only conducted before the VR assessment. A final assessment session (post-intervention) occurred 3-4 weeks later, employing the same instruments, excluding the clinical interview, AUDIT, and perceived levels of realism.

Regarding therapy, only the EG received six VR-CET booster sessions employing the ALCO-VR software, in addition to TAU. These booster sessions solely involved cue-exposure. During the sessions, patients interacted with the VR environment by handling alcoholic beverages and inspecting them from all angles without attempting to drink. VR-CET sessions comprised exposure to the most preferred alcoholic drinks within the four VR environments (pub, bar, at-home, and restaurant), conducted twice a week for three weeks (see Figure 3). The VR-CET approach involved gradual exposure from the lowest-rated to the highest-rated alcoholic drinks and VR environments in terms of alcohol craving. The ALCO-VR software encouraged participants to progress to the "next level" only if they scored 40% less anxiety and craving, three times in a row, than their initial ratings. Depending on the self-ratings of alcohol craving

and anxiety, the patient was either exposed again to the same alcohol drink and environment or allowed to move to the “next level”. “Next level” implied the exposure to a new alcohol drink from the five initially chosen ones. A similar procedure was implemented in all the six VR-CET sessions.

The CG did not receive VR-CET sessions and continued with their TAU. Participants in both the CG and the EG underwent the same baseline treatment, which consisted of standard treatment at the Hospital Clinic of Barcelona. Treatment encompassed a combination of pharmacotherapy and psychotherapy: 1) Pharmacotherapy typically included medications such as disulfiram, anxiolytics, and/or antidepressants; 2) Psychotherapy involved individual and group therapy sessions grounded in psychotherapeutic approaches like cognitive-behavioral therapy and motivational interviewing. Components of the psychotherapeutic approach were psychoeducation, addressing maladaptive cognitive styles and underlying core beliefs, behavioral activation, coping skills training, social support, as well as incorporating the stages of behavioral change. Weekly group sessions involved guided recovery-oriented discussions in an open-group format, meeting once or twice weekly for 1 hour and 30 minutes. All patients received TAU, however, it is important to mention that the VR exposure protocol was administered only to the participants in the experimental condition (EG). Participants in the TAU condition (CG) underwent two assessment sessions only, with a 4–5-week gap between them.

During the VR exposure, olfactory stimuli were employed to enhance the realism of the environments. A small quantity of an alcoholic beverage, matching those observed during VR exposure, was applied to cotton pads and placed in proximity to each participant. Assessment and therapy sessions had an approximate duration of one hour. The VR-CET treatment was administered by experienced research-practitioners with both clinical and research backgrounds. The TAU treatment was administered by the regular therapists at the hospital.

Follow-up measurement of abstinence maintenance/recovery management were performed at three different timepoints (3, 6 and 12 months).

Statistical analyses

Normality was assessed using Shapiro-Wilk tests and Q-Q plots, and parametric/non-parametric tests were subsequently adopted when the assumptions of normality were not met. Baseline variables were compared using independent samples t-tests. For participants who completed the protocol ($N_{\text{Total}} = 51$; $N_{\text{TAU}} = 33$; $N_{\text{VR-CET + TAU}} = 18$), data from the initial and final assessment sessions were utilized to assess the efficacy of VR-CET. Consistency (psychometric property measuring the extent to which several items that

propose to measure the same general construct produce, indeed, similar scores) of the instruments MACS and MACS-VR was tested by means of Cronbach’s alpha, a statistic calculated from the pairwise correlations between items: a value of around 0.7 or greater is generally accepted as an indicator of high or good consistency (Cohen et al., 2007).

To evaluate the comparative effects of both treatments through time, a 2x2 Analysis of Variance (ANOVA) was performed, with the aim of assessing the parameters corresponding to the main effects of the treatment, those corresponding to temporality (with Bonferroni adjustment in the estimated marginal means of the dependent variable for all level combinations of a set of factors), and the interaction between both factors. Also, effect sizes between pre and post treatment for both groups across the four different environments for VAS-C (craving) and VAS-A (anxiety) were calculated by means of the statistic Hedge’s *g*. For the intra-session assessment of momentary levels of alcohol craving and anxiety (VAS-C, VAS-A), Wilcoxon signed-rank tests were employed to examine specific differences across the six VR-CET sessions, whilst trends and trajectories for the final scores of craving and anxiety (VAS-C and VAS-A, respectively) across the six sessions were defined through gender-based multilevel growth models, offering a more profound awareness of the dynamics of treatment through time in both genders (male/female), assessing linear relationships (equidistant timepoints) through Restricted Maximum Estimation Likelihood (RMEL) with fixed slopes and random intercepts (since this method has the advantage of being more parsimonious and less intense from a computational perspective than that with random slopes and intercepts) (Hedeker & Gibbons, 2006; McCormick, 2021; Steele, 2008). Relapses registered at 3-, 6-, 12-month follow-ups were registered and compared through Chi-square tests across the total sample, the EG, and the CG. Analyses were performed using IBM SPSS Statistics for Windows, Version 28.0 (Armonk, NY, USA: IBM Corp, 2021), with a p-level of significance set at $p < 0.05$.

Results

Baseline characteristics of the sample

Baseline characteristics are presented in Table 1. A total of 85 AUD patients, of which 60% were males, with a mean age of 52 years ($SD = 8.83$; age range: 32-to-69), participated in the study. There were no statistically significant differences between the groups in terms of baseline characteristics. According to AUDIT scores, patients exhibited moderate to severe drinking patterns ($M = 16.09$; $SD = 9.77$), and their alcohol craving was assessed as moderate [MACS ($M = 22.96$; $SD = 10.95$) and MACS-VR ($M = 26.33$; $SD = 13.02$)]. Anxiety levels, as measured

Table 1

Baseline patient characteristics and data from the first assessment session (N = 85)

Baseline characteristics	VR-CET + TAU (N = 37)		TAU (N = 48)		Group comparison p value
	M/(N)	SD/(%)	M/(N)	SD/(%)	
Age	52.33	9.35	52.42	9.19	.96
Gender					.72
Female	14	37.8	20	41.7	
Male	23	62.2	28	58.3	
Marital status					.43
Married/in a relationship	19	51.4	21	43.8	
Divorced/separated	9	24.3	14	29.2	
Single	3	8.1	10	20.8	
Other (e.g., widower)	3	8.1	3	6.3	
Education					.81
Elementary school	4	10.8	6	12.5	
High school	6	16.2	10	20.8	
Junior college	10	27.0	8	16.7	
University degree (BSc, MSc)	17	46	24	50.1	
Socio-economic resources					.24
Low	4	10.8	10	20.8	
Medium	32	86.5	37	77.1	
High	1	2.7	1	2.1	
Comorbid psychopathology					.60
None	21	56.8	26	54.2	
Depressive disorders	6	16.2	12	25.2	
Depressive and anxiety disorders	4	10.8	3	6.3	
Depressive, anxiety and personality disorders	0	-	2	4.2	
Anxiety disorders	1	2.7	2	4.2	
Personality disorders	5	13.5	3	6.3	
Medication					.75
No medication	14	37.8	20	41.7	
Antidepressants	8	21.6	9	18.8	
Anxiolytics	7	18.9	5	10.4	
Antipsychotics	1	2.7	1	2.1	
Combination of medication	7	18.9	13	27.1	
Disulfiram					.19
No	23	62.2	23	47.9	
Yes	14	37.8	25	52.1	
Smoking patterns					.09
No currently smoking	14	37.8	27	56.3	
Currently smoking	23	62.2	21	43.8	
Use of other substances					.13
No use	23	62.2	37	77.1	
Yes (e.g., illicit drugs)	14	37.8	11	22.9	
Abstinence (in days)	74	95	96	115	.34
Baseline data (first assessment)	N = 37		N = 48		p Value
	M	SD	M	SD	
Questionnaires and ad-hoc items					
AUDIT	15.38	10.90	16.58	8.97	.58
MACS	22.96	9.89	22.95	10.92	.99
MACS-VR	28.96	13.04	24.52	12.82	.13
STAI – Trait subscale	25.33	12.70	28.06	10.47	.29
STAI – State subscale	20.72	11.57	18.97	10.41	.48
VR assessment					
VAS-C (0-100)					
Neutral environment (water)	11.63	22.91	18.72	21.36	.21
At-home	50.39	29.25	45.62	33.09	.55
Bar	39.43	28.17	41.74	30.59	.75
Restaurant	38.90	27.23	37.70	28.49	.86
Pub	41.23	27.72	41.59	30.72	.92
VAS-A (0-100)					
Neutral environment (water)	22.23	26.49	20.55	24.05	.57
At-home	48.06	31.64	43.29	31.17	.55
Bar	38.43	27.17	35.23	29.16	.65
Restaurant	37.72	26.53	32.70	26.17	.46
Pub	40.57	27.05	37.11	26.97	.61

AUDIT, Alcohol Use Disorder Identification Test; **Disulfiram**, is common pharmacotherapy for the treatment of alcohol use disorder and is usually combined with other medications (e.g. antidepressants) depending on the condition of the patient; **MACS**, Multidimensional Alcohol Craving Scale; **MACS-VR**, Multi-dimensional Alcohol Craving Scale – Virtual Reality; **STAI**, State and Trait Anxiety Inventory; **VAS-A**, visual analog scale – anxiety; **VAS-C**, visual analog scale – craving; **Use of other substances**, patients self-reported occasional use of illicit substances like cannabis in the month prior to their inclusion in the study; **VR assessment**, virtual reality assessment.

by the STAI-Trait subscale ($M = 26.95$; $SD = 11.43$) and STAI-State subscale ($M = 19.70$; $SD = 10.87$), were also in the moderate to severe range at baseline. Furthermore, there were higher levels of craving and anxiety in alcohol-related environments compared to the neutral one.

Effects of time, treatment and their interaction on craving and anxiety on MACS and STAI

A two-way ANOVA was conducted to determine to what extent treatment and time have an effect on “craving” (MACS and MACS-VR) and “anxiety” (STAI-State). Focusing on craving, there was no significant interaction between the effects of treatment and time (MACS: $F=0.008$, $p=0.931$; MACS-VR: $F=5.131$, $p=0.052$). Simple main effects showed that time played a significant role on MACS-VR ($F=7.880$, $p=0.020$), but not on MACS ($F=2.258$, $p=0.167$). Treatment had no significant effects, neither in MACS nor in MACS-VR. As for anxiety, no statistically significant interaction was stated ($F=0.258$, $p=0.624$). Simple main effects analysis on time showed significant differences ($F=14.002$, $p=0.005$). Treatment had no statistical significance whatsoever.

Effects of time, treatment and their interaction on craving and anxiety on VAS

Also, a two-way ANOVA was conducted to determine to what extent treatment and time have an effect on “craving” (VAS-C in four environments: home, bar, restaurant, and pub) and “anxiety” (VAS-A in the aforementioned four environments). Concerning craving, there was no significant interaction between the effects of treatment and time (p values in a 0.334-to-0.461 range). Simple main effects showed no statistically significant differences, neither in time (p values in a 0.356-to-0.600 range), nor in treatment.

As for anxiety, no statistically significant interaction was stated (p values in a 0.234-to-0.402 range), whilst simple main effects analysis did not show significant differences either on time (p values in a 0.221-to-0.426 range), or in treatment.

Table 2 provides data on the aforementioned treatment effects.

Table 3 displays the different effect sizes (Hedge's g) between pre and post treatment timepoints in both treatment groups across the four environments.

Intra-session treatment effects on craving (VAS-C) and anxiety (VAS-A) during the VR-CET treatment in each of the six sessions

In the experimental group (EG), Wilcoxon signed-rank tests revealed differences in self-reported momentary levels of alcohol craving during intra-session assessment on VAS-C between the highest value of craving and the final value of craving (end of VR-CET session) in each of the six sessions. These differences were statistically significant

in the first ($Mdn = 50$ vs $Mdn = 16.50$, $Z = -3.181$, $p < .001$), second ($Mdn = 33$ vs $Mdn = 3.50$, $Z = -2.934$, $p = .003$), third ($Mdn = 19.50$ vs $Mdn = 2$, $Z = -2.521$, $p = .005$), fourth ($Mdn = 19.50$ vs $Mdn = 2$, $Z = -2.201$, $p = .028$), fifth ($Mdn = 35.50$ vs $Mdn = 0$, $Z = -2.200$, $p = .028$), and sixth session ($Mdn = 14.50$ vs $Mdn = 0$, $Z = -2.201$, $p = .026$).

In terms of anxiety, Wilcoxon signed-rank tests revealed significant differences in self-reported momentary levels of anxiety during intra-session assessment on VAS-A between the highest value of anxiety and the final value of anxiety (end of VR-CET session) in each of the six sessions in the EG. These differences were statistically significant in the first ($Mdn = 49$ vs $Mdn = 11$, $Z = -2.934$, $p = .003$), second ($Mdn = 31.50$ vs $Mdn = 5.50$, $Z = -2.803$, $p = .005$), third ($Mdn = 41.50$ vs $Mdn = 1$, $Z = -2.524$, $p = .012$), fourth ($Mdn = 36$ vs $Mdn = 0$, $Z = -2.521$, $p = .012$), fifth ($Mdn = 14$ vs $Mdn = 0$, $Z = -2.371$, $p = .018$), and sixth session ($Mdn = 6$ vs $Mdn = 0$, $Z = -2.201$, $p = .028$). Intrasession changes of craving and anxiety are displayed in Figure 4.

Multilevel growth curves were used to assess trends and trajectories for the final scores of craving and anxiety (VAS-C and VAS-A, respectively) across the six sessions were defined through multilevel growth models for male/female participants, offering a more profound awareness of the dynamics of treatment through time in both genders. The model for VAS-C depicted a Schwartz's Bayesian Criterion (BIC) of 818.37, with estimates of fixed effects being not statistically significant, neither for time (95% Confidence Interval -95%CI: -10.812 – 3.954), nor for gender (95%CI: -20.398 – 24.446) or time*gender (95%CI: -6.448 – 3.501). The model concerning VAS-A displayed a BIC = 809.704, with the following non-statistically significant estimates of fixed effects: time (95%CI: -11.017 – 3.430), gender (95%CI: -19.173 – 20.595), time*gender (95%CI: -6.011 – 3.729). The graphical representation of the evolution of craving and anxiety through the six sessions of the EG displayed by gender is shown in Figure 5.

Relapses at follow-ups

Table 4 displays the relapse percentages registered at 3-, 6-, 12-month follow-ups. The Chi-square performed reported no statistically significant differences were observed between the EG and the CG in any of the three time-points assessed, with p -values ranging from 0.992 to 0.998.

Table 2
2*2 ANOVA (*Treatment*Time*)

2*2 ANOVA (Treatment, Time)							
	VR-CET+TAU		TAU		Principal Effect Treatment	Principal Effect Time	Interaction Treatment-Time
	Pre (n=37)	Post (n=16)	Pre (n=48)	Post (n=31)			
Craving							
MACS	22.96 ± 9.89	17.50 ± 9.75	22.95 ± 10.92	18.64 ± 7.77	F=1.021 p-value=0.339 Partial Eta²=0.102	F=2.258 p-value=0.167 Partial Eta²=0.201	F=0.008 p-value=0.931 Partial Eta²=0.001
MACS-VR	28.96 ± 13.04	16.18 ± 9.11	24.52 ± 12.82	20.35 ± 11.28	F=0.397 p-value=0.544 Partial Eta²=0.042	F=7.880 p-value=0.020* Partial Eta²=0.467	F=5.131 p-value=0.052 Partial Eta²=0.363
VAS-C							
Home	36.73 ± 26.75	7.21 ± 9.03	39.06 ± 30.97	38.53 ± 36.93	F=2.136 p-value=0.218 Partial Eta²=0.348	F=0.324 p-value=0.600 Partial Eta²=0.075	F=0.741 p-value=0.438 Partial Eta²=0.156
Bar	39.42 ± 28.17	6.85 ± 8.06	41.74 ± 30.59	34.33 ± 31.15	F=6.462 p-value=0.064 Partial Eta²=0.618	F=0.833 p-value=0.413 Partial Eta²=0.172	F=1.203 p-value=0.334 Partial Eta²=0.231
Restaurant	38.90 ± 27.23	7.78 ± 8.41	37.70 ± 28.49	36.13 ± 34.10	F=2.604 p-value=0.182 Partial Eta²=0.394	F=0.955 p-value=0.384 Partial Eta²=0.193	F=0.663 p-value=0.461 Partial Eta²=0.142
Pub	41.23 ± 27.72	8.00 ± 7.90	41.59 ± 30.72	36.13 ± 33.03	F=3.289 p-value=0.144 Partial Eta²=0.451	F=1.089 p-value=0.356 Partial Eta²=0.214	F=1.090 p-value=0.355 Partial Eta²=0.214
Anxiety							
STAI-State	20.72 ± 11.57	8.50 ± 8.16	18.97 ± 10.41	13.90 ± 8.51	F=3.110 p-value=0.112 Partial Eta²=0.257	F=14.002 p-value=0.005* Partial Eta²=0.609	F=0.258 p-value=0.624 Partial Eta²=0.028
VAS-A							
Home	35.74 ± 27.87	6.07 ± 9.97	36.73 ± 28.35	37.40 ± 34.22	F=1.126 p-value=0.348 Partial Eta²=0.220	F=0.785 p-value=0.426 Partial Eta²=0.164	F=0.878 p-value=0.402 Partial Eta²=0.180
Bar	38.43 ± 27.17	6.64 ± 9.95	35.23 ± 29.16	36.66 ± 27.39	F=5.872 p-value=0.073 Partial Eta²=0.595	F=1.189 p-value=0.337 Partial Eta²=0.229	F=1.965 p-value=0.234 Partial Eta²=0.329
Restaurant	37.71 ± 26.53	6.64 ± 9.14	32.69 ± 26.17	39.26 ± 34.65	F=1.375 p-value=0.306 Partial Eta²=0.256	F=2.101 p-value=0.221 Partial Eta²=0.344	F=1.472 p-value=0.292 Partial Eta²=0.269
Pub	40.57 ± 27.05	6.21 ± 8.64	37.11 ± 26.97	36.06 ± 31.58	F=2.713 p-value=0.175 Partial Eta²=0.404	F=2.089 p-value=0.222 Partial Eta²=0.343	F=1.761 p-value=0.255 Partial Eta²=0.306

MACS, Multidimensional Alcohol Craving Scale; MACS-VR, Multidimensional Alcohol Craving Scale – Virtual Reality; Perceived realism, the ad-hoc items were rated on a scale from 0 to 10; STAI, State and Trait Anxiety Inventory; TAU, treatment as usual; VAS-A, visual analog scale – anxiety; VAS-C, visual analog scale – craving; VR-CET, virtual reality cue exposure therapy; **p* < .05.

Table 3
Intragroup pre vs post Effect Sizes for VAS-C (craving) and VAS-A (anxiety)

	VR-CET+TAU			TAU		
	Pre (n=37)	Post (n=33)	Hedges' g	Pre (n=48)	Post (n=48)	Hedges' g
Craving						
VAS-C						
Home	36.73 ± 26.75	10.20 ± 11.69	1.28	39.06 ± 30.97	41.40 ± 26.75	0.01
Bar	39.42 ± 28.17	9.26 ± 10.34	1.35	41.74 ± 30.59	34.13 ± 31.12	0.24
Restaurant	38.90 ± 27.23	7.78 ± 8.41	1.33	37.70 ± 28.49	36.83 ± 34.90	0.05
Pub	41.23 ± 27.72	7.60 ± 7.96	1.40	41.59 ± 30.72	36.28 ± 33.24	0.17
Anxiety						
VAS-A						
Home	35.74 ± 27.87	6.11 ± 9.12	1.23	36.73 ± 28.35	27.90 ± 27.42	0.02
Bar	38.43 ± 27.17	6.64 ± 9.95	1.35	35.23 ± 29.88	36.66 ± 27.12	0.05
Restaurant	37.71 ± 26.53	6.64 ± 9.14	1.36	32.69 ± 26.17	39.88 ± 34.15	0.22
Pub	40.57 ± 27.05	6.88 ± 7.14	1.48	37.11 ± 26.97	35.76 ± 26.48	0.03

TAU, treatment as usual; VAS-A, visual analog scale – anxiety; VAS-C, visual analog scale – craving; VR-CET, virtual reality cue exposure therapy; * $p < .05$.

Figure 4
Momentary levels of alcohol craving reported on VAS-C and VAS-A

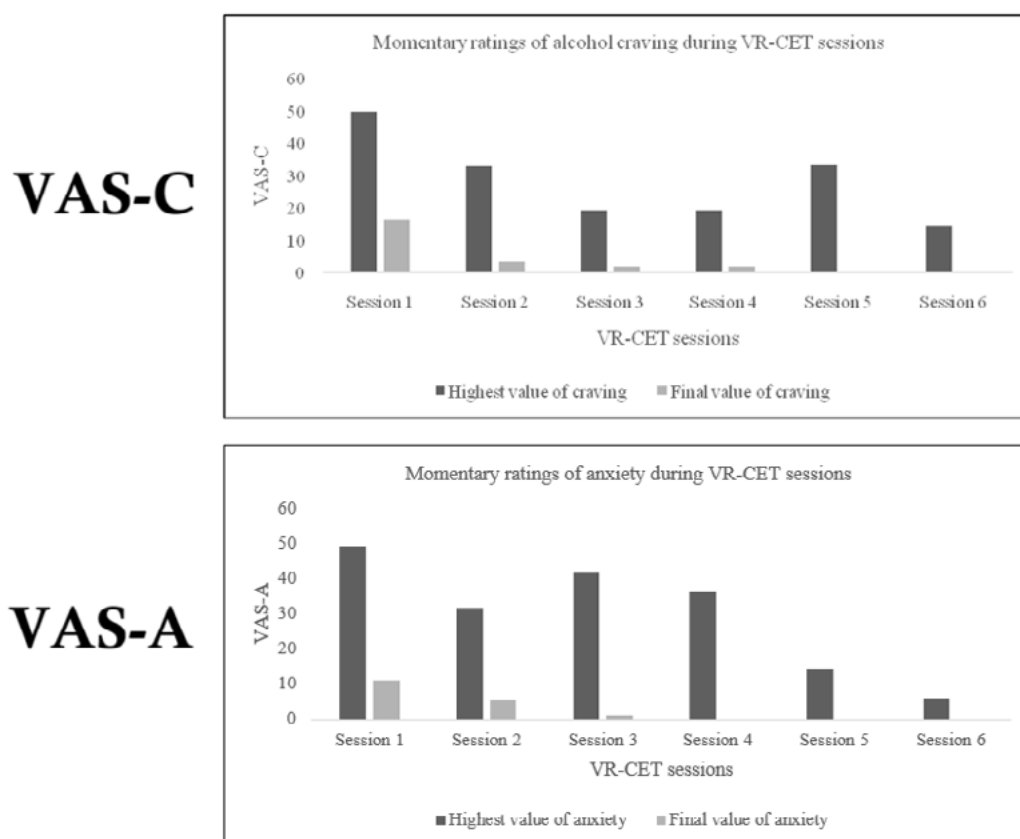


Figure 5
Momentary levels of alcohol craving reported on VAS-C and VAS-A

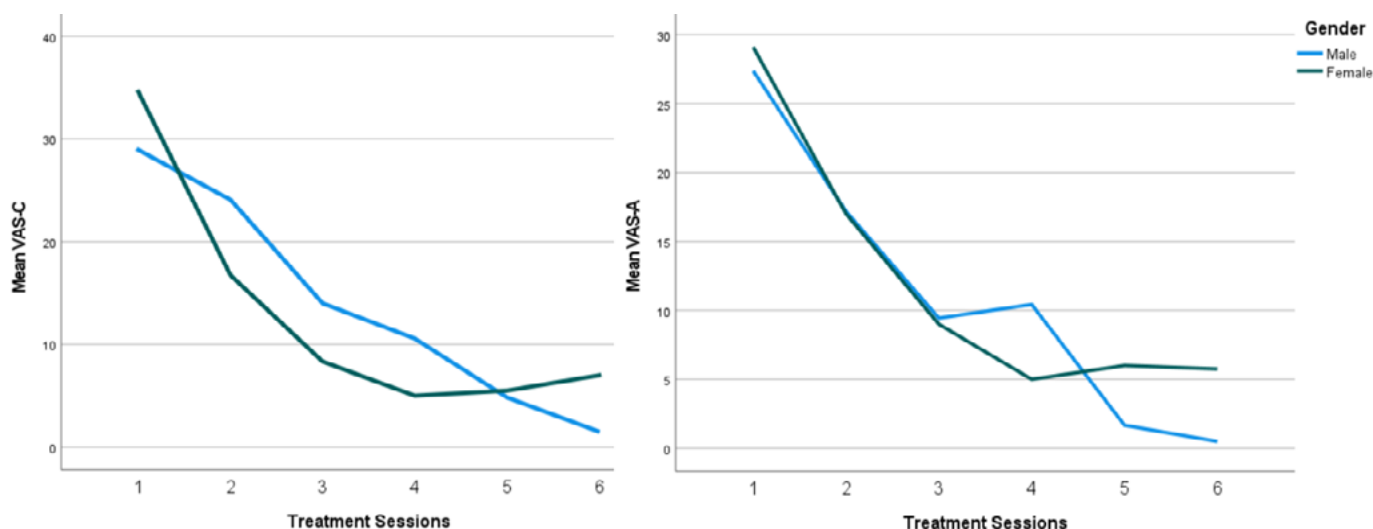


Table 4
Relapses at follow-up and comparison through Chi-square tests

	Total	EG	CG	p-value
3 months (n=43)	14/43 (32.55%)	6/18 (33.34%)	8/25 (32.00%)	0.998
6 months (n=19)	11/19 (57.89%)	4/7 (57.14%)	7/12 (58.33%)	0.997
12 months (n=12)	8/12 (66.67%)	3/5 (60.00%)	5/7 (71.42%)	0.992

Discussion

The study aimed to evaluate the efficacy of Virtual Reality – Cue Exposure Therapy (VR-CET) + Treatment as Usual (TAU) (experimental group -EG-) in comparison to TAU alone (control group -CG-), in terms of alcohol craving and anxiety levels; as well as to explore long-term effects of VR-CET versus TAU at follow-up timepoints (3, 6, and 12 months) after treatment completion. The clinical population consisted of patients diagnosed with AUD, who were considered resistant to TAU.

The first hypothesis yielded mixed results. The data indicated no significant treatment effects on alcohol craving (MACS, MACS-VR, and VAS-C) and anxiety (STAI-State and VAS-A). Nevertheless, the results showed significant principal effects of “time” over cue-induced craving (measured by MACS-VR) and anxiety (measured by STAI-State). There was no significant interaction between “type of treatment” and “time” regarding craving and anxiety. The “time” factor (pre-test versus post-test) had an effect on craving (MACS-VR) and anxiety (STAI-State) regardless of the type of treatment the participants received. Although the differences were not statistically significant, the VR assessment of cue-induced craving (VAS-C) and anxiety (VAS-A) reflected a tendency of the

EG to report lower scores on both VAS-C and VAS-A in all of the four VR environments; this tendency is endorsed by the effect sizes stated in the pre-post differences between both therapeutic approaches, as displayed in Table 3, figures in turn highlighted by the fact that VR contributes and provides the added value of controlling the input variables in a safe and secure context.

Hypothesis 2 was confirmed, as reflected by the analysis of momentary levels of VAS-C and VAS-A during the intra-VR-CET sessions in the experimental group (EG), which revealed a gradual decrease in alcohol craving and anxiety levels, progressing from the initial to the final session (as depicted in Figures 4 and 5). By the end of the therapy, participants reported minimal levels of both craving and anxiety. These findings underscore the effectiveness of VR-CET in mitigating cue-induced alcohol craving and anxiety within VR alcohol-related environments. Furthermore, these results align with research conducted in other mental health domains, such as post-traumatic stress disorder (Kothgassner et al., 2019) and anxiety disorders (Freeman et al., 2017).

The data corresponding to hypothesis 3 were contrary to our expectations, and no statistically significant differences

were observed between groups in terms of relapses at follow-ups. This suggests that both approaches (i.e., TAU and TAU+VR-CET) provide similar relapse-rates at medium and long term. These results should nonetheless be generalized cautiously, since the high drop-out rates, yet consistent with other studies in the field (Stohs et al., 2019), longitudinally hinder any potential conclusions in this framework.

Implications of the VR in AUD

The data from this study underscore the potential of technological advancements to offer valuable insights into the treatment-resistant patterns observed in individuals with AUD. Virtual reality technology offers a more ecologically valid approach compared to traditional cue-exposure techniques (Simon et al., 2020), and can complement and upgrade existing methods in clinical psychology in terms of treatment approaches (Segawa et al., 2020). Fully immersive VR environments, enriched with motivating sensory stimuli and enabling extensive interaction, provide a heightened sense of realism. This VR approximation to real-life scenarios can elicit momentary responses, such as cue-induced alcohol craving or anxiety. The theoretical foundation of VR-CET aligns with the core principles of systematic desensitization (Hernández-Serrano et al., 2020). This approach aims to diminish or extinguish reactions to alcohol-related cues and contexts, such as alcohol craving (Mellentin et al., 2016). Our research showed that prolonged, gradual, and systematic exposure significantly reduced responses to VR alcohol-related stimuli in patients with AUD as reflected by the intra-session data from the experimental group.

Limitations

Our study must be interpreted within the context of its limitations. Firstly, there was an imbalance in gender representation, and variables such as medication type and co-morbid psychopathological conditions were not controlled for. This was mainly due to the focus on treatment-resistant patterns in AUD, which made participant recruitment challenging. On another note, simple randomization was used for two fundamental reasons: simplicity, and absence of selection bias, as all subjects had equal probabilities of being assigned to one group or the other. Obviously, the greatest disadvantage of this method is the potential quantitative “imbalance” in the number of subjects between or across groups (as it happened, indeed, in our study), although the baseline comparison analyses of both groups guarantee an adequate and unbiased distribution of the subjects of study. Another limitation of the study was reflected by the overall drop-out rates. A total of 85 AUD patients were initially recruited for this study, with 51 successfully completing the protocol. It is worth noting that high non-adherence rates are commonplace in

this field, primarily due to the elevated levels of alcohol craving experienced during AUD treatment, which often lead to relapses both during and after treatment (Stohs et al., 2019). Additionally, the severity of AUD among our patients was considerable, as they all exhibited treatment-resistant patterns, representing the most severe end of the AUD spectrum. This underscores the significant challenges involved in managing recovery (Slidrecht et al., 2019), especially among our participants who were also diagnosed with co-morbid disorders such as anxiety, depression, or personality disorders. These co-occurring conditions further complicated communication and data collection processes. The results stemming specifically from hypothesis 2 should be cautiously generalized, since the authors did not compare the results of the EG vs CG, a fact that hinders and limits the statement on the relative effectiveness of both treatments. Finally, another significant limitation of the study refers to the follow-up data collection process itself. In substance use disorder research, variables such as time to/until lapse and relapse, total alcohol consumption, (heavy) drinking days, standard drink units per day, abstinence time, or craving (Bogenschutz et al., 2022; Brecht & Herbeck, 2014; Carroll et al., 2014; Slidrecht et al., 2019) are reported as indicators of treatment outcomes as part of the long-term data (at follow-ups) derived from clinical trials. Although our initial plan was to also consider several of these indicators, the COVID-19 pandemic led to collecting data from the patients at follow-up time points through phone calls instead of attending the Addictive Behaviors Unit in person. This critically interfered with reaching patients, in addition to patients having difficulties to accurately recall information about their alcohol use. Based on the limited data collected from the patients, we followed a previous study (Andersson et al., 2019), and we created a dichotomous item regarding alcohol use (yes/no) as a measure of treatment outcomes at 3-, 6-, and 12-month follow-ups (Table 4).

Future research directions

VR has shown promising short-term results, however further longitudinal research is necessary to assess the long-term effects of VR-CET on individuals with AUD (Durl et al., 2017). We acknowledge the importance of conducting an initial RCT with VR-CET in treatment-resistant adults with AUD, but we also suggest exploring additional complementary interventions (e.g., coping skills training) to potentially enhance treatment outcomes. Also, we strongly recommend incorporating measures to investigate the generalization of therapy effects to the everyday lives of patients to mitigate potential learning effects. Finally, further studies should include complementary measures, such as patients' perceived acceptability, a fact that will endorse and enhance the information on the usability and feasibility of the therapy itself.

Conclusions

The “time” factor (pre-test versus post-test) had an effect on craving and anxiety regardless of the type of treatment (EG vs CG) the participants received. Data from VR assessment indicated a tendency of the EG to report lower scores on both anxiety and craving in all of the four VR environments, a fact that is endorsed and supported by the differences in the effect sizes calculated between both treatment groups across the four environments. Additionally, participants in the EG displayed a gradual intra-session reduction in momentary alcohol craving and anxiety levels, from the first to the last session. In terms of relapse at follow-ups, the results should be interpreted cautiously since the limited data collection interferes with drawing solid conclusions about the long-term effects of VR-CET. More longitudinal research is therefore needed.

Although the incorporation of VR-CET into TAU programs may offer significant benefits, particularly in addressing alcohol craving and anxiety, the results of the present study should be interpreted carefully: 1) Future studies should expand their focus to include additional outcomes, such as total alcohol consumption, time to/ until lapse and relapse, (heavy) drinking days, standard drink units per day, abstinence time, or craving, to provide a more comprehensive understanding of the potential contributions of VR-CET in recovery management; 2) More long-term empirical research is warranted utilizing VR-CET in patients with AUD with different severity symptoms (mild, moderate, severe); 3) Further psychometric evaluation of VR should be conducted to compare traditional paper-and-pencil questionnaires with VR assessment.

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Conflicts of Interest

The authors declare no conflicts of interest.

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ORIGINAL

Association between emotional dependence, traumatic life events, and early maladaptive schemas in women with gambling disorder

Asociación entre dependencia emocional, sucesos vitales traumáticos, y esquemas desadaptativos tempranos en mujeres con trastorno de juego

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Abstract

Women with gambling disorder (GD) present a high number of traumatic life events, early maladaptive schemas, and emotional dependence towards the partner. The objectives of the study focused on (I) analyzing the relationships between traumatic life events, schemas, and emotional dependence in women with GD; (II) analyzing the differences in traumatic life events, emotional dependence, and schemas between women and men with GD; (III) analyzing the predictive role of traumatic life events and schemas in emotional dependence in women with GD; and (IV) analyzing the mediating role of schemas between traumatic life events and emotional dependence in a clinical sample of women with GD. The sample comprised 60 women ($M = 49.07$, $SD = 12.70$) and 48 men ($M = 41.33$, $SD = 12.32$) who were in outpatient treatment for GD. The findings reflected a significantly positive relationship between traumatic life events and early maladaptive schemas and emotional dependence (r between .31 and .57). Women reported higher scores in traumatic life events and the early maladaptive schema of self-sacrifice, whereas men did so in emotional dependence (attention-seeking) and in the early maladaptive schema of social isolation ($d \geq .34$). Finally, the mediating role of enmeshment and abandonment schemas in the relationship between traumatic life events and separation anxiety was demonstrated. The results allow the development of better interventions for women with GD. It is crucial to address enmeshment and abandonment patterns in women with GD with a history of traumatic life events to prevent them from leading to high emotional dependence on the partner.

Keywords: gambling disorder, traumatic life events, early maladaptive schemas, emotional dependence, women

Resumen

Las mujeres con trastorno de juego (TJ) presentan un elevado número de sucesos vitales traumáticos, esquemas desadaptativos tempranos y dependencia emocional hacia la pareja. Los objetivos del estudio se centraron en (I) analizar las relaciones entre sucesos vitales traumáticos, esquemas y dependencia emocional en mujeres con TJ; (II) analizar las diferencias en sucesos vitales traumáticos, dependencia emocional y esquemas entre mujeres y hombres con TJ; (III) analizar el papel predictivo de los sucesos vitales traumáticos y los esquemas en la dependencia emocional en mujeres con TJ; y (IV) analizar el papel mediador de los esquemas entre sucesos vitales traumáticos y dependencia emocional en una muestra clínica de mujeres con TJ. La muestra estuvo compuesta por 60 mujeres ($M = 49,07$, $DT = 12,70$) y 48 hombres ($M = 41,33$, $DT = 12,32$) que estaban en tratamiento ambulatorio por TJ. Los hallazgos reflejaron una relación positiva significativa entre los sucesos vitales traumáticos y los esquemas desadaptativos tempranos y la dependencia emocional (r entre ,31 y ,57). Las mujeres informaron puntuaciones más altas en sucesos vitales traumáticos y en el esquema desadaptativo temprano de autosacrificio, mientras que los hombres lo hicieron en dependencia emocional (búsqueda de atención) y en el esquema desadaptativo temprano de aislamiento social ($d \geq ,34$). Por último, se demostró el papel mediador de los esquemas de enredo y abandono en la relación entre los sucesos vitales traumáticos y la ansiedad por separación. Los resultados permiten el desarrollo de mejores intervenciones para mujeres con TJ. Es crucial abordar los patrones de apego/enredo y abandono en mujeres con TJ con antecedentes de sucesos vitales traumáticos para evitar que lleven a una alta dependencia emocional hacia la pareja.

Palabras clave: trastorno del juego, sucesos vitales traumáticos, esquemas desadaptativos tempranos, dependencia emocional, mujeres

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The prevalence of gambling disorder (GD) among women has been steadily increasing in recent years (Salonen et al., 2022). This could be due, in part, to new gambling modalities such as online gambling (Chóliz, 2016). Thus, the stigma of going to physical premises has been reduced (McCarthy et al., 2022). The consumption of online gambling is anonymous, convenient, and easy, and one can be connected from any place and device (Thomas et al., 2022). In addition, the design of the games is being modified to attract the female gender (McCarthy et al., 2019). All this has promoted the normalization and social acceptance of gambling behavior among women. It is losing the negative connotation that was previously implicit for years (McCarthy et al., 2023). Consequently, the harm stemming from gambling behavior in different domains of women's lives is increasingly severe (McCarthy et al., 2018). However, because men have historically presented a higher prevalence of GD than women, previous research has predominantly and even exclusively included only men (FEJAR, 2018). This has produced a significant bias in the current knowledge about women's gambling behavior and, thus, has posed a barrier to the development of effective prevention and treatment programs. More specifically, the treatment of GD in female gamblers is based on information from studies conducted in male gamblers (Estévez et al., 2023b). Such studies do not consider the specific personal, interpersonal, and contextual characteristics of female gamblers (Esparza-Reig et al., 2022). This has led to a high dropout and treatment failure rate among women (Granero et al., 2022; Lucas et al., 2023). Understanding gender-related differential factors in gambling behaviors is important for recovery processes (Lara-Huallipe et al., 2022; Miller & Söderpalm Gordh, 2022).

In this regard, previous studies have found a substantial comorbidity between GD and traumatic life events among women, now considered one of the most relevant psychological vulnerability factors in the involvement in gambling behaviors (Gavriel-Fried et al., 2020; Horak et al., 2021; Roberts et al., 2017; Thurm et al., 2023). Along these lines, women engage in gambling behaviors as a way to escape the painful emotions produced by traumatic experiences (Wang et al., 2020). Furthermore, the importance of the cumulative presence of traumatic experiences in the development of severe gambling problems has been mentioned, particularly challenging family situations, poor mental health, substance-related problems, and low educational attainment (Buth et al., 2017). However, although traumatic experiences are associated with an increased risk of developing and maintaining GD in adulthood, studies investigating the association between trauma and GD are scarce, and even more so among women (Horak et al., 2021; Russell et al., 2022).

In this sense, it has been shown that traumatic experiences in the first years of life establish erroneous beliefs that lead to developing early maladaptive schemas (Scott et al., 2020; Young & Brown, 1994). Early maladaptive schemas are beliefs consolidated at early ages and maintained throughout life as frozen learnings that encompass lived experiences, emotions, feelings, and bodily sensations concerning oneself and others. Thus, each problem is sustained by specific maladaptive schemas that guide the way of thinking, feeling, and behaving toward others throughout life (Young et al., 2013). Previous studies have shown that early maladaptive schemas are linked with behavioral addictions and, more specifically, with GD (Vieira et al., 2023). However, although it has been proven that both early maladaptive schemas and childhood trauma may lead to alcohol and substance use in women, there is no previous research on this topic on female gamblers (Ozgu & Isil, 2024).

Thus, the affective deficiencies experienced in childhood and the abandonment schema, that encompasses beliefs related to the possibility of breaking up with the partner at any time, may lead to emotional dependence towards the partner (Huerta et al., 2016; Momeñe et al., 2021). Emotional dependence towards the partner is characterized by an extreme need for the partner's contact and affection (Momeñe et al., 2022). People with dependence tend to prioritize their partner, assume submissive behaviors in the relationship, and present an intense terror of rejection or breakup. It has been shown that through emotional dependence, they disfunctionally fulfill early unsatisfied affective deficiencies: lack of support, lack of feeling alive, lack of self-acceptance, and low self-esteem (Castelló, 2019; Urbiola et al., 2017). For its part, this abandonment belief produces considerable anxiety, as it involves being constantly alert and performing checking behaviors that ensure the continuity of the relationship. This fear of loss, loneliness, and/or abandonment contaminates the affective bond, making it dysfunctional and pathological (Sirvent & Moral, 2018). Very few studies analyzed the relationship between emotional dependence and GD. It has been found that those gamblers with high gambling severity and poor mental health present greater emotional dependence (Aonso-Diego et al., 2024). Macía et al. (2023) also concluded that gamblers presented greater emotional dependence compared to no gamblers, but no significant differences in emotional dependence based on sex have been found in gamblers. Sex differences on emotional dependency remain unclear, since very few studies address this topic in GD, and previous studies in community samples present mixed results and are non conclusive on whether males or females present higher rates of emotional dependency (Castillo-González & Terán-Andrade, 2024; Estevez et al., 2017). Consequently, the role of emotional dependence in women's GD is still unknown.

The strong link between gambling problems, traumatic life events, early maladaptive schemas, and emotional dependence is well known. However, although previous studies show that early maladaptive schemas mediate the relationship between traumatic life events and psychological distress, and that intimate partner violence mediates the relationship between emotional dependency and addictive behaviors such as gambling (Gong & Chan, 2018; Macía et al., 2022), there is no previous research that assesses the mediating role of early maladaptive schemas among traumatic life events and emotional dependency in GD. Additionally, there are very few studies that include clinical samples of women with GD. It is important to conduct studies with women with GD to identify gender-specific needs and understand the extent of these relationships, and to design effective prevention and intervention programs. Consequently, the study aimed to (I) analyze the relationships between traumatic life events, early maladaptive schemas, and emotional dependence in female gamblers; (II) analyze the differences in traumatic life events, emotional dependence, and early maladaptive schemas among female and male gamblers; (III) analyze the predictive role of early maladaptive schemas and traumatic life events in emotional dependence; (IV) analyze the mediating role of early maladaptive schemas between traumatic life events and emotional dependence.

Method

Participants

A cross-sectional study was carried out with a Spanish sample of 60 women (age: $M = 49.07$; $SD = 12.70$) and 48 men (age: $M = 41.33$; $SD = 12.32$) with GD as a clinical group, recruited by convenience sampling in GD treatment associations belonging to FEJAR (Spanish Federation of Rehabilitated Gamblers). The age range of participants was 21-79 years old. The sample was recruited in both individual and group settings. Inclusion criteria included attending outpatient treatment addressing GD and scoring as a problem gambler on the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987) (see instruments section for further details) and being of legal age to participate in the study. Exclusion criteria included not scoring as a problem gambler on the SOGS (i.e., < 4 points) and not being of legal age.

The group of women gamblers (Mean SOGS score = 9.13, $SD = 2.17$) had the next characteristics: (1) Employment status: active workers (45%), unemployed (26.6%), retired (15%), students (1.7%), student and active worker (1.7%), other status (10%); (2) Marital status: single (41.7%), married (31.7%), separated or divorced (16.7%), widow (6.7%), other status (3.3%); (3) Education level: primary studies (33.3%); professional training (30%); university studies (16.7%), secondary studies (16.7%), and no studies (3.3%).

The group of men gamblers (Mean SOGS score = 9.42, $SD = 2.30$) had the next characteristics: (1) Employment status: active workers (68.8%), unemployed (6.3%), retired (8.3%), students (6.3%), and other status (10.4%); (2) Marital status: single (35.4%), married (33.3%), separated or divorced (14.6%), common-law partnership (12.5%), widow (2.1%), and other status (2.1%); (3) Education level: professional training (47.9%), university studies (18.8%), secondary studies (14.6%), primary studies (8.3%), no studies (8.3%) and other status (2.1%) (see Table 1).

Instruments

All participants completed an ad-hoc questionnaire in which they provided sociodemographic information relative to age, sex, employment status, civil status and educational level.

Gambling disorder. *South Oaks Gambling Screen* [SOGS] (Lesieur & Blume, 1987). The Spanish version was adapted by Echeburúa et al. (1994). The SOGS is a screening tool for GD that was developed for its detection in clinical populations. It consists of 20 items, which content is related to gambling patterns, sources of money to gamble, debt repayment, and involved emotions. Scores above 4 points suggest the possible presence of GD. Regarding its reliability, the SOGS has high internal consistency, with a Cronbach α of .94. In this study, Cronbach's α for the SOGS was .63.

Traumatic life events. *Centrality of Event Scale* (CES; Berntsen & Rubin, 2006, adapted to Spanish by Fernández-Alcántara et al., 2015). It comprises 20 items rated on a 5-point Likert scale (1 = *completely disagree*, 5 = *completely agree*). The instrument measures the centrality of a traumatic event in the respondents' life. At the beginning, participants are asked to remember their most traumatic life event to complete the questionnaire. The scale items are designed to assess how respondents interpret that traumatic event, whether it is perceived as a component of their personal identity, if it was a turning point in their life, and whether it is used by respondents to interpret other life events (Berntsen & Rubin, 2006). The authors reported a good reliability index (Cronbach's $\alpha = .91 - .94$). In the present study, Cronbach's alpha was also excellent ($\alpha = .94$).

Emotional Dependence. *Emotional Dependence Questionnaire* ("Cuestionario de Dependencia Emocional"; Lemos & Londoño, 2006) evaluates emotional dependence on the partner as a global construct through the sum of the items. It consists of 23 items distributed in six subscales: (1) *Separation anxiety* evaluates the emotional expression of fear of the possible breakup of the relationship; (2) *Affective expression of the partner* assesses the need for constant expressions of affection from the partner; (3) *Modification of plans* evaluates the change of plans and behaviors to satisfy the partner or to spend more time with them; (4) *Fear of loneliness* assesses the fear of not having a partner relationship and feeling

unwanted; (5) *Borderline expression* evaluates impulsive actions or manifestations of self-harm in the face of a possible breakup of the relationship; and (6) *Attention-seeking* assesses the respondent's seeking the attention of their partner to ensure their permanence in the relationship and to try to be the center of attention in their life. The response format is a 6-option Likert-type scale, ranging from 0 (*completely false*) to 5 (*describes me perfectly*). The original questionnaire presents good psychometric properties, with a Cronbach's alpha of .93. In the present study, Cronbach's alpha was .92.

Early maladaptive schemas. *Schema Questionnaire – Short Form* (Young & Brown, 1994) adapted to Spanish by Calvete et al. (2013). This questionnaire evaluates 18 schemas proposed by Young classified into four domains. This study evaluated the following 11 schemas according to the purpose of the study, grouped into four domains:

Domain of Disconnection/Rejection: (1) Emotional Deprivation includes beliefs that others will not adequately meet one's emotional needs or understand one's feelings. These people believe that they will be deprived of care (affection, affection, companionship, or attention), empathy (absence of listening and understanding), and protection (absence of determination, direction, guidance or guidelines from others); (2) Abandonment: People who develop this schema believe that they will be abandoned for someone better; (3) Abuse includes the belief that others will use one for their own purposes, hurt, deceive, or intentionally lie to one; (4) Defectiveness comprises the belief that one is imperfect, not valuable or loved, and inferior in important life aspects. Defects can be both private (e.g., aggression, unacceptable sexual desires) and public (e.g., appearance, social awkwardness); (5) Social Isolation refers to the feeling that one is isolated from the rest of the world.

Domain of Impaired Autonomy: (6) Failure includes the belief that one has failed, will inevitably fail, or is fundamentally inadequate compared to one's peers in terms of achievement; (7) Dependence refers to the belief that one is incapable of carrying out the activities of daily living competently without the help and approval of others; (8) Enmeshment includes the belief that it is impossible to be happy without the support and continuous and extreme proximity of a significant person. Excessive emotional involvement and closeness with one or more significant others at the expense of individuation or normal social development.

Domain of Other-Directedness: (9) Subjugation refers to excessive surrendering of control to others because one feels coerced, usually to avoid anger, retaliation, or abandonment; (10) Self-sacrifice comprises the belief that one must voluntarily satisfy the needs of others by postponing or giving up one's own needs.

Domain of Overvigilance and Emotional Inhibition: (11) Emotional Inhibition refers to the excessive inhibition of spontaneous action, feelings, or communication, usually

to avoid others' disapproval, feelings of shame, or losing control of one's impulses. Emotionally inhibited people believe that it is necessary to control spontaneous feelings and behaviors to avoid making mistakes.

The Spanish version presents good psychometric properties, with a Cronbach's alpha coefficient for the entire scale of .97 (Iruarrizaga et al., 2019). In this study, Cronbach's alpha coefficients were excellent in each subscale: Enmeshment ($\alpha = .78$), Abandonment ($\alpha = .87$), Abuse ($\alpha = .85$), Emotional Deprivation ($\alpha = .89$), Emotional Inhibition ($\alpha = .84$), Social Isolation ($\alpha = .78$), Subjugation ($\alpha = .83$), Self-Sacrifice ($\alpha = .86$), Failure ($\alpha = .87$), Defectiveness ($\alpha = .80$), and Dependence ($\alpha = .78$).

Procedure

The study participants had a diagnosis of GD. All of them were outpatients recruited through GD treatment associations belonging to FEJAR (Spanish Federation of Rehabilitated Gamblers). An invitation to participate was extended to all the associations, 23 in total, which recruited woman to participate in the study in individual and group settings in which woman were attending treatment. A total of 21 centers participated in the study.

They completed the questionnaires through two routes, online and face-to-face pencil-and-paper format. Firstly, to access the questionnaire, participants had to read the information about the main objectives of the study and give their informed consent. They were reminded that all the responses were anonymous and confidential and that their participation was voluntary and that they could leave the study at any time. The duration for completion of the study was approximately 30 minutes. No compensation was provided for participation in this study.

Ethics

The research obtained the ethics committee's approval from the first author's university (ref: ETK-17/20-21).

Data analysis

First, mean differences between male and female gamblers in gambling, traumatic life events, emotional dependence, and early maladaptive schemas were analyzed using Student's t-test to analyze the differences in traumatic life events, emotional dependence, and early maladaptive schemas among female and male gamblers. T-test results were chosen according to Levene's test of homoscedasticity, which controlled for the homogeneity of variance. Then, effect size was calculated using Cohen's *d* (1992), whose parameters establish that values below .20 correspond to a small effect size, around .50, to a medium effect size, and above .80, to a large effect size.

The correlations between the study variables were then analyzed using Pearson's *r* in the clinical sample of female gamblers to analyze the relationships between traumatic

life events, early maladaptive schemas, and emotional dependence in female gamblers. The results were contrasted by bootstrapping 1000 samples (95% Confidence Interval-CI). Next, hierarchical regression analyses were performed to test the predictive role of early maladaptive schemas and traumatic life events in emotional dependence, controlling for the effect of age in this sample. In the first step, age was introduced to control for its effect; in the second step, early maladaptive schemas were added; and in the third step, traumatic life events were added, verifying the changes in R^2 at each step. In total, six models were analyzed, one for each subscale of emotional dependence (separation anxiety, fear of loneliness, borderline expression, attention-seeking, affective expression, and plan modification).

Finally, multiple mediation analyses were conducted to analyze the mediating role of early maladaptive schemas between traumatic life events and emotional dependence in the clinical sample of female gamblers (Preacher & Hayes, 2008). First, the relationship between traumatic life events (independent variable [IV]) and mediating variables (early maladaptive schemas) (a-path), and between mediating variables (early maladaptive schemas) and emotional dependence (dependent variable [DV]) (b-path) were found to be significant. Then, the total effect between traumatic life events (IV) and emotional dependence (DV) along with the mediator variables (c-path) and the direct effect between traumatic life events (IV) and emotional dependence (DV), while controlling for the effect of mediator variables, were found to be significant. When both the c-path and the c'-path are significant, a partial mediation effect is shown, whereas if the c-path is significant and the c'-path is not, a total mediation effect is shown. A model was run for each of the six subscales of emotional dependence.

Results

The results related to correlations showed that traumatic life events correlated positively and significantly with early maladaptive schemas (enmeshment, abandonment, abuse, and emotional deprivation) and emotional dependence (total, separation anxiety, and borderline expression). Early maladaptive schemas correlated positively and significantly with emotional dependence. Specifically, total emotional dependence correlated with early maladaptive schemas of abandonment, abuse, emotional deprivation, social isolation, subjugation, and defectiveness (see Table 2).

Secondly, mean differences between traumatic life events, emotional dependence, and early maladaptive schemas between female and male gamblers were analyzed (Table 3). Females scored significantly higher on traumatic life events and the early maladaptive schema of self-sacrifice, whereas males scored significantly higher on emotional dependence/attention-seeking and the early maladaptive schema of social isolation. The effect size of the significant differences

Table 1
Sociodemographic data of the sample

	Male gambler	Female gambler
Age (M, SD)	41.33(12.32)	49.07(12.70)
Gambling - SOGS (M, SD)	9.42(2.30)	9.13(2.17)
Employment situation		
Working	68.8%	45%
Unemployment benefits	4.2%	23.3%
Student	6.3%	1.7%
Retired	8.3%	15%
Student and worker	0%	1.7%
Unemployed	2.1%	3.3%
Others	10.4%	10%
Civil status		
Single	35.4%	41.7%
Married	33.3%	31.7%
Common-law couple	12.5%	0%
Separated-Divorced	14.6%	16.7%
Widowed	2.1%	6.7%
Others	2.1%	3.3%
Education level		
Without studies	8.3%	3.3%
Primary	8.3%	33.3%
Secondary	8.3%	6.7%
High school	6.3%	10%
Vocational training	47.9%	30%
University studies	18.8%	16.7%
Others	2.1%	-

found was moderate in traumatic life events, emotional dependence/attention seeking, and the maladaptive schemas of social isolation, and self-sacrifice.

Thirdly, hierarchical regression analyses of the predictive role of early maladaptive schemas and traumatic life events in emotional dependence were performed controlling for the effect of age (Tables 4, 5, 6, 7 and 8). In the case of separation anxiety, early maladaptive schemas of enmeshment, abandonment, subjugation, and dependence were predictors, with a significant effect of age. In the case of affective expression, early maladaptive schemas of enmeshment, abandonment and subjugation were predictors, with a significant effect of age. Furthermore, when introducing traumatic life events in the third step, they were also predictors, with a significant change in R^2 at that step. In the case of fear of loneliness, early maladaptive schemas of subjugation and self-sacrifice were predictors. In the case of borderline expression, the early maladaptive schema of subjugation was predictive. In the case of attention-seeking, neither early maladaptive schemas nor

Table 2
Correlations between traumatic life events, early maladaptive schemas, and emotional dependence in female gamblers

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Traumatic life events	-																	
CI 95% LL																		
CI 95% UL																		
2. EMS - Enmeshment	.31*	-																
CI 95% LL	.02																	
CI 95% UL	.54																	
3. EMS - Abandonment	.46**	.63**	-															
CI 95% LL	.26	.38																
CI 95% UL	.64	.83																
4. EMS- Abuse	.47**	.40**	.64**	-														
CI 95% LL	.25	.12	.44															
CI 95% UL	.64	.64	.82															
5. EMS- Emotional Deprivation	.37*	.19	.434**	.69**	-													
CI 95% LL	.09	-.07	.22	.49														
CI 95% UL	.56	.45	.65	.86														
6.EMS- Emotional Inhibition	.05	.11	.22	.18	.08	-												
CI 95% LL	-.24	-.30	-.05	-.10	-.19													
CI 95% UL	.34	.49	.50	.47	.38													
7. EMS- Social Isolation	.21	.04	.21	.48**	.51**	.31*	-											
CI 95% LL	-.05	-.19	-.06	.16	.25	.10												
CI 95% UL	.41	.29	.47	.75	.76	.51												
8. EMS- Subjugation	.26	.45**	.38*	.40**	.43**	.27	.52**	-										
CI 95% LL	-.01	.18	.08	.03	.11	-.08	.24											
CI 95% UL	.49	.65	.62	.68	.70	.62	.74											
9. EMS- Self-sacrifice	.03	.29	.10	.20	.11	.01	-.15	.41**	-									
CI 95% LL	-.33	.03	-.24	-.12	-.24	-.32	-.50	.15										
CI 95% UL	.41	.54	.39	.45	.44	.32	.25	.64										
10.EMS- Failure	.22	.10	.15	.19	.29	.35*	.33*	.17	-.20	-								
CI 95% LL	-.04	-.22	-.11	-.10	-.03	.10	-.10	-.09	-.50									
CI 95% UL	.43	.44	.44	.49	.58	.62	.65	.46	.16									
11. EMS- Defectiveness	.21	.05	.11	.22	.35*	.41**	.52**	.37*	-.02	.46**	-							
CI 95% LL	-.03	-.23	-.18	-.04	.06	.08	.19	.10	-.40	.07								
CI 95% UL	.42	.40	.42	.51	.65	.69	.79	.62	.430	.74								
12. EMS-Dependence	.04	.18	.41**	.21	.10	.32*	.19	.22	.23	.11	.38*	-						
CI 95% LL	-.22	-.16	-.03	-.10	-.20	.12	-.09	-.03	-.11	-.15	.08							
CI 95% UL	.26	.43	.65	.51	.37	.59	.51	.42	.47	.47	.65							
13. Total Emotional Dependence	.25	.11	.57**	.37*	.44**	.23	.45**	.49**	-.10	.19	.34*	.21	-					
CI 95% LL	.01	-.19	.33	-.01	.08	-.001	.23	.25	-.41	-.10	.12	-.14						
CI 95% UL	.46	.42	.75	.69	.72	.49	.65	.72	.29	.45	.56	.48						
14. ED- Separation anxiety	.36*	.12	.66**	.46**	.46**	.38*	.44**	.40**	-.10	.24	.34*	.23	.92**	-				
CI 95% LL	.09	-.17	.47	.13	.13	.15	.24	.12	-.40	-.03	.12	-.10	.84					
CI 95% UL	.57	.43	.82	.73	.74	.60	.65	.65	.26	.50	.57	.49	.95					
15. ED- Emotional expression	.09	.01	.48**	.27	.32*	.09	.355*	.351*	-.093	.19	.38*	.23	.85**	.73**	-			
CI 95% LL	-.16	-.27	.20	-.10	-.05	-.18	.08	.08	-.44	-.10	.07	-.18	.77	.55				
CI 95% UL	.37	.31	.71	.56	.62	.34	.57	.56	.33	.45	.63	.53	.91	.86				

Table 2 (cont.)

Correlations between traumatic life events, early maladaptive schemas, and emotional dependence in female gamblers

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
16. ED – Modification of plans	-.05	-.09	.06	.14	.15	.04	.31*	.28	.004	-.10	-.01	-.10	.57**	.38*	.36*	-		
CI 95% LL	-.34	-.38	-.32	-.24	-.20	-.26	-.11	-.10	-.35	-.34	-.31	-.36	.22	-.001	.002			
CI 95% UL	.22	.19	.36	.48	.48	.37	.60	.59	.39	.14	.29	.27	.79	.65	.66			
17. ED – Fear of loneliness	.17	.10	.36*	.13	.31*	.17	.35*	.55**	-.11	.11	.30	.26	.73**	.58**	.56**	.23	-	
CI 95% LL	-.11	-.18	.11	-.19	-.03	-.09	.11	.28	-.42	-.18	.06	.003	.57	.33	.32	-.13		
CI 95% UL	.46	.39	.58	.46	.62	.46	.59	.76	.21	.37	.52	.50	.84	.76	.73	.55		
18. ED – Borderline expression	.26	.31*	.52**	.37*	.49**	.12	.33*	.47**	-.13	.31*	.20	.07	.78**	.71**	.58**	.35*	.60**	-
CI 95% LL	.06	.03	.35	.10	.17	-.13	.07	.25	-.38	-.08	-.05	-.17	.62	.48	.37	.01	.38	
CI 95% UL	.49	.57	.69	.65	.75	.42	.61	.67	.18	.64	.50	.42	.87	.84	.75	.61	.77	
19. ED – Attention-seeking	.28	.16	.45**	.26	.28	.09	.22	.25	-.03	.08	.32*	.27	.77**	.67**	.66**	.38*	.50**	.51**
CI 95% LL	.03	-.13	.09	-.09	.01	-.12	-.09	-.02	-.35	-.21	.04	-.29	.58	.40	.42	.01	.22	.17
CI 95% UL	.49	.48	.71	.59	.54	.29	.51	.48	.31	.31	.52	.60	.89	.82	.80	.68	.71	.72

Note. CI = Confidence Interval; LL = Lower Level; UL = Upper Level; EMS = Early Maladaptive Schemas; ED = Emotional Dependence.

* $p < .05$. ** $p < .01$.

Table 3

Difference in means between male and female gamblers in traumatic events, early maladaptive schemas and emotional dependence

	Male gamblers M(SD)	Female gamblers M(SD)	<i>t(df)</i>	<i>p</i>	<i>d</i>
Traumatic life events	69.54(17.47)	75.39(14.20)	-1.78(1,91)*	.04	-.37
Emotional dependence	66.14(21.39)	61.83(23.15)	.93(1,92)	.18	.19
Separation anxiety	20.07(8.56)	18.70(8.84)	.76(1,93)	.22	.16
Emotional expression	13.70(4.77)	13.45(5.39)	.23(1,94)	.41	.05
Modification of plans	10.65(4.57)	10.08(4.83)	.60(1,94)	.28	.12
Fear of loneliness	8.56(4.52)	8.92(4.43)	-.40(1,94)	.35	-.08
Borderline Expression	6.28(3.51)	5.74(2.93)	.83(1,94)	.21	.17
Attention-seeking	6.00(2.73)	4.94(2.83)	1.83(1,93)*	.04	.38
Early Maladaptive Schemas					
Enmeshment	10.67(5.50)	11.38(6.58)	-.55(1,90)	.29	-.11
Abandonment	13.85(6.69)	13.84(7.28)	.01(1,92)	.50	.001
Abuse	12.38(6.62)	12.37(6.43)	.003(1,92)	.50	.001
Emotional Deprivation	11.28(5.76)	13.70(7.83)	-1.66(1,92)	.05	-.35
Emotional Inhibition	12.31(5.91)	11.79(6.67)	.37(1,87)	.35	.08
Social Isolation	10.85(5.80)	9.04(4.58)	1.68(1,91)*	.04	.34
Subjugation	11.40(4.90)	12.13(6.40)	-.60(1,90)	.27	-.12
Self-sacrifice	17.15(5.83)	21.37(6.21)	-3.31(1,90)*	<.001	-.70
Failure	9.18(4.35)	9.10(4.62)	.08(1,88)	.47	.02
Defectiveness	10.13(5.18)	10.31(5.62)	-.16(1, 88)	.44	-.03
Dependence	9.78(4.96)	8.52(4.56)	1.26(1,90)	.11	.26

Note. * $p < .05$.

Table 4

Hierarchical regression of the predictive role of early maladaptive schemas and traumatic life events in emotional dependence (separation anxiety), controlling for the effect of age

Separation anxiety	<i>B</i>	<i>SE B</i>	<i>B</i>	<i>R</i> ²	Change in <i>R</i> ²	<i>p</i>
<i>Step 1</i>				.15	.15*	
Age	-.32*	.12	-.38*			.02
<i>Step 2</i>				.80	.65*	
Age	-.24*	.11	-.30*			.04
EMS- Enmeshment	-.80*	.17	-.58*			<.001
EMS- Abandonment	1.14*	.22	.88*			<.001
EMS-Abuse	-.15	.23	-.10			.53
EMS- Emotional Deprivation	.17	.17	.14			.33
EMS- Emotional Inhibition	.27	.15	.18			.09
EMS- Social Isolation	.02	.32	.01			.96
EMS- Subjugation	.47*	.22	.31*			.04
EMS- Self-sacrifice	-.04	.18	-.03			.84
EMS- Failure	.19	.29	.07			.53
EMS- Defectiveness	-.01	.31	-.003			.99
EMS-Dependence	-.75*	.30	-.28*			.02
<i>Step 3</i>				.80	.00	
Age	-.25*	.11	-.30*			.04
EMS- Enmeshment	-.80*	.18	-.68*			<.001
EMS- Abandonment	1.12*	.24	.87*			<.001
EMS-Abuse	-.16	.24	-.10			.52
EMS- Emotional Deprivation	.17	.18	.14			.33
EMS- Emotional Inhibition	.27	.16	.18			.09
EMS- Social Isolation	.02	.32	.02			.96
EMS- Subjugation	.46*	.22	.31*			.05
EMS- Self-sacrifice	-.04	.18	-.03			.84
EMS- Failure	.18	.30	.07			.55
EMS- Defectiveness	-.02	.32	-.01			.95
EMS-Dependence	-.74*	.32	-.27*			.03
Traumatic life events	.02	.07	.03			.81

Note 1. * = *p* <.05

Note 2. EMS = Early Maladaptive Schemas.

Table 5

Hierarchical regression of the predictive role of early maladaptive schemas and traumatic life events in emotional dependence (affective expression), controlling for the effect of age

Affective expression	B	SE B	β	R²	Change in R²	p
<i>Step 1</i>				.21	.21*	
Age	-.23*	.07	-.45*			.003
<i>Step 2</i>				.67	.47*	
Age	-.20*	.09	-.40*			.03
EMS- Enmeshment	-.54*	.13	-.64*			<.001
EMS- Abandonment	.62*	.17	.79*			.001
EMS-Abuse	-.16	.18	-.17			.40
EMS- Emotional Deprivation	.04	.13	.05			.79
EMS- Emotional Inhibition	-.19	.12	-.21			.11
EMS- Social Isolation	-.06	.25	-.05			.80
EMS- Subjugation	.40*	.17	.43*			.03
EMS- Self-sacrifice	-.01	.14	-.01			.96
EMS- Failure	.25	.23	.16			.27
EMS- Defectiveness	.16	.24	.13			.51
EMS-Dependence	-.35	.24	-.21			.15
<i>Step 3</i>				.72	.05*	
Age	-.18*	.08	-.36*			.04
EMS- Enmeshment	-.54*	.13	-.64*			<.001
EMS- Abandonment	.72*	.17	.92*			<.001
EMS-Abuse	-.09	.17	-.10			.61
EMS- Emotional Deprivation	.01	.13	.02			.92
EMS- Emotional Inhibition	-.23	.11	-.25			.05
EMS- Social Isolation	-.08	.23	-.07			.73
EMS- Subjugation	.41*	.16	.44*			.02
EMS- Self-sacrifice	-.01	.13	-.02			.92
EMS- Failure	.28	.21	.18			.20
EMS- Defectiveness	.27	.23	.22			.26
EMS-Dependence	-.45	.23	-.27			.06
Traumatic life events	-.11*	.05	-.27*			.04

Note 1. * $p < .05$.

Note 2. EMS = Early Maladaptive Schemas.

Table 6

Hierarchical regression of the predictive role of early maladaptive schemas and traumatic life events in emotional dependence (fear of loneliness), controlling for the effect of age

Fear of loneliness	B	SE B	β	R²	Change in R²	p
<i>Step 1</i>				.04	.04	
Age	-.08	.06	-.20			.20
<i>Step 2</i>				.62	.58*	
Age	-.02	.08	-.05			.77
EMS- Enmeshment	-.21	.12	-.31			.08
EMS- Abandonment	.22	.15	.35			.16
EMS-Abuse	-.21	.16	-.28			.20
EMS- Emotional Deprivation	.13	.12	.21			.29
EMS- Emotional Inhibition	-.03	.10	-.04			.78
EMS- Social Isolation	-.23	.21	-.22			.29
EMS- Subjugation	.63*	.15	.86*			<.001
EMS- Self-sacrifice	-.32*	.12	-.46*			.01
EMS- Failure	-.14	.20	-.11			.48
EMS- Defectiveness	.05	.21	.05			.81
EMS-Dependence	.19	.21	.14			.36
<i>Step 3</i>				.62	.00	
Age	-.02	.08	-.05			.78
EMS- Enmeshment	-.21	.12	-.31			.08
EMS- Abandonment	.22	.16	.35			.18
EMS-Abuse	-.21	.17	-.28			.22
EMS- Emotional Deprivation	.13	.12	.21			.30
EMS- Emotional Inhibition	-.03	.11	-.04			.79
EMS- Social Isolation	-.23	.22	-.22			.30
EMS- Subjugation	.63*	.15	.86*			<.001
EMS- Self-sacrifice	-.32*	.12	-.46*			.01
EMS- Failure	-.14	.20	-.11			.49
EMS- Defectiveness	.05	.22	.05			.82
EMS-Dependence	.19	.21	.14			.38
Traumatic live events	.00	.05	.001			.99

Note 1. * $p < .05$.

Note 2. EMS = Early Maladaptive Schemas.

Table 7

Hierarchical regression of the predictive role of early maladaptive schemas and traumatic life events in emotional dependence (borderline expression), controlling the effect of age

Borderline expression	B	SE B	β	R²	Change in R²	p
<i>Step 1</i>				.02	.02	
Age	-.04	.04	-.15			.37
<i>Step 2</i>				.59	.57*	
Age	-.07	.05	-.28			.16
EMS- Enmeshment	-.05	.08	-.11			.53
EMS- Abandonment	.11	.10	.28			.28
EMS-Abuse	-.03	.10	-.06			.79
EMS- Emotional Deprivation	.15	.08	.39			.07
EMS- Emotional Inhibition	-.02	.07	-.04			.76
EMS- Social Isolation	-.16	.14	-.24			.26
EMS- Subjugation	.28*	.10	.61*			.01
EMS- Self-sacrifice	-.15	.08	-.33			.07
EMS- Failure	.19	.13	.24			.15
EMS- Defectiveness	-.14	.14	-.22			.32
EMS-Dependence	-.10	.14	-.12			.47
<i>Step 3</i>				.59	.004	
Age	-.07	.05	-.27			.18
EMS- Enmeshment	-.05	.08	-.12			.53
EMS- Abandonment	.13	.11	.32			.24
EMS-Abuse	-.02	.11	-.04			.86
EMS- Emotional Deprivation	.14	.08	.38			.08
EMS- Emotional Inhibition	-.03	.07	-.06			.71
EMS- Social Isolation	-.17	.14	-.25			.26
EMS- Subjugation	.29*	.10	.61*			.01
EMS- Self-sacrifice	-.15	.08	-.34			.07
EMS- Failure	.20	.13	.24			.15
EMS- Defectiveness	-.12	.14	-.20			.39
EMS-Dependence	-.11	.14	-.13			.43
Traumatic life events	-.02	.03	-.08			.60

Note 1. * $p < .05$.

Note 2. EMS = Early Maladaptive Schemas.

Table 8

Hierarchical regression of the predictive role of early maladaptive schemas and traumatic life events in emotional dependence (attention seeking), controlling for the effect of age

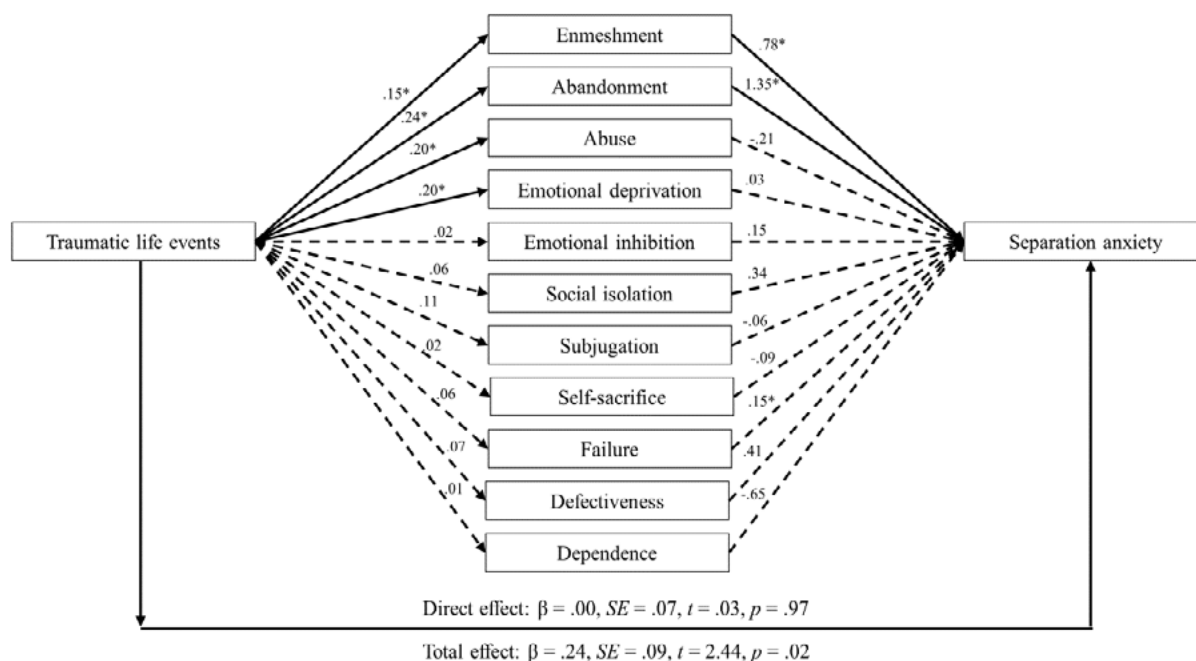
Attention-seeking	B	SE B	β	R ²	Change in R ²	p
<i>Step 1</i>				.11	.11*	
Age	-.09*	.04	-.34*			.03
<i>Step 2</i>				.35	.23	
Age	-.02	.06	-.08			.75
EMS- Enmeshment	-.10	.10	-.23			.32
EMS- Abandonment	.24	.13	.59			.07
EMS-Abuse	-.05	.13	-.11			.69
EMS- Emotional Deprivation	.03	.10	.07			.80
EMS- Emotional Inhibition	-.06	.09	-.12			.51
EMS- Social Isolation	-.05	.18	-.08			.77
EMS- Subjugation	.07	.13	.15			.56
EMS- Self-sacrifice	-.04	.10	-.09			.70
EMS- Failure	-.08	.17	-.10			.62
EMS- Defectiveness	.21	.18	.32			.26
EMS-Dependence	-.02	.17	-.02			.92
<i>Step 3</i>				.35	.003	
Age	-.02	.07	-.09			.73
EMS- Enmeshment	-.10	.10	-.22			.34
EMS- Abandonment	.23	.14	.56			.10
EMS-Abuse	-.06	.14	-.13			.65
EMS- Emotional Deprivation	.03	.10	.07			.78
EMS- Emotional Inhibition	-.05	.09	-.11			.56
EMS- Social Isolation	-.05	.19	-.07			.79
EMS- Subjugation	.07	.13	.15			.57
EMS- Self-sacrifice	-.04	.10	-.09			.71
EMS- Failure	-.09	.17	-.11			.61
EMS- Defectiveness	.19	.18	.30			.31
EMS-Dependence	-.01	.18	-.01			.97
Traumatic life events	.01	.04	.07			.72

Note 1. * $p < .05$.

Note 2. EMS = Early Maladaptive Schemas.

Figure 1

Mediational effect of early maladaptive schemas between traumatic life events and emotional dependence.



Note. * $p \leq .05$. Solid lines indicate significant indirect effects at a 95% confidence interval. Dashed lines indicate non-significant indirect effects at a 95% confidence interval.

traumatic life events were predictors. No significant effects were found in the case of plan modification.

Finally, multiple mediation analyses were conducted to analyze the mediating role of early maladaptive schemas between traumatic life events and emotional dependence (Figure 1). The results showed that there was a full mediation effect in the case of the relationship between traumatic life events and separation anxiety (a-path, b-path, and c-path were significant, whereas c'-path was not). Specifically, enmeshment and abandonment schemas were mediators of this relationship. Mediation effects were not found in the relationship between traumatic life events and the rest of the subscales of the emotional dependence.

Discussion

The first objective of the study was to analyze the relationships between traumatic life events, early maladaptive schemas, and emotional dependence in female gamblers. The results obtained showed that traumatic life events increased as early maladaptive schemas (enmeshment, abandonment, abuse, and emotional deprivation) and emotional dependence on the partner increased. These results are consistent with those reported by previous studies in general population in which childhood traumatic experiences of maltreatment were associated with early maladaptive

schemas of emotional deprivation and subjugation, as well as with abandonment and dependence schemas (Zheng et al., 2022). Furthermore, it has been mentioned that specific early maladaptive schemas may be important psychological correlates of behavioral addictions, including gambling (Vieira et al., 2023), as well as other psychological disorders, such as obsessive-compulsive disorder (Dostal & Pilkington, 2023; Yoosefi et al., 2016), depression (Bishop et al., 2022), anxiety (Tariq et al., 2021) and post-traumatic stress disorder (Greenblatt-Kimron et al., 2023). Previous studies show that early maladaptive schemas mediate the relationship between post-traumatic stress disorder and illicit substance use disorder (Lecigne & Tapia, 2018); additionally, women who have experienced traumatic life events such as child sexual abuse have greater degrees of impulsive behaviors mediated by early maladaptive schemas (Estévez et al., 2017), but these results are novel in women with GD.

In turn, the results suggested that early maladaptive schemas of abandonment, abuse, emotional deprivation, social isolation, subjugation, and defectiveness increased in parallel with emotional dependence toward the partner. These results are consistent with previous studies in general population in which emotional dependence toward a partner has been linked to the presence of early maladaptive schemas (Huerta et al., 2016), with abandonment and

subjugation schemas predominating (Momeñe et al., 2021). The predominance of schemas integrating the disconnection and rejection domain is noteworthy. This domain is based on the belief that the needs for security, protection, love, and respect will not be met or satisfied by others. These schemas usually emerge in cold, distant, unpredictable, rejecting, and abusive family environments (Young et al., 2013). Thus, these schemas encompass beliefs that are very present among people with emotional dependence. That is, the fear of being abandoned at any time, adopting submissive behaviors to avoid the breakup of the relationship, isolation from other friendships to prioritize caring for the partner, and the belief of being invalid or imperfect (Pinzón & Pérez, 2014). In this line, it has been mentioned that early maladaptive schemas developed through traumatic experiences perpetuate problematic emotional responses over the years as is the case of emotional dependence (Dadomo et al., 2016). Although gambling has been found to correlate with early maladaptive schemas in clinical samples of male gamblers (Shorey et al., 2012), there are no previous studies in clinical samples of women gamblers.

The second aim of the study was to analyze differences in traumatic life events, emotional dependency, and early maladaptive schemas between women and men with GD. Women reported higher scores on stressful life events and the early maladaptive schema of self-sacrifice compared to men. These results are consistent with previous studies in which female gamblers have been found to present more pre-gambling traumatic life events than men (Russel et al., 2022; Wang et al., 2020). In fact, many women with GD begin to gamble as a way of escaping from problems that overwhelm them, such as feelings of loneliness, abusive situations, and problematic relationships (Jauregui et al., 2018; Lelonek-Kuleta, 2021; Macía et al., 2023a). In this line, stressful life events have been related to the severity of gambling differentially in men and women, as they only correlated negatively with the improvement of GD symptoms in men (Gavriel-Fried et al., 2019). These results show the importance of including the management of traumatic life events in intervention programs for women with GD.

The predominant self-sacrifice schema in women with GD—which encompasses beliefs related to voluntarily satisfying the needs of others by postponing or renouncing one's own needs—can be explained by the role of caregiver socially assigned to women (Estévez et al., 2023a). This role implies women's permanent postponement and constant subordination of their own health in favor of others' well-being (Bueno et al., 2020). In GD, the breaching of gender stereotypes has a very negative impact on women gamblers, increasing their feelings of guilt for not following the imposed social mandate, especially if they have children (Rius-Buitrago et al., 2021).

On the other hand, in the present study, males obtained higher scores in emotional dependence, specifically in attention-seeking and in the early maladaptive schema of social isolation. These results coincide with previous studies in other populations in which men scored higher in emotional dependence (Estévez et al., 2017; Laca & Mejía, 2017; Momeñe et al., 2017). However, these results are novel in GD, since there are very few studies that have analyzed sex differences and those studies found higher rates of emotional dependency in women (Macía et al., 2023). More studies are needed to clarify sex differences in emotional dependency in individuals with GD. Additionally, the social isolation schema—which encompasses beliefs related to not belonging to any group or being different from others—could be explained through previous studies that point to a higher presence of antisocial behaviors among men with GD compared to women with GD (Carneiro et al., 2020).

The third objective of the study was to analyze the predictive role of early maladaptive schemas and traumatic life events in emotional dependence in women gamblers. The results obtained suggest that early maladaptive schemas of enmeshment, abandonment, subjugation, and dependence are predictors of separation anxiety. Likewise, the results suggest that early maladaptive schemas of enmeshment, abandonment and subjugation are predictors of affective expression. In the case of fear of loneliness, the results reflect the predictive role of early maladaptive schemas of subjugation and self-sacrifice. Finally, the early maladaptive subjugation schema predicted borderline expression, highlighting it as a predictor of emotional dependence. Beliefs related to the need to give up one's rights, postpone or forgo one's needs, and give in to coercion and control by others to avoid negative consequences (e.g., angry reactions or abandonment and relationship breakup) are very present among persons with emotional dependence. Their needs, hobbies, friendships, and family relationships—although the latter not so abruptly—take a back seat. Thus, they tend to sacrifice their own desires and needs, avoid circumstances that may jeopardize the continuity of the relationship, such as arguments, and adopt a subordinate or submissive role in the relationship (Castelló, 2019). In addition, they tend to be excessively obedient and compliant in couple relationships and delegate decision-making to the partner (Riso, 2014). All these retentive strategies produce a sense of security due to the belief that they can control the continuity of the relationship (Markez, 2015). The highlighted role of subjugation is of great interest in women gamblers, since gambling among females has been related with factors such as stress associated with family care roles or intimate partner violence, which are also related with subjugation (Hing et al., 2024; Holdsworth et al., 2012). Also, it has been found that the crossover of social strain and its emotional consequences from husband to wife are closely related to gambling problems in females, whereas

this phenomenon is not so common from wife to husband in male gamblers (Cheung, 2015).

The fourth objective of the study was to analyze the mediating role of early maladaptive schemas in the relationship between traumatic life events and emotional dependence in women gamblers. The results revealed the mediating role of attachment and abandonment schemas in the relationship between traumatic life events and separation anxiety. These results can be explained because specific traumatic life events can install dysfunctional schemas or beliefs related to the possibility of being abandoned by someone better at any time and the impossibility of being happy without the partner's presence and extreme support. This, in turn, favors the establishment of dependent partner relationships (Roth, 2014). Furthermore, in people with ED, it has been shown that early traumatic events generate early maladaptive schemas with implicit internal dialogues, maintaining a negative view of oneself and others. This negative view, together with low self-esteem, could explain the fear of abandonment and the need to remain attached to the partner as a source of security and well-being (Markez, 2015). Likewise, the belief that one cannot be happy without the partner's support and proximity is observed in the abrupt emotional ups and downs suffered depending on the state of the relationship, and the need for the partner to feel emotionally complete (Moral et al., 2018). Thus, these individuals present depressive episodes when the relationship is not going well or when the feared breakup occurs (Macía et al., 2023). In this regard, it has been pointed out that the probability of major depressive disorder is between 10 and 25 times higher than in the population without dependence (Cano, 2006). Although previous studies show lower rates of anxiety of separation in gamblers than in population with anxiety disorders (Pozzi et al., 2014), insecure attachment has been found to be a strong predictor of gambling problems (Ghinassi & Casale, 2023). In the case of women, insecure attachment predicted gambling problems in young populations of community samples (Macía et al., 2023). Previous studies have found that insecure attachment predicted relationship with others have been signaled as both the cause and cure of gambling problems in women (Karter, 2014), and fear of separation has been highlighted as a barrier to treatment for female problem gamblers (Kaufman et al., 2017). However, these results are novel in clinical population of female gamblers.

The present study presents some limitations. The first limitation concerns the study's cross-sectional nature, making it difficult to obtain causal relationships between the variables. It is recommended that the study be replicated in the future through a longitudinal study. A second limitation involves the scarce or null awareness of the problem presented by people with emotional dependence and their tendency to conceal it if they are aware of the problem (Sirvent & Moral, 2018). The third limitation of the study

is based on the use of self-report measures. Respondents can deduce what is being measured and can provide socially accepted answers, biasing the results. Finally, it is worth mentioning that the method of online sample acquisition was not considered as a relevant covariate, since previous studies show that there is no difference in the results depending on whether it has been collected online or in paper-and-pencil (Dodou & De Winter, 2014). It is also important to highlight that the romantic status has not been measured and it could have affected to the obtained results, so future studies should include and control this variable.

In conclusion, understanding the specific factors that favor the establishment of dependent partner relationships among women with GD could help to develop more effective prevention and treatment interventions. Thus, the importance of addressing enmeshment and abandonment patterns in women with GD with a history of traumatic life events has been shown to be important to prevent their leading to high emotional dependence on the partner. Furthermore, this study underlines the importance of the analysis of gender differences in gambling problems. These results can be helpful for interventions with clinical populations with GD. Clustering by sex can help to establish preventive and treatment interventions that are specific to each gender (Jiménez-Murcia et al., 2020). It has been proposed that due to the higher rates of traumatic life events such as intimate partner violence, which is also related to emotional dependency, women with GD may have a greater benefit from treatment in groups that only comprise women or individual therapeutic settings (Lamas et al., 2018). These results may provide guidance for conducting sex-specific interventions taking into account traumatic life events and psychological variables related to them.

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Ethics approval

The Institutional Review Board of the University of Deusto approved the study (ETK-17/20-21).

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ORIGINAL

A relational model of wellbeing-centered recovery in alcohol use disorder

Modelo relacional de la recuperación centrada en el bienestar en el trastorno por uso de alcohol

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Abstract

Wellbeing is a key element among the prevailing definitions of recovery from alcohol use disorder. However, there is an increasing need to develop a unified framework for recovery conceptualization and characterization of its components, as well as the mechanisms to achieve it. The objective of the study was to test a model relating the dimensions involved in recovery. A total of 348 participants with different periods of abstinence (range: 1 month-28 years) were assessed using self-reports of psychological well-being, quality of life, negative emotionality and coping strategies. Statistical analyses entailed an exploratory factor analysis (EFA) to uncover the underlying dimensions of psychological measures and a structural equation model (SEM) to elucidate their interrelations. The EFA identified 3 factors that explained 54.95% of the variance: i) Coping; ii) Functional Discomfort (emotional management and recovery capital); iii) Positive Mental Health (well-being and quality of life). The SEM demonstrated robust fit indices ($GFI = 1.00$, $SRMR = .137$) and explained 85% of the variance in well-being ($R^2 = .85$). The results suggest that during recovery in AUD, abstinence duration propels coping strategies which can ameliorate negative emotionality and enable an increase in personal and social resources. This process ultimately contributes to heightened well-being and an enhanced quality of life. The study represents a first methodologically sound proposal in Spain for a clinical recovery model centered on well-being. Its comprehensive paradigm not only reshapes our understanding of AUD recovery but also establishes a robust foundation for more efficacious clinical interventions and evaluations.

Keywords: model of recovery; alcohol use disorder; positive mental health; functional discomfort; enriched recovery; coping

Resumen

El bienestar es un elemento clave de las definiciones actuales de recuperación en el trastorno por uso de alcohol (TUA). No obstante, es preciso desarrollar un marco unificado para conceptualizar la recuperación, caracterizar sus elementos y los mecanismos para lograrla. El objetivo del estudio fue proponer un modelo que relacionara las dimensiones psicológicas implicadas en la recuperación del TUA. Se evaluó a 348 participantes con diferentes períodos de abstinencia (rango: 1 mes-28 años), mediante autoinformes de bienestar psicológico, calidad de vida, emocionalidad negativa y estrategias de afrontamiento. El análisis estadístico contó con un análisis factorial exploratorio (AFE) para identificar las dimensiones subyacentes a los indicadores evaluados y un modelo de ecuaciones estructurales (SEM) que las interrelacionó. El AFE identificó 3 factores que explicaron el 54,95% de la varianza: i) Afrontamiento; ii) Malestar Funcional (gestión emocional y capital de recuperación); iii) Salud Mental Positiva (bienestar y calidad de vida). El SEM mostró buenos índices de ajuste ($GFI = 1,00$, $SRMR = ,137$) y explicó el 85% de la varianza en Salud Mental Positiva ($R^2 = ,85$). Los resultados muestran que el tiempo de abstinencia se asocia con el aumento del empleo de estrategias de afrontamiento, lo que contribuye a la mejora del malestar funcional, y esto favorece la salud mental positiva. Esta investigación representa la primera propuesta metodológicamente sólida realizada en España para un modelo clínico de recuperación centrado en el bienestar, que redefine la comprensión de la recuperación en el TUA y proporciona soporte para intervenciones clínicas y evaluaciones más efectivas.

Palabras clave: modelo de recuperación, trastorno por uso de alcohol, salud mental positiva, malestar funcional, recuperación enriquecida, afrontamiento

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In 1948, the World Health Organization (WHO) expanded its definition of health to include new aspects with which to complete the concept. Health was thus considered to be “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 1948). Given this enrichment of the concept of health as transcending the mere absence of disease, a substantial revision of the notion of “recovery” has followed in various disciplines which also involved an extension of the scope of recovery beyond the remission of symptoms (Kaskutas et al., 2014, 2015; Slade et al., 2012). Nevertheless, the definition proposed by the WHO is weak in operationality as it uses terms such as “complete state of well-being” which lack a clear meaning (Moreno, 2008). These terms, while expressing an aspiration to optimal levels of health, are challenging in terms of practical application and measurement, thus raising questions about their rendering into measurable actions and criteria.

In response to this need for operationalization in optimal health approaches, new health models have been explored from a positive psychology perspective (Seligman & Csikszentmihalyi, 2000). The dual-factor model of mental health (Greenspoon & Saklofske, 2001), for example, illustrates mental health through two distinct but interrelated constructs: one focused on levels of distress, discomfort or dysfunction, and another on levels of well-being. Mental health is thus considered as a complete state that includes both the absence of negative indicators and the presence of positive parameters (Wang et al., 2011). Negative indicators in this model include psychopathology, symptoms of depression and anxiety, distress and mental disorders, while positive indicators include life satisfaction, psychological, emotional and social well-being (Magalhães & Calheiros, 2017; Westerhof & Keyes, 2010). Each of these would reflect two distinct continuums, rather than the extremes of a single spectrum. With evidence accumulating in different contexts and mental disorders (Iasiello & van Agteren, 2020), this model has developed a consistent psychometric foundation based on a two-dimensionality of health (Magalhães, 2024). However, this promising dual-factor model of mental health has yet to be developed in the field of recovery in addictive disorders.

In this context of a paradigm shift in health, recovery approaches are needed in the field of addictive disorders, in particular alcohol use disorder (AUD), that focus on the comprehensive health of the individual, beyond abstinence and remission of symptoms. Although the attempts to define recovery in substance use disorders have contributed positively to delimiting the concept and its constituents, a consensus is still clearly lacking (Ashford et al., 2019; Esteban-Rodríguez et al., 2024a; Inanlou et al., 2020; Witkiewitz et al., 2020). The diversity of definitions illustrates the lack of a consolidated theoretical framework unifying the understanding of recovery in AUD

(Kelly & Hoepfner, 2015). This scenario highlights the need to develop a holistic conceptual framework where a convergence of ideas and perspectives is promoted which can allow for a unified understanding of health-centred recovery.

Definitions proposed in the first decade of the 2000s (e.g., Betty Ford Institute Consensus Panel, 2007; Center for Substance Abuse Treatment, CSAT, 2005; UK Drug Policy Commission Group, UKDPC, 2008) were characterized by the integration of abstinence into the definition of recovery, although this was qualified by the admission that they were not totally comparable concepts. These initial post-paradigm shift definitions conceived recovery as a process that includes improvements in health, well-being and social participation. Later definitions (Ashford et al., 2019; Best et al., 2016; Substance Abuse and Mental Health Services Administration, 2011; Witkiewitz et al., 2020) have mainly highlighted the notions of well-being and quality of life, decoupling substance management from the definition itself. However, all of these definitions also present challenges in terms of applicability, as they tend to be more prescriptive than descriptive and are difficult to operationalize in practice.

In response to these criticisms, Kelly and Hoepfner (2015) proposed a biaxial model of recovery. This model is defined by two fundamental components: remission (maintaining sobriety) and recovery capital (resources to support recovery, for more information see the review by Hennessy et al., 2017). This model postulates that the relationship between remission and recovery capital is reciprocal, mediated by absolute reductions in stress and/or an improvement in coping strategies to manage it (Kelly & Hoepfner, 2015). Moreover, the biaxial model suggests that, instead of being static, the recovery process has different characteristics at different times of development, suggesting the existence of various stages or phases of change, depending on the length of abstinence (Kelly & Hoepfner, 2015). According to the proposal of the UK Drug Policy Commission (UKDPC, 2008), the biaxial model of recovery proposes three stages: early sobriety (first year of abstinence); sustained sobriety (1-5 years of abstinence); and stable sobriety (more than 5 years of abstinence).

In this regard, quantitative work has outlined different stages of recovery based on the interaction between abstinence duration and the different domains that have been linked to recovery. In the Spanish context, four stages have been proposed based on the alignment of well-being and quality of life levels between individuals with AUD and a control group without an addiction diagnosis (Rubio et al., 2023). Early recovery manifests itself during the first year of sobriety, where patients with AUD reach levels similar to those of healthy people in the quality of life in terms of physical health. Sustained recovery (from 1 to 4 years

of sobriety) is characterized by attaining the quality of life related to psychological health. With increasing abstinence duration, new alignments emerge in dimensions such as relational quality of life, affective symptoms, eudaimonic well-being and subjective well-being, marking the advanced recovery phase (from 4 to 10 years of sobriety). Finally, after 10 years of sobriety, alignments were observed in dimensions such as self-acceptance and autonomy (Rubio et al., 2023).

While this study (Rubio et al., 2023) and other research (Kelly et al., 2018) have provided valuable perspectives on long-term recovery and levels of positive and negative health at different times during abstinence, they raise the difficulty of how the recovery process should be approached in an integrated way. The considerable diversity of variables which have been used to characterize the stages has been beneficial in approaching the complexity of recovery, but hampers the development of a global vision of it as a unitary and dynamic process. Likewise, while these studies focused on analyzing the individual relationship of the variables with abstinence duration help to understand the process, they fail to provide information on how these dimensions interrelate to promote long-term recovery.

In summary, the development of the recovery paradigm in AUD, now oriented towards the comprehensive health of the individual, has prompted at least two crucial challenges. First, the absence of a common definition and operational dimensions of recovery makes it difficult to construct a solid theoretical framework, essential for a holistic and effective understanding of the process. Second, the lack of a model of interrelations between the various dimensions limits the description and understanding of the long-term recovery process.

The application of the dual-factor model of mental health in the field of AUD recovery could be beneficial in this context. The model offers a complete and operational conceptualization of health, addressing distress reduction (negative component) and the increase of positive mental health. Understanding recovery as the process of change towards that complete state of health can act as a link between the various definitions of recovery. While recent conceptualizations increasingly emphasize positive indicators of health (Ashford et al., 2019; Best et al., 2016; Substance Abuse and Mental Health Services Administration, 2011; Witkiewitz et al., 2020), conflicts have emerged when these are dissociated from symptoms, such as alcohol use (Esteban Rodríguez et al., 2024b). The dual model of health would allow distress reduction throughout the recovery process to be covered alongside the attainment of well-being as the ultimate goal, in accordance with the definitions of recovery. If abstinence and recovery capital are also taken into consideration, together with coping strategies, within Kelly and Hoepfner's biaxial model

framework (2015), a global and dynamic vision of the recovery process could be developed.

This study addresses key issues related to AUD recovery, integrating various domains to offer a comprehensive view of the process. The idea of recovery as a health-improving process is adopted, with both its negative and positive components considered. In addition, contributions from other specific models for addictive disorders are incorporated, examining the relationships of remission (abstinence), recovery capital, and coping strategies with these positive and negative health indicators.

From the understanding of addiction as a deeply rooted maladaptive operant behaviour (Apud & Romani, 2016; Heinz et al., 2019; Lewis, 2017; Lüscher et al., 2020; Ruiz Sánchez de León, 2022; Wise & Jordan, 2021), it may be posited that a significant behavioural change, such as ceasing consumption and adopting alternative behaviours, leads to a remission of negative health indices. In turn, eliminating the problem behaviour, developing coping strategies and reducing discomfort all promote positive health in people in recovery. It is thus hypothesized that recovery will evolve towards a state of full health: abstinence and coping strategies will be associated with a reduction of negative mental health indices, which will in turn promote substantial improvements in well-being and quality of life.

The aim of this study is therefore to verify the interconnections between psychological dimensions involved in recovery to achieve a state of positive mental health, formulating a relational model of recovery in a clinical population during abstinence.

Methods

Design

A cross-sectional study was carried out with a clinical sample of abstinent patients diagnosed with alcohol use disorder (AUD). The study included different abstinence durations, and patients were treated either in the psychiatric unit of the Hospital 12 de Octubre or in mutual aid groups in the Community of Madrid.

Participants

A sample of 348 participants diagnosed with AUD in complete sobriety was obtained (range of abstinence durations: 1 month to 28 years). All participants attended abstinence-oriented treatments, either in the alcohol program of the psychiatric unit of the Hospital 12 de Octubre, or in mutual support groups.

Participants with under two years of sobriety attended the Hospital 12 de Octubre program on an outpatient basis. This is a public treatment program (funded and managed by the Spanish public health system) with a two-year duration. For more details on the program, see Rubio

et al. (2018). After this, participation continued in mutual support groups.

To complete the sample, patients with more than two years of sobriety, attending mutual help groups, were invited to participate. More specifically, three associations of the Federation of Alcoholics of the Community of Madrid (FACOMA), which follow the cognitive-behavioural treatment model (FACOMA, 2016), and three from Alcoholics Anonymous (AA), with a 12-step model, participated in the study.

The sample comprised 114 women and 234 men aged between 27 and 75 years ($M = 52.71$; $SD = 9.01$). Patients

mostly had compulsory (38.79%) or higher education (34.20%), and 39.66% of them were in active employment. The abstinence durations up to the time of assessment ranged from 1 month to 28 years ($M = 3.84$ years; $SD = 4.44$), (Table 1).

All patients had been abstinent for at least one month and were not actively using other substances (except coffee and/or tobacco). Patients diagnosed with another psychiatric pathology or neurological condition that could interfere with the assessment were excluded.

Participants provided both spoken and written consent to participate in the study.

Table 1
Sample descriptives

Sociodemographic data		n	M (SD)/ Frequency (%)	Min.-Max.
Age		348	52.71 (9.01)	27-75
Sex	Male	234	67.24%	
	Female	114	32.76%	
Level of education	Compulsory education	135	38.79%	
	Secondary education	94	27.01%	
	Higher education	119	34.20%	
Employment	Active	138	39.66%	
	Unemployed	73	2.98%	
	Sick leave	41	11.78%	
	Student	3	.86%	
	Retired	92	26.44%	
	Marital status			
	Single	75	21.55%	
	Married	158	45.40%	
	Divorced	58	16.67%	
	Separated	13	3.74%	
	In a relationship	39	11.21%	
	Widowed	5	1.44%	
Clinical data		n	M (SD)/ Frequency (%)	Min.-Max.
Abstinence duration (in years)		348	3.84 (4.44)	1 month-28 years
Groups by abstinence duration	Less than 1 year	98	28.2%	
	1-5 years	164	47.1%	
	More than 5 years	86	24.7%	
Age of alcohol use onset		348	14.55 (4.07)	4 - 47
Smoker	No	173	49.71%	
	Yes	172	49.43%	
Prior use of other substances	No	206	59.20%	
	Yes	142	40.8%	
Treatment	Hospital	164	47.13%	
	FACOMA	129	37.07%	
	AA	55	15.80%	

Note. Means (M) of clinical and demographic measures, standard deviations (SD), frequency values (expressed in %), minimum (Min.) and maximum (Max.) values.

Instruments

- **Quality of Life Scale (WHOQOL-BREF).** The WHOQOL-BREF is an abridged version (27 items) of the original WHOQOL-100 (World Health Organization-Quality of Life, 1998), which measures four domains: A) Physical health, which includes activities of daily living, dependence on medication and medical aids, energy and fatigue, mobility, pain, sleep and work ability; B) Psychological health, which includes body image, negative and positive feelings, self-esteem, spirituality or personal beliefs, learning ability, memory and concentration; C) Social relationships, assessing personal relationships, social support and satisfaction with sexual activity; D) Environment, covering economic resources, physical safety, access to health and social care, home environment, opportunities to acquire new information and skills, participation in leisure activities, and transport. The domains show internal consistency alpha values of .82, .81, .68 and .80, respectively (Skevington et al., 2004). The Spanish version of the WHOQOL-BREF have an internal consistency range of .69 to .77 (Benitez-Borrego et al., 2014).
- **Psychological Well-Being Scale (PWBS).** This is based on Ryff's (1989a, 1989b) multidimensional model of psychological well-being. The 54-item version (van Dierendonck, 2004) used in this study assesses six dimensions: Self-acceptance (feeling good about oneself, recognizing one's own limitations); Autonomy (independence and self-determination); Environmental mastery (ability to choose or create favourable environments); Purpose in life (defining goals that give meaning to life); Personal growth (striving to develop potential) and Positive relationships (maintaining stable and trusting social relationships). The dimensions show internal consistency values of .83, .78, .77, .73, .65 and .80, respectively (van Dierendonck, 2004). The internal consistency of the Spanish version varies between .58 and .71 (Díaz et al., 2006).
- **Satisfaction With Life Scale (SWLS).** Life satisfaction refers to the overall assessment that people make of their own life, comparing their own life circumstances with the standards considered adequate (Diener et al., 1985). The original version shows an internal consistency of .87 (Diener et al., 1985), with the Spanish version of the SWLS having an internal consistency of .88 (Vázquez et al., 2013).
- **Hamilton Anxiety Rating Scale (HAM-A).** This self-report measure assesses the severity or intensity of anxiety symptoms. It comprises 14 items defined by both psychological and somatic symptoms. Its internal consistency values range from .79 to .86 (Hamilton, 1959). It has been translated into Cantonese, French and Spanish (Thompson, 2015). Our study used the Spanish version by Lobo et al. (2002).
- **Hamilton Depression Scale (HAM-D).** This self-report measure assesses the symptomatic profile and severity of depression. The version used consists of 21 items with 5 response options. Internal consistency values range from .76 to .92 (Hamilton, 1960). The Spanish version of HAM-D has an internal consistency of .78 (Bobes et al., 2003).
- **Acceptance and Action Questionnaire (AAQ-II).** This assesses experiential avoidance and psychological inflexibility. In the present study, the Spanish version of 10 items with 7 Likert-type response options was used. The original scale has an internal consistency of .87 (Bond et al., 2011).
- **Litman's Coping Behaviors Inventory (CBI).** Identifies the coping strategies used to avoid alcohol when experiencing desires to drink or risky situations. It distinguishes four factors or strategies: A) Positive thinking (reflecting on the positive consequences of abstinence); B) Negative thinking (reflecting on the problematic consequences of drinking); C) Distraction (starting pleasant activities); D) Avoidance (avoiding situations related to drinking). These factors explain 54% of the variance, with internal consistency values of .91, .81, .65 and .75, respectively (Litman et al., 1983). In Spanish samples, internal consistency values reach .90 in alcohol-dependent individuals (García González & Alonso Suárez, 2002).
- **Assessment of Recovery Capital (ARC).** This assesses 10 domains involved in recovery: substance use and sobriety, global psychological health, global physical health, community involvement, social support, meaningful activities, housing and safety, risk taking, coping and life functioning, and recovery experience (for more information see Groshkova et al. (2013). The original scale shows intraclass correlations between .50 and .73 (Groshkova et al., 2013), and the Spanish adaptation has an internal consistency of .90 (Sion et al., 2022).

Procedure

Sample size was determined in relation to the planned statistical analyses. Given the nature of exploratory factor analysis (EFA), the ratio of participants per element needed to be at least between 5:1 (Gorsuch, 1983) or 10:1 (Velicer & Fava, 1998), with a minimum of 100 participants. Since 19 dimensions (subscale dimensions and each scale's global concepts) were to be assessed, it was established that the minimum sample should comprise 100-190 participants for the EFA. With reference to structural equation modelling (SEM), Kline (2005) and Jackson (2003) recommend at least 200 observations, so in line with these standards, a final sample of 348 participants met all criteria.

A non-probabilistic convenience sampling strategy was used. Voluntary participation was requested from patients treated for AUD at the outpatient treatment program of the alcohol unit of the Hospital 12 de Octubre's psychiatric service, and from the mutual aid groups of the FACOMA and AA associations.

Participants from the Hospital 12 de Octubre were recruited in the treatment context. Senior psychiatrists responsible for the programme asked patients to participate in the study. The voluntary nature of participation, and that it would not in any way affect their treatment, was emphasised. Those who agreed to take part in the study were assessed individually at the hospital facilities.

Recruitment of participants from the FACOMA associations was carried out at the FACOMA offices by the psychologist responsible for the treatment groups and psychological support. Recruitment conditions were similar to those mentioned above: participation was to be explicitly voluntary, with no repercussions on treatment, and patients were assessed at each of the FACOMA offices. For AA group members, recruitment was carried out by a representative in charge of the invitation to the study. Those expressing an interest in the study were contacted by a senior psychiatrist from the Hospital 12 de Octubre, who also assessed them at the hospital facilities.

In all cases, once the study had been explained to them and each participant had signed the informed consent, they completed the questionnaires. These were administered in a single session (approximately 90 minutes), alongside a brief semi-structured interview to record sociodemographic and clinical data. The questionnaires were completed digitally using the RedCap platform with the support of the researchers. The responses to the questionnaires were entered into a database in SPSS for subsequent analysis.

All procedures were approved by the Ethics Committee of the Hospital 12 de Octubre, guaranteeing that the study and the methodology used met the essential ethical standards and deontological criteria governing the centre (CEIm 19/086).

Data analysis

First, a descriptive analysis was performed to explore the sociodemographic (e.g., age, gender, education level, employment status) and clinical characteristics (e.g., abstinence duration, previous treatments, age at onset of use) of the sample. A descriptive analysis of the questionnaire scores was also performed. Next, the questionnaire scores were compared according to the self-help group that the participants attended, adjusting for age and abstinence duration, using a MANCOVA analysis.

Third, correlations were calculated between abstinence duration (direct score in months) and the Z scores of the different scales and subscales. The Spearman coefficient (Spearman's rho) was used due to the lack of normality in

some variables, as determined by the Kolmogorov-Smirnov test, and/or because the Likert-type scale had fewer than six options. Only those variables showing significant correlations with abstinence duration were considered for further analysis.

The variables transformed into Z scores that showed significant correlations with abstinence duration were used in a structural equation model (SEM). SEMs allow effects and relationships between multiple variables to be estimated on the basis of the correlations existing in a sample in a cross-sectional manner (Ruiz et al., 2010), thereby making the model particularly suitable for this study. SEM assessment was carried out in two steps, taking into account that a valid measurement model is necessary prior to assessing the structural component (Orgaz Baz, 2008). Thus, an acceptable measurement model was first sought, before the structural component was assessed.

Although a preliminary hypothesis regarding the underlying dimensions was available, there was no sufficiently consolidated theory to specify a confirmatory model, so an exploratory factor analysis (EFA) was carried out. This approach allows the number and nature of latent factors to be identified without imposing a predetermined structure, in accordance with the recommendations of Ferrando and Anguiano-Carrasco (2010) in situations where the underlying theory is not yet fully developed. Unweighted least squares (ULS) was used as the estimation method, following the guidelines of Lloret-Segura et al., (2014), and Oblimin for factor rotation. The Kaiser rule was used to determine the number of factors.

Once the factors for guiding the measurement model were identified using EFA, the proposed theoretical model was assessed with the structural model. An advantage of SEM is that it makes it possible to propose the type and direction of the relationships expected to be found between the various variables contained in it, so that the parameters specified by the relationships proposed at a theoretical level can then be estimated (Ruiz et al., 2010). The theoretical specification of the model allows relational structures to be proposed between the variables, with some having an effect on others, thus creating concatenations of effects and allowing the path of influence between multiple variables to be measured (Escobedo Portillo et al., 2016).

The purpose of this specific model was to explain the variability in the factor identified in the positive mental health EFA, composed of quality-of-life, hedonic and eudaimonic well-being measures. This factor was selected as a dependent variable due to its presence in most current definitions of recovery, which emphasize said positive health indicators (Ashford et al., 2019; Best et al., 2016; Substance Abuse and Mental Health Services Administration, 2011; Witkiewitz et al., 2020). To this end, the scores of the other two factors identified in the EFA were used, alongside abstinence duration, in line with

our hypothesis. We were thus able to test our theoretical model and establish the direct and indirect contribution of sobriety and the identified factors to the variability of positive mental health. The ULS method was used for parameter estimation, appropriate for the type of variables used (Morata-Ramírez et al., 2015). The fit of the models was estimated using the indicators provided by the AMOS v.26 program: RMR (root mean square residual), SRMR (standardized root mean square residual), AGFI and GFI as absolute fit indices, as well as NFI (normed fit index) and RFI (relative fit index) as incremental indices. The criteria for the interpretation of these indicators were: AGFI, GFI, NFI and RFI $> .95$, and RMR and SRMR close to zero (Byrne, 2016; Hu & Bentler, 1999). The model is presented graphically, indicating the standardized regression weights and marginal measures. In addition, tables detailing the standardized total and indirect effects are provided, offering a comprehensive view of the interrelations between the variables studied.

All analyses were performed using the statistical software SPSS v.26 (IBM, 2019) and AMOS v.26, with the level of significance set at $p < .05$.

Results

Table 2 shows the descriptive analysis of the questionnaire scores, including subscales. When comparing the scores on the different scales according to the mutual aid group in which treatment was received, statistically significant differences ($p < .05$), adjusted for abstinence duration and age, were found only in the Environment subscale of the WHOQOL-Bref questionnaire ($F = 6,27$; $p = .014$; $\eta^2 = 0.04$), (Table 2). AA participants had higher scores in the subjective assessment of their environment than those from FACOMA. In the other variables, no statistically significant differences were found when comparing the mutual aid group attended for treatment.

Correlation analysis between abstinence duration and scale scores revealed statistically significant correlations ($p < .05$) between abstinence duration and scores on all scales and subscales (Table 3), except for the environment-related quality of life subscale (WHOQOL-Bref), the psychological well-being subscale regarding positive relationships (PWBS), and avoidance strategy use (CBI). These were therefore excluded from subsequent analyses.

Exploratory factor analysis (EFA) identified three factors which explained 54.95% of the total variance. The sampling adequacy criteria, reflected by the Kaiser-Meyer-Olkin test ($KMO = .871$), as well as Bartlett's sphericity criteria were met ($\chi^2 = 2128,19$; $p < .05$), indicating that the data were suitable for factor analysis. Factor 1, Positive Mental Health, included variables related to psychological or eudaimonic well-being, quality of life, and life satisfaction. Factor 2, Functional Discomfort, included

the scales of depression, anxiety, experiential avoidance, and recovery capital, the latter with negative loadings. Factor 3, Coping, comprised coping skills (see Table 4). The commonalities between variables and factors were greater than 15%, and the factor weights exceeded the .40 threshold recommended for samples larger than 150 participants, except for the life satisfaction variable, which had a factor loading of .364 on one factor and .361 on the other.

Based on these EFA results, the SEM measurement model was constructed with the three identified and correlated factors, and the validity of the model with adequate fit indices (GFI = .975; AGFI = .964; RMR = .074; SRMR = .074; NFI = .963; RFI = .955) was confirmed. Coping, Functional Discomfort, and Positive Mental Health were thus used as latent dimensions.

Relationships between these latent factors as well as abstinence duration were established following the working hypothesis, and the structural model was built. Thus, the SEM shown in Figure 1 reflects the relational hypothesis by which abstinence duration is associated with the use of coping strategies, which are in turn related to a decrease in functional discomfort, contributing to the increase in positive mental health. The model explained 85% of the variance in Positive Mental Health ($R^2 = .85$) with adequate fit indices (GFI = 1.00; AGFI = 1.00; RMR = .136; SRMR = .137; NFI = .999; RFI = .999).

Coping had a statistically significant impact on both Functional Discomfort (standardized total effect = $-.392$; $p < .001$) and Positive Mental Health (standardized total effect = $.876$; $p < .001$). In turn, Functional Discomfort also had a statistically significant effect on Positive Mental Health (standardized total effect = $-.731$; $p < .001$), (see Table 5).

In line with the working hypothesis, abstinence duration also had a direct and statistically significant effect on Coping (standardized total effect = $.772$; $p = .02$). However, no statistically significant effect of abstinence on Positive Mental Health was found (Total standardized effect = $.296$; $p = .145$). It should be noted here that, while the direct effect of abstinence duration on Positive Mental Health was negative (standardized direct effect = $-.381$), the indirect effect was positive and stronger (standardized indirect effect = $.677$), (see Table 6).

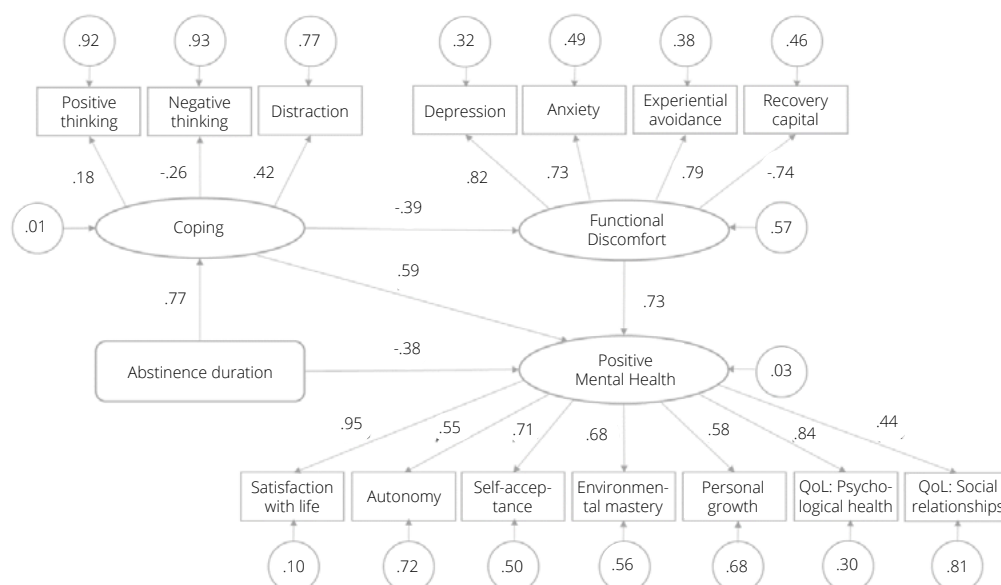
Finally, as Figure 1 shows, the regression weights of the scores on the different scales and subscales on the corresponding factors exceeded .40, and the commonalities exceeded 15%, with the exception of positive and negative thinking strategies, the latter also having a negative regression weight.

Table 2
Descriptives of scale scores and MANCOVA by mutual aid program (MAP)

Scales	MANCOVA by MAP						
	M	SD	Min.	Max.	F	p	μ^2_p
Depression (HAM-D)	11.76	8.15	1.00	47.00	0.095	.758	.001
Anxiety (HAM-A)	9.03	6.85	1.00	42.00	0.684	.410	.005
Satisfaction with life (SWLS)	21.33	6.47	5.00	35.00	0.027	.870	.000
Autonomy (PWBS)	37.60	6.68	17.00	51.00	0.052	.820	.000
Relationship with others (PWBS)	39.87	7.73	20.00	54.00	0.120	.729	.001
Self-acceptance (PWBS)	35.61	8.29	10.00	53.00	2.676	.104	.018
Environmental mastery (PWBS)	38.70	8.22	16.00	54.00	3.869	.051	.027
Purpose (PWBS)	37.05	7.52	13.00	54.00	1.082	.300	.008
Growth (PWBS)	37.66	7.96	15.00	53.00	0.987	.322	.007
Physical health (WHOQOL)	13.67	1.88	8.00	17.71	2.817	.095	.019
Psychological health (WHOQOL)	14.04	2.25	6.67	18.00	0.009	.925	.000
Social relationships (WHOQOL)	13.56	3.01	5.00	20.00	0.365	.547	.003
Environment (WHOQOL)	15.40	2.08	9.00	20.00	6.256	.014*	.042
Experiential avoidance and psychological inflexibility (AAQ-II)	32.37	11.14	11.00	64.00	0.251	.617	.002
Positive thinking (CBI)	28.90	4.53	10.00	37.00	2.402	.123	.017
Negative thinking (CBI)	17.34	5.39	0	24.00	1.085	.299	.008
Distraction (CBI)	16.89	6.66	0	30.00	0.084	.773	.001
Avoidance (CBI)	9.03	3.06	0	15.00	0.097	.756	.001
Total Recovery Capital (ARC)	43.55	6.68	8.00	50.00	0.004	.949	.000

Note. (*) $p < .05$. Means (M) of the scale scores, standard deviations (SD), minimum (Min.) and maximum (Max.) values. MANCOVA of the questionnaire scores by type of mutual aid program (FACOMA vs AA), adjusting for age and abstinence duration.

Figure 1
Structural equation model of AUD recovery



Note. Rectangles represent observable variables. Ovals represent unobservable (latent) variables. Circles represent marginal measures. Straight arrows represent structural effects, originating in the predictor variable and ending at the arrowhead in the dependent variable. The parameters of the standardized direct effects of the model are shown on the corresponding arrow.

Table 3

Spearman correlation between abstinence duration and scale scores

Scale	Abstinence duration
Depression (HAM-D)	-.283**
Anxiety (HAM-A)	-.245**
Satisfaction with life (SWLS)	.275**
Autonomy (PWBS)	.167**
Positive relationships (PWBS)	.066
Self-acceptance (PWBS)	.203**
Environmental mastery (PWBS)	.214**
Purpose in life (PWBS)	.108*
Personal growth (PWBS)	.255**
Physical health (WHOQOL-Bref)	.148**
Psychological health (WHOQOL-Bref)	.302**
Social relationships (WHOQOL-Bref)	.132*
Environment (WHOQOL-Bref)	.067
Experiential avoidance and psychological inflexibility (AAQ-II)	-.361**
Recovery capital (ARC)	.248**
Positive thinking (CBI)	.160**
Negative thinking (CBI)	-.193**
Distraction (CBI)	.366**
Avoidance (CBI)	.090

Note. Spearman's Rho correlation values between Z scores on the subscales and abstinence duration. *p < .05; **p < .01.

Table 4

Reduction of recovery indicators to dimensions. EFA: Rotated loading matrix and communalities

Variables	Factor			Commonalities
	1	2	3	
Self-acceptance (PWBS)	.850			.725
Psychological health (WHOQOL)	.692			.583
Autonomy (PWBS)	.686			.399
Environmental mastery (PWBS)	.574			.672
Personal growth (PWBS)	.568			.426
Social relationships (WHOQOL)	.411			.379
Life satisfaction (SWLS)	.364	-.361		.469
Depression (HAM-D)		.913		.784
Anxiety (HAM-A)		.689		.544
Recovery capital (ARC)		-.627		.661
Experiential avoidance and psychological inflexibility (AAQ-II)	-.340	.486		.557
Negative thinking (CBI)			.709	.504
Positive thinking (CBI)			.700	.619
Distraction (CBI)	.340		.594	.372

Note. Rotated loading matrix (weights under .30 are omitted). ULS parameter estimation method. Rotation method: Oblimin. Commonalities after extraction.

Table 5

Structural model hypothesis: Non-standardized effect and test results

Predictor	Dependent	Coefficient estimation	S.E.	C.R.	p
Abstinence duration	Coping	.002	.001	2.333	.020
Coping	Functional Discomfort	-.258	.062	-4.167	<.001
Functional Discomfort	Positive Mental Health	-.541	.057	-9.541	<.001
Coping	Positive Mental Health	.116	.033	3.472	<.001
Abstinence duration	Positive Mental Health	.001	.000	1.458	.145

Note. S.E. (Standard error of the coefficient), C.R. (Critical value).

Table 6
Standardized total and indirect effects

Standardized total effects			
	Abstinence duration	Coping	Functional Discomfort
Coping	.772		
Functional Discomfort	-.302	-.392	
Positive Mental Health	.296	.876	-.731
Standardized indirect effects			
	Abstinence duration	Coping	Functional Discomfort
Functional Discomfort	-.302		
Positive Mental Health	.677	.286	

Note. Values represent regression weights.

Discussion

Current definitions suggest that recovery from AUD is a holistic, dynamic, self-directed, and prosocial process leading to improvements in health and well-being (Esteban Rodríguez et al., 2024b). Our study identified three dimensions involved in recovery from AUD: i) Coping; ii) Functional Discomfort; iii) Positive Mental Health. Based on these dimensions, we constructed a relational model that provides a comprehensive framework for understanding recovery in a more comprehensive way. According to the model obtained, recovery in the clinical AUD population can be understood as a broad, dynamic, and multifaceted process, where abstinence duration prompts behavioural changes and the implementation of coping strategies. In turn, these actions lead to an improvement in negative emotionality and a growing availability of personal and social resources, which in turn contribute to increased well-being and quality of life. This study is the first initiative in Spain to present a clinical model of recovery focused on well-being and supported by rigorous methodological evidence. The proposed model provides indicators for recovery process monitoring, highlights the dimensions which need to be addressed in order to achieve recovery towards a state of complete health, and offers considerable potential for guiding treatment interventions.

Although the assessed mutual aid programs use different approaches, statistical differences were only found in the scores on the environment-related quality of life subscale. The absence of differences among the rest of the variables across the mutual aid groups (MAGs) could be due to the fact that, while diverse, the treatment approaches focus on personal growth during recovery (Arias et al., 2023). Previous studies have shown similar results, with no significant differences in the functioning of participants between 12-step-based MAGs and those following

cognitive-behavioural approaches (Kelly et al., 2023). This suggests that the programs may offer comparable benefits, so future research on the role of the components or approaches used by MAGs would be of interest in studying factors that may influence the recovery process.

Identified dimensions of recovery in AUD: Coping, Functional Discomfort and Positive Mental Health

The Coping dimension groups the strategies of the coping skills inventory of Litman et al. (1983). This dimension captures the responses, attitudes and strategies used to prevent relapses (Litman et al., 1983). Different theoretical models, such as Litman et al. (1984), the relapse prevention model of Marlatt and Gordon (1985) or stress and coping theory (Folkman, 1984), have confirmed the influence of these strategies. These models posit that the acquisition and effective implementation of active coping strategies promote self-efficacy, which is why they constitute a relevant component of recovery (Hasking & Oei, 2008; Larimer et al., 1999; Laudet, 2008; Laudet et al., 2002; Marlatt & Gordon, 1985; Marlatt, 1996; Monti & Rohsenow, 1999; Witkiewitz & Marlatt, 2007). Most treatment programs for addictive disorders currently include relapse prevention, the effectiveness of which has been widely confirmed (Hasking & Oei, 2008; Larimer et al., 1999; Marlatt, 1996; Monti & Rohsenow, 1999; Witkiewitz & Marlatt, 2007). These strategies, ranging from the identification of risk situations to the implementation of adaptive coping techniques, have the potential to empower individuals during recovery and strengthen their resources when facing challenges to avoid relapses (Hasking & Oei, 2008; Litman et al., 1984; Witkiewitz & Marlatt, 2007).

The Functional Discomfort dimension refers to difficulties in meeting the demands of daily life, encompassing emotional distress and deficits in available resources.

This dimension can be understood from the perspective of the dual-factor model of mental health (Greenspoon & Saklofske, 2001) as the decrease in negative indicators or dysfunction, since it includes symptoms of depression, anxiety and experiential avoidance. It also includes the personal and social resources available to the individual (social support, leisure activities, family environment, etc.), broadening the distress beyond psychopathology. In the context of recovery from addictive disorders, this dimension can be compared to “essential recovery,” proposed by Kaskutas et al. (2014), which refers to the basic elements necessary for maintaining significant changes in substance use. It should be noted that, although it seems critical, this dimension is not sufficient for understanding recovery and health in its entirety. This is because the Functional Discomfort dimension focuses on changes in clinical measures of harm and the vital resources available that support recovery, but this is not equivalent to recovery.

The literature on addictive disorders and recovery from them has stressed the importance of pathological negative affect and poor management of negative emotionality as risk factors in predicting relapse, underlining their role in clinical recovery (Marlatt & Gordon, 1985; Pandina et al., 1992; Stasiewicz & Maisto, 1993). For its part, the recovery capital assessment (Groshkova et al., 2013; Sion et al., 2022) considers the availability of resources to meet basic needs in different areas of life and associates them with the clinical course of addiction, as well as with the likelihood of starting and maintaining recovery. There is a ceiling effect of this recovery capital measure in patients who seek treatment for alcohol addiction and who are in recovery (Sion et al., 2022), so lower scores on this scale may indicate a deficit in the normal resources at the disposal of the Spanish population. In this way, it is understood as more of a negative indicator of health than as an indicator related to well-being, since limited recovery capital is detrimental to the individual. Thus, the Functional Discomfort or Functional Recovery dimension addresses the need highlighted by Groshkova et al. (2013) for a joint assessment of symptom profiles with recovery capital to predict the course of recovery.

In summary, Functional Discomfort or Functional Recovery considers risk factors of risk as well as of protection in AUD improvement. It recognizes the premorbid situation of available resources that can ameliorate or exacerbate the impact of adverse situations, thus affecting resilience and coping (Cloud & Granfield, 2008; Kelly & Hoepfner, 2015), and can help to mitigate and reduce the stress associated with adjusting to sobriety (Laudet & White, 2008).

The Positive Mental Health dimension includes variables relating to quality of life, eudaimonic well-being and satisfaction with life. These factors are recognized in research on the dual-factor model of mental health as

positive indicators of mental health (Magalhães, 2024). They also feature in the current definitions of enriched recovery as fundamental dimensions of the process (Kaskutas et al., 2014). In the AUD context, many studies show improvements in well-being and quality of life during abstinence maintenance or consumption reduction in people receiving treatment (Donovan et al., 2005), from cross-sectional results with long periods of abstinence (Kelly et al., 2018; Rubio et al., 2023), to follow-ups of up to seven years (Frischknecht et al., 2013).

Among the dimensions constituting this factor, those that showed the greatest shared variance in the factor analysis were self-acceptance and environmental mastery. Self-acceptance, in the psychological well-being scale (PWBS; Ryff, 1989b; Ryff & Keyes, 1995), has been suggested as exerting a core influence on the other dimensions of the psychological well-being network (Blasco-Belled & Alsinet, 2022). Feeling proud, confident and positive about oneself, valuing both one's present life and accepting one's past life, can be a key element of recovery in the programs considered in this study (12 steps and help yourself – help us). These dimensions have been highlighted in the study of user-oriented recovery; specifically, the meta-synthesis of Klevan et al. (2021) highlights self-acceptance and control as essential components in personal recovery. Moreover, the Positive Mental Health dimension includes aspects such as personal growth, satisfaction with relationships and autonomy, corresponding to those proposed by Kaskutas et al. (2014), identified from the perspective of people involved in the recovery process.

In this sense, the Positive Mental Health factor is in line with contemporary definitions of enriched recovery and with evidence accumulated to date (Ashford et al., 2019; Betty Ford Institute Consensus Panel, 2007; SAMHSA, 2011; UKDPC, 2008; Witkiewitz et al., 2020). It could be considered that the goal of the recovery process should not be limited exclusively to sobriety, but rather to achieve optimal levels of health. While this aim is long-term, as observed in previous studies, it is an achievable goal (Kelly et al., 2018; Rubio et al., 2023). The evidence suggests that not only is there an improvement in positive mental health, but the magnitude of the improvement is such that those immersed in the process of AUD recovery can achieve levels of well-being and quality of life comparable to the general population over time (Rubio et al., 2023).

Relational model of recovery in AUD

The results obtained support the view of recovery as a process with differentiated stages, where the interruption of the problem behaviour (alcohol use) favours the development of alternative behaviours. This relationship contributes to a reduction of the affective symptoms characteristic of AUD and to the construction of recovery capital. Distraction-based coping strategies act as mediators

in the relationship between sobriety and the decrease in functional discomfort. Thus, improved use of distraction skills boosts the relationship between sobriety and the management of negative emotionality and the increase in recovery capital. This reduction in functional discomfort in turn influences positive mental health or enriched recovery, to the extent that the effects of sobriety on positive mental health are present only if there is an improvement in functional discomfort. This model has presented good fit indices (Pérez et al., 2013), with a GFI of 1,00 and an SRMR of 0.137, which supports its validity and coherence in explaining the recovery process in AUD contexts.

The coping strategy that emerged in our study with the greatest relevance is distraction. This measure covers a wide range of distracting activities, both individual (walking or going to work) and social (establishing contact with friends). It involves making a conscious decision in at-risk situations, making a choice between the known behaviour (drinking alcohol) and a constructive alternative. This approach corresponds with the principles of behavioural activation, since implementing a different behaviour is reinforcing for several reasons. First, it prevents alcohol use, which strengthens the feeling of self-efficacy in abstinence. Second, it offers alternative reinforcers to drinking, enriching the environment, which supports the view of recovery from the perspective of operant theories and environmental enrichment.

According to classic behavioural theories of choice, the presence of competing reinforcers in the environment predicts reductions in both consumption and seeking behaviour (Bickel et al., 1995; Vuchinich & Tucker, 1988, 1996). Some of the most powerful effects in the treatment of substance use disorder have been demonstrated by behavioural treatments, exploiting operant learning procedures with the purpose of consolidating desired behaviours (Carroll & Onken, 2005). Likewise, distraction can also be achieved through social contact, which provides the natural reinforcement of social relationships (McNamara et al., 2021; Thoits, 2011) and consequently social control, and motivates people to assume responsible behaviours and abstain from problematic behaviours, such as alcohol abuse (Hirschi, 2004; Thoits, 2011).

The relationship between maintaining abstinence and improved emotional management and recovery capital has been the subject of extensive research (Cloud & Granfield, 2008; Granfield & Cloud, 1999; Pandina et al., 1992; Stasiewicz & Maisto, 1993; White, 2008). However, our data highlight an indirect relationship between the two, mediated by the use of coping strategies. This supports a treatment approach that involves alternative activities, since changes in behaviour can lead to transformations in thoughts and emotional states. Behavioural activation has been shown to be effective in reducing depressive symptoms, negative affect, and experiential avoidance in

populations with substance use disorder (Daughters et al., 2008; Vujanovic et al., 2017). This strategy would allow the motivation for change to be based not only on eliminating a problematic behaviour, but also to be aimed at promoting more adaptive behaviours and environmental enrichment. Taken together, these findings highlight the importance of distraction as a key strategy in the recovery process, offering behaviours and reinforcers alternative to alcohol use.

Finally, our results indicate that the impact of abstinence on positive mental health is only positive indirectly, that is, through increased use of coping strategies and reduced functional discomfort. This is in line with the mechanism proposed by Carlon et al. (2022), who argue that improvements in quality of life during recovery in individuals who have reduced drinking or achieved sobriety are based on the reduction of stress and negative affect. While several studies have shown that quality of life improves in both conditions (Dawson et al., 2005), this is more pronounced in those who are abstinent (Donovan et al., 2005; Subbaraman & Witbrodt, 2014). Thus, sobriety appears to be better for optimal long-term quality of life (Subbaraman & Witbrodt, 2014), which, based on our results, is explained by its indirect effect on positive mental health. Thus, in order for abstinence to be beneficial for positive health indicators and act as an enhancer of treatment success, it is also essential to focus on emotional management and recovery capital during treatment.

Limitations

Although this study has important implications for clinical practice by highlighting, for example, the importance of considering abstinence, consolidating coping strategies, managing negative emotionality, and building recovery capital, its inherent limitations must be noted. The cross-sectional design is valuable for identifying associations between variables, but it does not allow causal and temporal inferences to be drawn. Elucidating temporal relationships would require longitudinal research addressing the temporal sequence of the phenomena studied. Nevertheless, the cross-sectional design has allowed different dimensions of recovery to be examined at different times, including patients with very long periods of sobriety, seeing recovery as a long-term process, and this would be complicated with a longitudinal study.

Moreover, the recovery model proposed is preliminary and is based on one specific study, which poses challenges for generalization to diverse populations and contexts. Although the sample proved sufficient to obtain statistically robust results, it may not fully represent the diversity of alcohol addiction. Individual and cultural factors, including gender issues, could modulate the interactions between the identified dimensions and the established relationships.

Added to this is the wide range of abstinence periods and the geographical limitation of the sample, exclusively comprising residents of the Community of Madrid (Spain). Although the sample covers three different types of treatment approach, two of them belong to the associative environment and involve very long periods of sobriety, making it difficult to compare with the group from the hospital environment, whose maximum period of abstinence is 2 years, the limit of the program. In addition, all participants were involved in abstinence-oriented treatments, which may contribute to the perception of alcohol use cessation as an integral part of recovery. The fact that these treatments were chosen voluntarily by the participants may also affect the generalizability of results. It would be interesting to replicate the model in populations in treatments using different approaches or even in individuals who have not received treatment.

Despite the inclusion of dimensions relevant to the recovery process, it is recognized that substance use disorders are multifactorial and complex. Additional aspects, such as reductions in stigma and self-stigma or cognitive changes, could enrich future research and the model presented.

Therefore, it is important to complement this study with other research and other types of study design, for example, longitudinal studies that consider the proposed variables from an intra-subject perspective, in order to obtain a more complete and robust understanding of the recovery process in AUD contexts.

All in all, the proposed model offers a valuable conceptual framework that can guide intervention and assessment in AUD treatment, providing improvement in these areas.

Conclusions

The three dimensions identified (Coping, Functional Discomfort, and Positive Mental Health) have a strong theoretical basis as core components in AUD recovery for attaining a complete state of health. However, much of the literature has focused on analyzing separately the relationship of each dimension with abstinence or alcohol-use reduction. The fundamental innovation of this study lies in presenting a relational model that encompasses the dimensions of Positive Mental Health, Functional Discomfort, and Coping. Our holistic approach provides a theoretical and empirical framework that highlights the interconnection of these dimensions over long periods of recovery. This model suggests that abstinence is the starting point but not the goal, as its influence extends through the implementation of coping strategies, the gains in affective symptomatology and recovery capital, and finally, the attainment of greater well-being and quality of life, as reflected in positive mental health.

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Conflict of interests

The authors declare that the research was conducted with no commercial or financial relationships that could be construed as a potential conflict of interest.

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ORIGINAL

Core vs. peripheral: Exploring social media overvaluation and problematic use in a longitudinal adolescent study

Criterios centrales vs. periféricos: Explorando la sobrevaloración de redes sociales y el uso problemático en un estudio longitudinal con adolescentes

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Abstract

Individuals with Overvaluation of the Relative Utility of Social Media (ORUSM) overestimate the value of social media to meet needs, prioritizing it over alternative activities. ORUSM is a key mechanism in the development of Problematic Social Media Use (PSMU), frequently associated with mental health issues. The Plan-net 25 measures ORUSM but lacks evaluation of its longitudinal psychometric properties. PSMU is assessed using six criteria derived from substance use disorders, reclassified into core criteria (mood modification, withdrawal, conflict, relapse) as indicators of problematic use, and peripheral criteria (salience, tolerance) that reflect high engagement without pathology. This study examined the temporal stability and longitudinal invariance of the Plan-net 25, as well as its associations with PSMU criteria and various mental health indicators over six weeks. A sample of 294 adolescents (14–20 years old) completed measures of ORUSM, PSMU, depression, anxiety, loneliness, and life satisfaction. The results showed low to moderate temporal stability of the subscales and longitudinal invariance of the Plan-net 25. ORUSM domains related to emotional regulation, social expression, and boredom management were positively associated with both core and peripheral PSMU criteria. Core criteria predicted worse mental health outcomes, while peripheral criteria were positively associated with life satisfaction. These findings highlight the importance of distinguishing between core and peripheral PSMU criteria.

Keywords: Overvaluation of social media, problematic social media use, test-retest reliability, longitudinal invariance, components model of addiction

Resumen

Las personas con Sobrevaloración de la Utilidad Relativa de las Redes Sociales (ORUSM) sobreestiman el valor de las redes sociales para satisfacer necesidades, priorizándolas sobre otras actividades alternativas. La ORUSM es un mecanismo clave en el desarrollo del Uso Problemático de Redes Sociales (UPRS), frecuentemente asociado a problemas de salud mental. La Plan-net 25, mide la ORUSM pero carece de evaluación de sus propiedades psicométricas longitudinales. El UPRS se evalúa utilizando seis criterios derivados de los trastornos por consumo de sustancias, reclassificados en criterios centrales (modificación del estado de ánimo, abstinencia, conflicto, recaída) como indicadores de uso problemático, y criterios periféricos (saliente, tolerancia) que reflejan alta implicación sin patología. Este estudio examinó la estabilidad temporal y la invarianza longitudinal de la Plan-net 25, así como sus asociaciones con los criterios de UPRS y diversos indicadores de salud mental durante seis semanas. Una muestra de 294 adolescentes (14-20 años) completó medidas de ORUSM, UPRS, depresión, ansiedad, soledad y satisfacción con la vida. Los resultados mostraron una estabilidad temporal baja a moderada de las subescalas e invarianza longitudinal de la Plan-net 25. Los dominios de ORUSM relacionados con la regulación emocional, la expresión social y el manejo del aburrimiento se asociaron positivamente con criterios centrales y periféricos de UPRS. Los criterios centrales predijeron peores resultados en salud mental, mientras que los criterios periféricos se asociaron positivamente con satisfacción con la vida. Estos hallazgos destacan la importancia de distinguir entre los criterios centrales y periféricos del UPRS.

Palabras clave: Sobrevaloración de redes sociales, uso problemático de redes sociales, fiabilidad test-retest, invarianza longitudinal, modelo de componentes de la adicción

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Social media (SM) platforms are designed to facilitate interactions between individuals and have become especially popular among adolescents (e.g., Instagram, TikTok). In the United States, half of teenagers report near-constant use of SM (Pew Research Center, 2023). Similarly, in Spain, 98.5% of adolescents are registered on at least one SM app, with 83.5% using three or more (Andrade et al., 2021). This widespread adoption highlights the significant role that SM plays in adolescents' daily lives.

Problematic Social Media Use (PSMU) has emerged as a growing concern alongside the increasing popularity of SM (Fineberg et al., 2024). PSMU refers to excessive use of SM that leads to significant impairment in personal, social or academic functioning (Cataldo et al., 2022). PSMU is typically assessed following the Components Model of Addiction (Griffiths, 2005), which includes six criteria derived from substance use disorders: salience, tolerance, mood modification, withdrawal, relapse and conflict. The most widely used instrument to evaluate PSMU following this model is the Bergen Social Media Addiction Scale (BSMAS; Andreassen et al., 2016), which comprises one item to measure each criterion.

Despite its popularity, the Components Model of Addiction has faced criticism regarding the validity of applying substance use criteria to excessive behaviors such as PSMU or gaming disorder (Castro-Calvo et al., 2021; Lopez-Fernandez, 2018). Specifically, concerns have been raised about whether all six criteria are equally indicative of pathological behavior in PSMU. To address this issue, researchers have proposed distinguishing between core and peripheral criteria (Billieux et al., 2019; Charlton & Danforth, 2007). Core criteria—mood modification, withdrawal, conflict, and relapse—are considered essential indicators of a problematic behavior. In contrast, peripheral criteria—salience and tolerance—may reflect high engagement without necessarily indicating pathology (Billieux et al., 2019; Castro-Calvo et al., 2021; Flayelle et al., 2022).

Empirical studies on PSMU support this distinction. Fournier et al. (2023, 2024) found that modelling PSMU with correlated core and peripheral factors provided a better fit than a unidimensional model using the BSMAS. Additionally, Peng & Liao (2023) identified a subgroup of users exhibiting peripheral criteria without core criteria, indicating that peripheral criteria alone may not measure PSMU (Zarate et al., 2023). Moreover, peripheral criteria have shown non-significant associations with psychological distress, unlike the positive associations observed for core criteria (Fournier et al., 2023).

While meta-analytic evidence links PSMU to mental health issues such as depression or anxiety and reduced life satisfaction (Huang, 2022; Shannon et al., 2022), inconsistencies remain regarding the association of

peripheral criteria with these outcomes (Fournier et al., 2023; Peng & Liao, 2023). Additionally, the clinical utility of peripheral criteria to distinguish between problematic and healthy SM users remains limited (Stănculescu & Griffiths, 2022; Zarate et al., 2023). This line of research is currently generating extensive debate, which may shed light on the features of PSMU (Amendola, 2023; Griffiths, 2019).

The mechanisms underlying PSMU remain a matter of debate (Perales & Muela, 2019). Researchers have identified several risk factors, including impulsivity and difficulties in emotional regulation (Gioia et al., 2021; Lewin et al., 2023), but they have yet to establish a clear explanatory model.

One novel popularized mechanism which could account for the development of PSMU is the Overvaluation of the Relative Utility of Social Media (ORUSM) (Perales et al., 2020; Perales & Muela, 2019). ORUSM refers to a vulnerability in the decision-making process where individuals perceive the value of using SM to meet certain needs or goals as significantly higher than alternative activities. This leads to excessive reliance on these platforms for gratification (Ciudad-Fernández et al., 2024a). In essence, PSMU may develop when SM is perceived as the best or the only means to achieve specific reinforcers, especially when these reinforcers are otherwise unavailable through more adaptative activities (Flayelle et al., 2023; Perales & Muela, 2019; Perales et al., 2020).

This vulnerability has been reported in qualitative research, where users express overreliance on SM to interact with people or manage emotions (Aksoy, 2018; Chegeni et al., 2021; Ciudad-Fernández et al., 2024b). Quantitative studies have found moderate associations between PSMU and viewing SM as essential for communication (Aparicio-Martínez et al., 2020). Additionally, a preference for SM over other communication methods is positively linked to loneliness and PSMU, while negatively associated with life satisfaction (Lyyra et al., 2022; van Duin et al., 2021). However, research on ORUSM has been scarce due to the lack of specific measurement tools.

To address this gap, Ciudad-Fernández et al. (2024a) developed the Plan-net 25 scale, the first instrument designed to measure ORUSM. This scale consists of seven factors that measure different utility domains of ORUSM: interacting socially, meeting new people, regulating unpleasant emotions, feeling socially accepted, keeping up with what is happening, expressing socially, and managing boredom. In the original validation study, these domains showed moderate associations with PSMU and were positively related to depression, anxiety and loneliness while negatively associated with self-esteem and life satisfaction. Although the Plan-net 25 scale demonstrated promising psychometric properties, data regarding its temporal stability or longitudinal latent structure are lacking. Understanding the stability of ORUSM over time

is crucial for determining whether it is a consistent trait or a fluctuating state before using it in experimental or longitudinal designs. Given the novelty of this variable in the context of SM, no specific hypotheses are formulated regarding temporal stability or longitudinal invariance of ORUSM.

Building on the conceptualization of ORUSM as a key mechanism in the development of PSMU, it is essential to examine how ORUSM contributes to the emergence of PSMU and, in turn, how PSMU may impact mental health. ORUSM leads individuals to excessively prioritize SM as a means to achieve certain reinforcers (e.g., feeling calm or avoiding boredom) (Kardefelt-Winther, 2014). This overreliance can foster PSMU, which is characterized by core criteria (pathological involvement and negative consequences), as well as peripheral criteria (high engagement without necessarily negative outcomes). It is hypothesized that all domains of ORUSM will predict both core and peripheral PSMU criteria (Lyyra et al., 2022; van Duin et al., 2021). However, it is proposed that core criteria will be uniquely associated with mental health issues such as depression, anxiety, loneliness and reduced life satisfaction, while peripheral criteria will not (Fournier et al., 2023). This distinction aligns also with findings that peripheral criteria are not inherently pathological in other problematic behaviors such as gaming disorder or binge-watching (Infanti et al., 2023; Orosz et al., 2016).

Therefore, this study aims to examine the longitudinal psychometric properties of the Plan-net 25 and to assess the associations between its domains and both core and peripheral criteria of PSMU, and in turn, how these latter variables predict a range of mental health outcomes.

Methods

Participants

The inclusion criteria for participation in this study were: a) being 14 years old during the first assessment b) being fluent in Spanish and c) having access to SM. The final sample consisted of 294 participants, with a mean age of 15.78 years ($SD = 1.37$). The sample included a nearly equal proportion of boys (50.68%) and girls (47.96%). The vast majority of participants used SM more than three times a week (98.98%). See Table 1 for a more detailed description. All participants completed both the first and the second assessment, which were conducted between November 2023 and June 2024.

Measures

Plan-net 25 (Ciudad-Fernández et al., 2024a). This questionnaire evaluates seven domains of ORUSM: Interact socially (e.g., If I didn't have access to social media, I would have a lot of difficulty staying in touch with my classmates), Meet new people (e.g., If I didn't have access

Table 1

Sociodemographic characteristics of the sample

	Mean (SD) or n (%)
Age	15.78 (1.37)
Course	
3 rd year of Compulsory Secondary Education	40 (13.61%)
4 th year of Compulsory Secondary Education	126 (42.86%)
1 st year of Baccalaureate	78 (26.53%)
2 nd year of Baccalaureate	0 (0%)
Intermediate Vocational Training	24 (8.16%)
Advanced Vocational Training	16 (5.44%)
Other	10 (3.4%)
Gender	
Boy	149 (50.68%)
Girl	141 (47.96%)
Non-binary	1 (.34%)
Other	1 (.34%)
Prefer not to answer	2 (.68%)
Nationality	
Spanish	254 (86.05%)
Other	41 (13.95%)
Do you have access to social media on your phone, computer, or your parents'/ guardians' device?	
Yes	294 (100%)
No	0 (0%)
Do you frequently use social media, such as WhatsApp, TikTok, Instagram, Twitch, Youtube... more than 3 times a week?	
Yes	291 (98.98%)
No	2 (.68%)

Note. Having access to social media was an inclusion criterion; therefore, the entire sample answered "Yes" to that question. Only the mean and standard deviation are reported for age. SD = Standard deviation.

to social media, I would have a lot of difficulty making new friends), Regulate unpleasant emotions (e.g., If I didn't have access to social media, I would have a lot of difficulty calming myself down when I feel nervous), Feel socially accepted (e.g., If I didn't have access to social media, I would have a lot of difficulty feeling included in my group of friends), Keep up with what is happening (e.g., If I didn't have access to social media, I would have a lot of difficulty finding out what people around me are doing), Express socially (e.g., If I didn't have access to social media, I would have a lot of difficulty expressing my emotions), Manage boredom (e.g., If I didn't have access to social media, I would have a lot of difficulty having fun). It consists of 25 items rated on a 6-point Likert scale (0 = Completely

disagree, 5 = Completely agree). Ciudad-Fernández et al. (2024a) reported Cronbach's α coefficients ranging from .87 to .93 and McDonald's ω coefficients ranging from .88 to .94. McDonald's ω coefficients in this sample range between .83 (Plan-net 2) and .95 (Plan-net 3).

Bergen Social Media Addiction Scale (BSMAS) (Andreassen et al., 2012; Brailovskaia & Margraf, 2024). This scale assesses social media problematic use through six items. In this study we employed a 6-point Likert scale (0 = Completely disagree, 5 = Completely agree), with an overall score ranging from 0 to 30. A 6-point Likert scale was employed and not the traditional 5-point Likert scale. Since this study is part of a larger project this decision was made (see OSF for more details). Following previous research (Fournier et al., 2023, 2024), BSMAS was not conceptualized as a one factor measure. Instead, this measure was divided into two factors: peripheral criteria, comprising two items assessing salience and tolerance (e.g., How often during the last year have you spent a lot of time thinking about social media or planning how to use it?); and core criteria, comprising items evaluating mood modification, relapse, conflict, and withdrawal (e.g., How often during the last year have you become restless or troubled if you have been prohibited from using social media?). Cronbach's α when treated as a single factor ranged from .81 to .90 (Brailovskaia & Margraf, 2024). McDonald's ω for the peripheral factor was .76 and for the core factor .72 (Fournier et al., 2023). In the current study, McDonald's ω coefficient for the core factor is .80. Additionally, the Spearman-Brown coefficient for the peripheral factor is .80.

Patient Health Questionnaire-9 (PHQ-9) (Diez-Quevedo et al., 2001; Kroenke et al., 2001). This questionnaire is a 9-item scale which assesses depression symptoms (e.g., little interest or pleasure in doing things). Each item is scored from 0 (not at all) to 3 (nearly every day). This version was adapted by Diez-Quevedo et al. (2001). The adolescent version was obtained from the AIDS Education & Training Center Program (www.aidsetc.org). In the original validation, this measure obtained Cronbach's α coefficients ranging from .86 to .89 (Kroenke et al., 2001). McDonald's ω coefficient is .89 in this sample.

Generalized Anxiety Disorder (GAD-7) (Crockett et al., 2022; Mossman et al., 2017). This tool evaluates the presence and severity of generalized anxiety disorder symptoms. It consists of 7 items rated on a 4-point ordinal scale (from 0 = never to 3 = almost every day). This measure obtained a .86 Cronbach's α and a .82 Spearman-Brown coefficient in previous literature (Crockett et al., 2022). McDonald's ω coefficient in this sample is .93.

Three-Item Loneliness Scale (TILS) (Trucharte et al., 2023; Hughes et al., 2004) measures the perception of social loneliness (e.g., How often do you feel left out?). Respondents rate three items on a 3-point Likert scale from

1 (hardly ever) to 3 (often), with higher scores indicating greater loneliness (range from 3 to 9). This measure obtained a moderate internal consistency in the Spanish validation ($\alpha = .82$; Trucharte et al., 2023). McDonald's ω coefficient in this sample is .85.

Satisfaction with Life Scale (SWLS-3) (Jovanović et al., 2022; Kjell & Diener, 2021) evaluates overall life satisfaction through 3 items (e.g., In most ways my life is close to my ideal). Items are rated on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). This measure obtained a high internal consistency ($\omega = .88$; Kjell & Diener, 2021). McDonald's ω coefficient in this study is .89.

Procedure

First, public and private educational centres were contacted to participate in a study (see the preregistration in <https://osf.io/wc4ev/> for details). During the first evaluation, participants completed a series of questionnaires, including Plan-net 25 and BSMAS along with other measurement tools. Subsequently, participants aged 14 years or older were invited to retake the survey in their classroom after five to seven weeks from the first assessment. This was proposed to avoid overlapping with any events or school holidays. Thus, after an average of six weeks, some participants from the initial study completed the Plan-net 25, PHQ-9, GAD-7, TILS and SWLS-3 at a second assessment.

These questionnaires were administered either on paper or using available technological devices, with researchers present in the classroom whenever possible to assist. When researchers were unavailable to attend, teachers addressed students' questions regarding the questionnaires. Data were collected using the Qualtrics platform, with data collection starting in November 2023 and concluding in June 2024. Participating centres were offered an incentive in the form of a personalized report comparing their mental health scores and PSMU scores with those of other centres, while maintaining the anonymity of the other participating centres.

Data analysis

First, internal consistency was evaluated using McDonald's ω coefficient. Additionally, to report internal consistency of the peripheral factor (comprised by two items) Spearman-Brown coefficient was computed (Eisinga et al., 2013).

Second, to assess the temporal reliability of the Plan-net 25 scale, intraclass correlation coefficients (ICCs) were calculated for each subscale. The ICC estimates and their 95% confidence intervals were computed using a single-measurement, absolute-agreement, two-way mixed-effects model. According to Koo and Li (2016), ICC values less than .50 indicate poor reliability, values between .50 and .75 indicate moderate reliability, values between .75 and .90 indicate good reliability, and values greater than .90 indicate excellent temporal reliability.

Third, the longitudinal measurement invariance of the seven-factor correlated model was tested across two time points. Initially, the same measurement model was fitted separately at each time point (T1 and T2). The measurement model was a seven-factor correlated model. Measurement invariance testing was then conducted by sequentially evaluating configural, metric, and scalar invariance models. Configural invariance examines whether the same factor structure holds across time points, allowing all parameters to vary freely. Metric invariance assesses whether factor loadings are equivalent across time points by constraining factor loadings while allowing intercepts and residuals to vary. Scalar invariance tests whether both factor loadings and intercepts are equivalent across time points by constraining both, while allowing only residuals to vary. Achieving scalar invariance suggests that the measurement model operates consistently over time, allowing for meaningful comparison across different time points (Meredith, 1993).

To evaluate the goodness of fit χ^2 statistic and its associated *p*-value, Comparative Fit Index (CFI), and Tucker-Lewis Index (TLI) were reported. Values above .95 for CFI and TLI were considered excellent, and values above .90 were deemed acceptable. Additionally, the Root Mean Square Error of Approximation (RMSEA) and its 90% confidence interval was reported. RMSEA values below .06 were considered adequate. The Standardized Root Mean Square Residual (SRMR) was also reported, and it was deemed acceptable with a cutoff lower than .08. Cutoff scores were following the guidelines of Hu and Bentler (1999). To compare nested models and assess longitudinal invariance, Chen's (2007) guidelines were followed, using changes in CFI ($\Delta\text{CFI} \leq .01$) and RMSEA ($\Delta\text{RMSEA} \leq .015$) to determine whether to accept or reject invariance between models. Maximum likelihood estimation with robust standard errors (MLR) was employed to correct for the lack of multivariate normality.

Fourth, a structural equation model (SEM) was conducted. Given the sample size achieved, a SEM with latent variables could not be performed. Instead, factor scores for each variable were computed using the regression method to be included in the model, aiming to reduce measurement error (McNeish, 2023). The same cut-off criteria were employed for fit indexes as in longitudinal invariance testing. Results of each CFA are included in supplementary materials.

Therefore, the 7 subscales of the Plan-net 25 scale were included as exogenous variables and were considered predictors of both subscales of BSMAS. Depression, anxiety, loneliness, and life satisfaction were included as endogenous variables. These mental health variables were hypothesized to be temporally associated only with the two PSMU subscales. Additionally, indirect effects from ORUSM subscales to the mental health variables through

both peripheral and core criteria were computed. Only statistically significant indirect effects are reported in the manuscript due to limited space.

Fifth, to assess whether this model had sufficient statistical power to detect potential model misspecification, a *post hoc* power analysis was conducted following the guidelines of Jobst et al. (2023). Statistical power refers to the probability of correctly rejecting a false null hypothesis ($1 - \beta$), where β represents the probability of a Type II error—failing to detect an actual effect when one exists. Considering both Type I (α) and Type II (β) errors is crucial because insufficient power (i.e., a high β error) may lead to incorrect conclusions by not detecting meaningful effects (Maxwell, 2004).

For the power analysis, RMSEA from the SEM was selected as the effect size measure, with lower values indicating a better fit (MacCallum et al., 1996). Using the RMSEA value yielded in the model, along with the model's degrees of freedom ($df = 28$), sample size ($N = 294$), and significance level ($\alpha = .05$), the analysis indicated a power of .87, exceeding the conventional threshold of .80 for adequate power (Cohen, 1992). This suggests that the sample size was sufficient to detect model misspecification.

Missing data did not exceed the commonly accepted cutoff point of 5% in any item from T1 or T2 (Schafer, 1999). Missing values were handled using full information maximum likelihood (FIML) in the longitudinal invariance and SEM models. However, missing values were not addressed in test-retest reliability analysis.

All analyses were conducted using R version 4.4.1 and RStudio. The packages were *ir*, *lavaan*, *psych*, *semPower*, *gtExtras* and *MplusAutomation* (Gamer, 2019; Hallquist & Wiley, 2018; Mock, 2023; Moshagen & Erdfelder, 2016; Revelle, 2024; Rosseel, 2012).

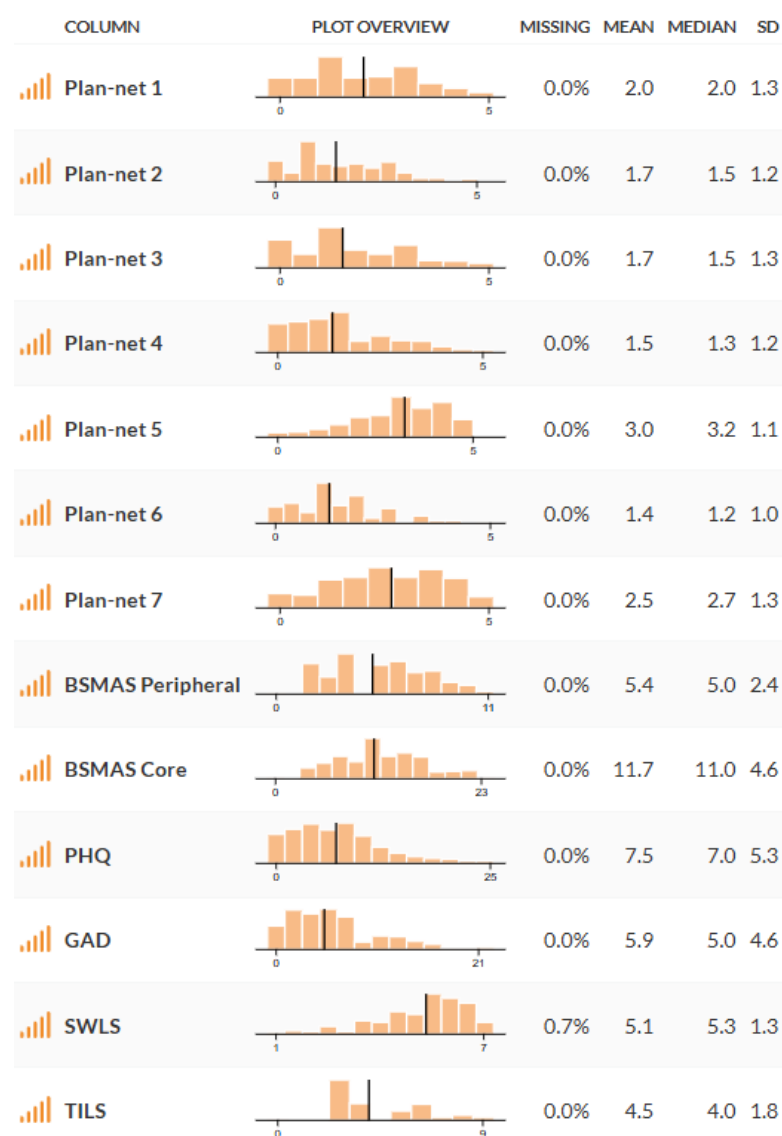
Ethics

This study was preregistered in April 2022 on the Open Science Framework (<https://osf.io/wc4ev/>). Prior to participation, all individuals provided informed consent and were allowed to withdraw at any time. Additionally, passive informed consent was obtained by notifying teachers and parents in advance. The study was approved by the Ethics Committee of the University of Valencia (approval number 2039883). Following the study, informational sessions on PSMU were offered to any participating centre that requested them. The full dataset from the first assessment was employed in the initial validation study (Ciudad-Fernández et al., 2024a).

Results

Descriptives

Descriptive statistics of the psychological variables assessed are reported in Figure 1.

Figure 1*Descriptives of the psychological variables*

Note. SD = Standard Deviation. Plan-net 1 = ORUSM for interacting socially; Plan-net 2 = ORUSM for meeting new people; Plan-net 3 = ORUSM for regulating unpleasant emotions; Plan-net 4 = ORUSM for feeling socially accepted; Plan-net 5 = ORUSM for keeping up with what is happening; Plan-net 6 = ORUSM for expressing oneself socially; Plan-net 7 = ORUSM for managing boredom; BSMAS Peripheral = Tolerance and salience items from the Bergen Social Media Addiction Scale; BSMAS Core = Mood modification, withdrawal, conflict and relapse items from the Bergen Social Media Addiction Scale; PHQ = Patient Health Questionnaire-9; GAD = Generalized Anxiety Disorder-7; SWLS = Satisfaction With Life Scale-3; TILS = Three-item Loneliness Scale.

Test-retest reliability

Results in Figure 2 show values of test-retest reliability assessed through ICC. Overall, the results indicate that the confidence intervals range from poor to moderate temporal reliability for most subscales. Both Plan-net 3 and Plan-net 7 subscales show moderate temporal reliability, and their confidence intervals do not include values considered poor (i.e., below .50). However, the remaining subscales exhibited higher variability in scores.

Longitudinal invariance

Regarding the longitudinal invariance of the seven-factor correlated model, the results indicate minimal loss of fit across all levels of invariance. Although the change in the χ^2 statistic is significant when comparing metric and scalar constrained models, the change in misfit indicated by the fit indices is minimal among these models, as shown in Table 2. Specifically, the change in RMSEA is less than .001 in both comparisons. Accordingly, the change in CFI between the metric and configural models is -.0001, and the change between the scalar and metric models is -.003. Neither fit index surpasses the selected cut-offs, thus providing evidence in favor of the scalar invariance of the measurement model.

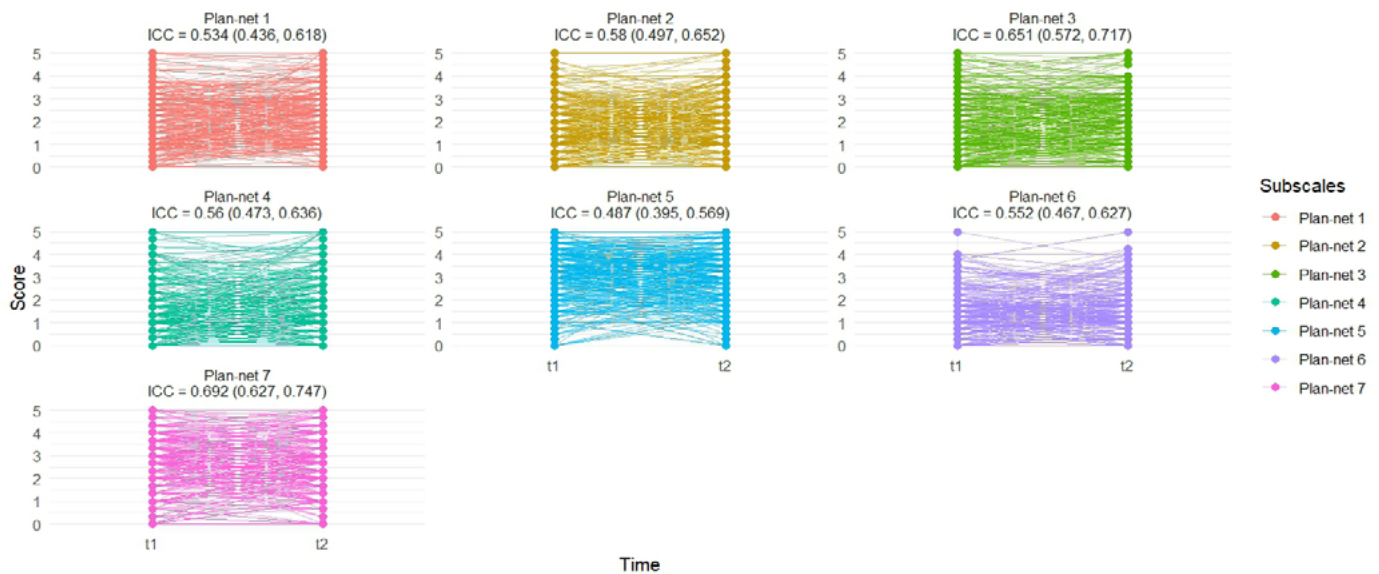
Structural equation modelling of the hypothesized model

The proposed model provides a good fit to the data [$\chi^2(28) = 53.901, p = .002$; CFI = .973; TLI = .945; RMSEA = .058, 90% CI [.034, .082]; SRMR = .054]. Plan-net 3, 6, and 7 positively predict both PSMU core criteria and PSMU peripheral criteria (β values ranging from .196 to .316). Additionally, Plan-net 4 negatively predicts PSMU peripheral criteria ($\beta = -.195$). In turn, after six weeks, the PSMU core factor is temporally associated with depression ($\beta = .420$), anxiety ($\beta = .369$), loneliness ($\beta = .318$), and life satisfaction ($\beta = -.397$). None of the relationships between the PSMU peripheral factor and depression, anxiety, and loneliness were significant. However, PSMU peripheral criteria are temporally associated with life satisfaction ($\beta = .230$). The model is depicted in Figure 3.

Indirect effects of the Plan-net 25 subscales on life satisfaction, loneliness, depression, and anxiety through both peripheral and core criteria of PSMU were examined. Table 3 presents all significant indirect effects. Notably, significant indirect effects were primarily observed for the Plan-net 3, 6, and 7 factors mediated through the core criteria of PSMU across all four mental health variables. Specifically, these indirect effects were positive for depression, anxiety, and loneliness, indicating that higher scores on these Plan-net subscales are associated with increased levels of these mental health issues through the mediation of the core criteria of PSMU. In other words, the PSMU core subscale explains part of the relationship between the Plan-net subscales and these negative mental health outcomes.

Figure 2

Test-retest reliability of the Plan-net 25 subscales



Note. ICC values show the estimate of the value, with its confidence interval in parentheses. According to Koo and Li (2016), ICC values less than .50 indicate poor reliability, values between .50 and .75 indicate moderate reliability, values between .75 and .90 indicate good reliability, and values greater than .90 indicate excellent temporal reliability. Plan-net 1 = ORUSM for interacting socially; Plan-net 2 = ORUSM for meeting new people; Plan-net 3 = ORUSM for regulating unpleasant emotions; Plan-net 4 = ORUSM for feeling socially accepted; Plan-net 5 = ORUSM for keeping up with what is happening; Plan-net 6 = ORUSM for expressing oneself socially; Plan-net 7 = ORUSM for managing boredom.

Table 2

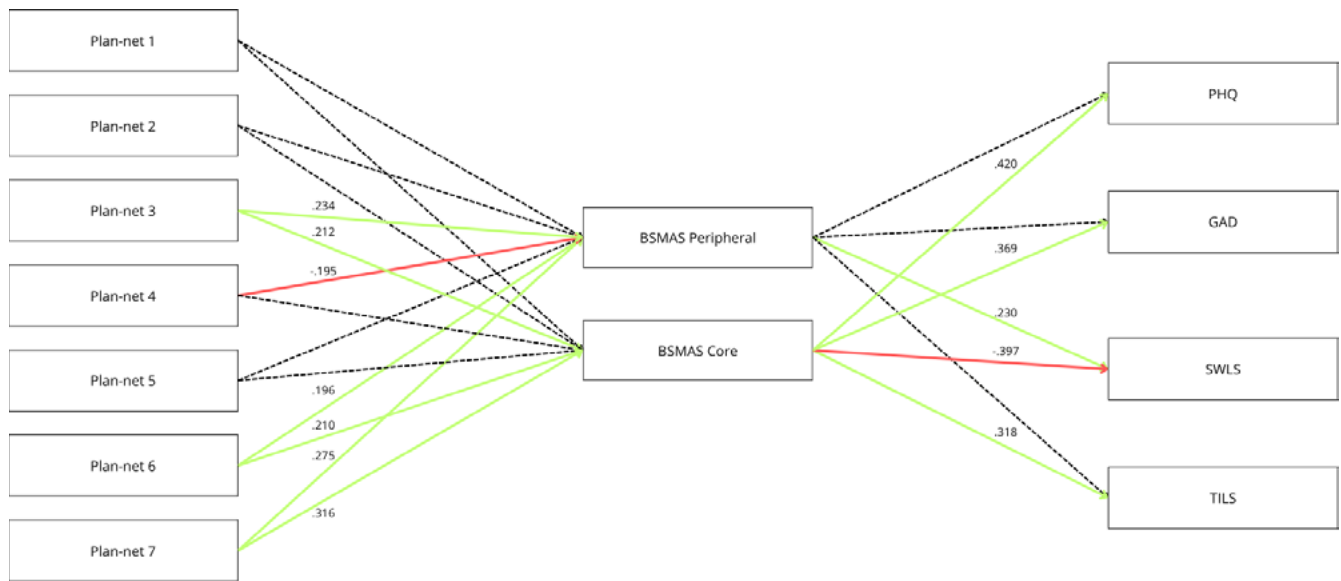
Fit indices for the longitudinal invariance models

Model fit values														Models compared		Differences in fit				
Model	χ^2	df	CFI	TLI	RMSEA		SRMR		$\Delta \chi^2$	<i>p</i> -value	Δ df	Δ CFI	Δ RMSEA							
Time 1	554.093*	254	.929	.916	.063 [.056, .071]		.067		-	-	-	-	-							
Time 2	511.284	254	.940	.929	.059 [.052, .065]		.057		-	-	-	-	-							
Configural	1975.953*	1084	.912	.900	.053 [.049, .057]		.060		-	-	-	-	-							
Metric	2003.223*	1102	.911	.901	.053 [.049, .056]		.060	Configural vs. Metric	25.540	.1107	18	-.001	.000							
Scalar	2045.789*	1120	.908	.900	.053 [.049, .057]		.060	Metric vs. Scalar	45.977*	.0003	18	-.003	.000							

Note. χ^2 values marked with an asterisk are statistically significant at $p < .05$. Model fit values are provided for each model tested: Time 1, Time 2, Configural, Metric, and Scalar models. Differences in fit between nested models are also included (Configural vs. Metric and Metric vs. Scalar), with $\Delta \chi^2$ tests for each model comparison, along with p -values, differences in degrees of freedom (Δdf), ΔCFI , and $\Delta RMSEA$. The configural model serves as the baseline model, and subsequent models are compared to assess measurement invariance across time. Metric invariance model constrains factor loadings, while scalar invariance model constrains factor loadings and item intercepts.

Conversely, the indirect effects were negative for life satisfaction. Higher scores on Plan-net 3, 6, and 7 are linked to lower life satisfaction via the core criteria of PSMU. This suggests that the detrimental impact on life satisfaction is partially explained by the PSMU core

subscale. Interestingly, there was also a significant positive indirect effect from Plan-net 7 on life satisfaction through the peripheral criteria of the BSMAS.

Figure 3*Structural equation model*

Note. Dashed lines are non-significant relationships. Green lines indicate positive significant associations and red lines indicate negative significant associations among variables. Regression paths estimations are depicted using the beta standardized value. Path analysis variable included were factor scores of each questionnaire using the regression method. Plan-net 1 = ORUSM for interacting socially; Plan-net 2 = ORUSM for meeting new people; Plan-net 3 = ORUSM for regulating unpleasant emotions; Plan-net 4 = ORUSM for feeling socially accepted; Plan-net 5 = ORUSM for keeping up with what is happening; Plan-net 6 = ORUSM for expressing oneself socially; Plan-net 7 = ORUSM for managing boredom; BSMAS Peripheral = Tolerance and salience items from the Bergen Social Media Addiction Scale; BSMAS Core = Mood modification, withdrawal, conflict and relapse items from the Bergen Social Media Addiction Scale; PHQ = Patient Health Questionnaire-9; GAD = Generalized Anxiety Disorder-7; SWLS = Satisfaction With Life Scale-3; TILS = Three-item Loneliness Scale.

Table 3*Indirect effects from Plan-net 25 subscales to Mental health indicators through PSMU core and peripheral criteria*

Indirect effects	Estimate	SE	z	p-value	Standardized estimate
Plan-net 3 - BSMAS Core - PHQ	.042	.017	2.433	.015	.089
Plan-net 6 - BSMAS Core - PHQ	.066	.028	2.331	.020	.088
Plan-net 7 - BSMAS Core - PHQ	.064	.024	2.702	.007	.133
Plan-net 3 - BSMAS Core - GAD	.042	.018	2.271	.023	.078
Plan-net 6 - BSMAS Core - GAD	.065	.029	2.294	.022	.077
Plan-net 7 - BSMAS Core - GAD	.063	.023	2.789	.005	.117
Plan-net 7 - BSMAS Peripheral - SWLS	.068	.034	2.014	.044	.063
Plan-net 3 - BSMAS Core - SWLS	-.089	.038	-2.318	.020	-.084
Plan-net 6 - BSMAS Core - SWLS	-.139	.059	-2.345	.019	-.083
Plan-net 7 - BSMAS Core - SWLS	-.134	.051	-2.611	.009	-.125
Plan-net 3 - BSMAS Core - TILS	.025	.012	2.058	.040	.067
Plan-net 6 - BSMAS Core - TILS	.039	.019	2.024	.043	.067
Plan-net 7 - BSMAS Core - TILS	.038	.014	2.627	.009	.100

Note. Only significant indirect effects were reported due to the length of the table. *SE* = Standard Error. Plan-net 3 = ORUSM for regulating unpleasant emotions; Plan-net 6 = ORUSM for expressing oneself socially; Plan-net 7 = ORUSM for managing boredom. BSMAS Core = Mood modification, withdrawal, conflict and relapse items from the Bergen Social Media Addiction Scale; BSMAS Peripheral = Tolerance and salience items from the Bergen Social Media Addiction Scale; PHQ = Patient Health Questionnaire-9; GAD = Generalized Anxiety Disorder-7; SWLS = Satisfaction With Life Scale-3; TILS = Three-item Loneliness Scale.

Discussion

This study aimed to examine the longitudinal psychometric properties of the Plan-net 25 scale, which measures ORUSM, and to assess the associations between its domains and both core and peripheral criteria of PSMU, as well as how these criteria predict mental health outcomes. It was hypothesized that all domains of ORUSM would predict both core and peripheral PSMU criteria (Lyyra et al., 2022; van Duin et al., 2021). Additionally, it was proposed that core criteria would be uniquely associated with negative mental health outcomes, such as increased depression, anxiety, loneliness, and reduced life satisfaction, whereas peripheral criteria would not show these associations (Fournier et al., 2023; Infanti et al., 2023; Orosz et al., 2016).

Regarding the first aim, the temporal stability and longitudinal measurement invariance of the Plan-net 25 scale were investigated. Findings indicated that the scale exhibits low to moderate temporal stability across its seven domains, with variability among them. Specifically, the domains related to regulating unpleasant emotions (Plan-net 3) and managing boredom (Plan-net 7) demonstrated moderate temporal reliability, whereas domains such as interacting socially (Plan-net 1) and meeting new people (Plan-net 2) showed lower stability.

The higher stability of Plan-net 3 and Plan-net 7 may be attributed to the consistency of emotional regulation strategies in adolescents during this period (Izadpanah et al., 2019). In contrast, the lower stability in social domains could reflect the dynamic nature of adolescent social relationships and SM use patterns (Boyd et al., 2012). Adolescents frequently experience changes in their social circles and interests, which may influence their use of SM for social purposes.

Furthermore, the Plan-net 25 scale demonstrated scalar longitudinal measurement invariance, indicating that the factor structure, factor loadings, and item intercepts remained consistent. This finding supports the use of the Plan-net 25 scale in longitudinal research, as it ensures that changes in scores reflect true changes in ORUSM rather than measurement artifacts (Millsap & Cham, 2012).

Addressing the second aim, the relationships between ORUSM domains, PSMU factors and mental health outcomes were examined. The hypothesis that all domains of ORUSM would predict both core and peripheral PSMU criteria was partially supported. Specifically, the ORUSM domains of regulating unpleasant emotions (Plan-net 3), expressing oneself socially (Plan-net 6) and managing boredom (Plan-net 7) were significantly and positively associated with both core and peripheral PSMU criteria.

These findings indicate that overreliance on SM to regulate emotions, as well as to express thoughts or opinions, may pave the way for high involvement in SM or even problematic use. Kardefelt-Winther (2014) further

proposed that overreliance on technological devices as coping mechanisms might contribute to problematic use. These results are supported by previous literature on overvaluation of SM (Aparicio-Martínez et al., 2020; Lyyra et al., 2022; van Duin et al., 2021).

Conversely, other domains such as interacting socially (Plan-net 1), meeting new people (Plan-net 2), or keeping up with what is happening (Plan-net 5) did not significantly predict PSMU criteria, while feeling accepted (Plan-net 4) showed a negative association with peripheral criteria. These findings suggest that using SM primarily for social communication and information gathering may not contribute to problematic use. Such activities might reflect normative SM engagement among adolescents, emphasizing the platform's role in facilitating social connections without necessarily leading to impairment (e.g., after recently moving to a different country).

Concerning the next hypothesis, stating that core PSMU criteria would be uniquely associated with negative mental health outcomes, whereas peripheral criteria would not, was supported by the findings. Results showed that core criteria of PSMU are significantly associated with higher levels of depression, anxiety, and loneliness, and with lower life satisfaction. Conversely, peripheral criteria were not significantly associated with depression, anxiety or loneliness. Interestingly, they were positively associated with life satisfaction. This finding suggests that high engagement with SM, as captured by the peripheral criteria of salience and tolerance, may not be inherently harmful and could even be linked to positive well-being outcomes in some contexts. This aligns with the notion that not all intensive SM use is problematic and that high engagement can coexist with healthy functioning (Billieux et al., 2019; Peng & Liao, 2023).

Meta-analytic studies indicate an association between PSMU and poorer mental health and lower well-being (Huang, 2022; Shannon et al., 2022). However, in the scarce longitudinal designs, this relationship appears less evident (Beeres et al., 2021; Kelly et al., 2018; Twigg et al., 2020). Nonetheless, our findings are consistent with prior research using item-level analysis or distinguishing between core and peripheral criteria in PSMU, obtaining no association or even negative associations with psychopathology for peripheral criteria (Fournier et al., 2023; Peng & Liao, 2023), being thus considered poor indicators of PSMU (Abal et al., 2024; Zarate et al., 2023).

Concerning the indirect effects of the model, Plan-net 3 (regulating unpleasant emotions), Plan-net 6 (expressing oneself socially), and Plan-net 7 (managing boredom) had indirect effects on mental health outcomes through core PSMU criteria. Specifically, these ORUSM domains were associated with increased depression, anxiety, and loneliness, and decreased life satisfaction, mediated by core PSMU criteria. This underscores the role of core PSMU

symptoms in linking the overvaluation of SM for certain purposes to negative mental health consequences (Perales et al., 2020; Perales & Muela, 2019). This supports the notion of ORUSM as a relevant explanatory mechanism in the emergence of PSMU and the negative psychological consequences derived from this issue. In contrast, peripheral PSMU criteria did not mediate the relationship between ORUSM domains and negative mental health outcomes, except for a positive indirect effect of managing boredom (Plan-net 7) on life satisfaction.

Implications

These findings have relevant implications, highlighting the importance of addressing specific ORUSM domains in prevention and intervention efforts. Interventions targeting the overvaluation of SM for emotional regulation and boredom management, rather than other utility domains, may help reduce the risk of developing PSMU and its associated mental health problems. Additionally, the differential associations of core and peripheral PSMU criteria with mental health outcomes support the idea of distinguishing between these criteria. Core criteria appear to capture the pathological aspects of PSMU that are linked to psychological distress, while peripheral criteria reflect high engagement that may not be harmful and can even be beneficial.

Limitations

This study has several limitations. First, the selection of participants for the second data collection was determined by the school, which decided whether it was willing to collaborate again. This may bias the type of students who participated in the second point, as schools with greater SM-related issues or more interest in research might have been more likely to contribute to a second measurement without receiving anything in return. Second, all measures were self-reported, relying heavily on participants' perceptions of themselves and potentially introducing bias due to social desirability.

Future lines

Regarding future studies, several avenues of research can build upon these results. First, given the low stability of the scores, future research could evaluate some domains of the Plan-net 25 in an ecological momentary assessment context to assess their fluctuations and understand which events cause increases or decreases in scores over short periods. Second, other relevant dependent variables that are not self-reported, such as participants' academic performance, could be incorporated into the model. Third, given the results obtained with the distinction between peripheral and core criteria, it is pertinent to expand this distinction to other domains, which according to current research is feasible (e.g., gaming disorder, Ballou & Van Rooij,

2021). Finally, since ORUSM has been identified as a key mechanism in the development of PSMU, future studies could focus on designing interventions that directly address this mechanism. For instance, promoting alternative behaviors that compete with the use of SM. These activities could be designed to provide similar reinforcements that users seek in SM but through more adaptive and healthy means.

Conclusions

This study provides evidence that the Plan-net 25 scale might be a promising instrument for evaluating a key mechanism in the development of PSMU. In addition, given the increasing attention to problematic behaviors associated with internet use, these results shed light on the distinction between users who genuinely exhibit a problematic profile associated with mental health problems and those who can be categorized as highly involved users but with low negative consequences. This distinction, along with a better understanding of the causal mechanisms of PSMU, could enable clinicians and professionals to refine prevention programs and individualized interventions more effectively.

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Conflict of interest

The authors report no potential conflict of interest.

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ORIGINAL

Social media addiction, personality, psychopathology and gender: Cross-sectional and longitudinal findings in adolescents

Adicción a redes sociales, personalidad, psicopatología y género: Hallazgos transversales y longitudinales en adolescentes

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Abstract

Social media addiction (SMA) is associated with a wide range of psychological problems in adults, but there are fewer studies about its impact on adolescents. A first step for SMA research in adolescents is to develop instruments to properly examine SMA among them. So the first aim of the current study was to explore the psychometric properties of the Bergen Social Media Addiction Scale (BSMAS) among Spanish adolescents. The study also examined the role of personality in SMA, the associations between SMA and mental health both cross-sectionally and longitudinally, and how these associations may be affected by gender and when personality is considered. A sample of 616 adolescents participated in the study (mean age = 15.01, $SD = 1.17$, 309 girls), with 1-year follow-up with 222 of them. The BSMAS emerged as a psychometrically sound instrument to assess SMA in adolescents, and showed proper evidence for construct and criterion-related validity, invariance between genders and excellent internal consistency. SMA was related to extraversion, neuroticism and low agreeableness in boys, and to neuroticism, extraversion and lower conscientiousness, openness and agreeableness in girls. SMA showed cross-sectional and longitudinal associations with many psychological problems, with differential associations appearing according to gender, but most disappeared when considering personality. Accordingly, disordered gaming and defiant behaviors predicted SMA after controlling for personality. These findings show the importance of using longitudinal designs and considering personality and gender when examining SMA development and its relations with psychological problems.

Keywords: social media addiction, psychometric validation, five-factor model of personality, psychopathology, comorbidity, adolescence

Resumen

La adicción a redes sociales (ARS) se asocia a un amplio rango de problemas psicológicos en adultos, aunque su impacto en adolescentes ha sido menos estudiado. Un paso necesario en la investigación de la ARS en la adolescencia es el desarrollo de instrumentos que permitan evaluarla adecuadamente en esta etapa evolutiva. Por ello, un primer objetivo del presente estudio fue explorar las propiedades psicométricas de la *Bergen Social Media Addiction Scale (BSMAS)* en adolescentes españoles. El estudio también examinó el papel de la personalidad en la ARS, las asociaciones entre la ARS y la salud mental, transversal y longitudinalmente; y cómo esas asociaciones se ven afectadas por el género y cuando la personalidad es considerada. La muestra del estudio se compuso de 616 adolescentes (media de edad = 15,01; $DT = 1,17$, 309 chicas), 222 fueron seguidos un año después. La BSMAS emergió como un instrumento adecuado para evaluar ARS en adolescentes, mostrando evidencia apropiada de validez de constructo y de criterio, invarianza entre géneros y excelente consistencia interna. La ARS se relacionó con extraversión, neuroticismo y baja amabilidad en chicos; y neuroticismo, extraversión, y menor responsabilidad, apertura y amabilidad en chicas. La ARS mostró asociaciones transversales y longitudinales con un gran número de problemas psicológicos, y estas difirieron según el género. No obstante, la mayoría de las relaciones desaparecieron cuando se tuvo en cuenta a la personalidad. En este sentido, la ARS estuvo predicha por uso problemático de videojuegos y conducta desafiante una vez se controló por personalidad. Estos hallazgos muestran la importancia de emplear diseños longitudinales y considerar la personalidad y el género a la hora de estudiar el desarrollo de la ARS y su relación con problemas psicológicos.

Palabras clave: adicción a redes sociales, validación psicométrica, modelo de los cinco factores, psicopatología, comorbilidad, adolescencia

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Social networking has become one of the most popular human behaviors. It is estimated that 62.3% of the world population is an active social media user, who spend an average of 2 hours and 23 minutes daily. For instance in Spain, where the present study takes place, 83.6% of citizens frequently use social networking sites (SNSs) (Kemp, 2024). The greatest use of SNSs is observed for adolescents and young adults, particularly girls (Kemp, 2024). Despite the positive functions that SNSs provide, such as social connection or entertainment, a minority of SNS users can develop the addictive symptomatology observed in other substance and non substance addictive behaviors (i.e., salience, mood modification, tolerance, withdrawal, conflict and relapse) (Griffiths, 2005). Accordingly, addictive SNSs use is defined as “an excessive concern about online activities, driven by an uncontrollable motivation that implies so much time and effort resulting in important life impairments” (Andreassen & Pallesen, 2014). As with its regular use, adolescents (Cheng et al., 2021) and the female gender (Andreassen et al., 2017) obtain the highest social media addiction (SMA) prevalence.

Many studies have shown an association between SMA and a large set of negative outcomes for adults and adolescents, such as anxiety and depression symptoms (Hussain & Griffiths, 2018; Keles et al., 2019; Marino et al., 2018), lower levels of well-being and life satisfaction (Duradoni et al., 2020; Marino et al., 2018), and poorer academic performance (Luo et al., 2021; Tsitsika et al., 2011). Very few studies are available about other psychopathological conditions of interest, especially in adolescence, such as eating behaviors problems (Imperator et al., 2021), Internet gaming disorder (IGD) (Andreassen et al., 2016; Monacis et al., 2017), and cyberbullying and cybervictimization (Kircaburun et al., 2018a; Longobardi et al., 2020). In addition, and as far as we know, associations between SMA and other substance addictions and well-established non substance addiction (i.e., problematic gambling) are still largely unexplored.

Although the literature describes significant associations between SMA and different negative outcomes cross-sectionally, the directionality of such associations is not well-established. For instance, a longitudinal study with adolescents found that SMA predicted less life satisfaction and increased cybervictimization and depressive symptoms, but not *vice versa* (Boer et al., 2021). Nonetheless, another study in adolescent girls showed that baseline depressive symptoms predicted SMA, but not *vice versa* (Raudsepp & Kais, 2019), whereas another research work observed a bidirectional longitudinal effect between SMA and depressive symptoms (Li et al., 2018). Overall, as longitudinal studies in adolescents are rare and, in some cases, report contradictory findings, more longitudinal research is necessary to clarify the directionality of the relations between SMA and psychological outcomes.

Therefore, and regardless of researchers' assumptions (i.e., SMA predicts future negative outcomes, psychological problems lead to SMA, or both cases), there is the belief that an etiological connection exists between SMA and a wide range of psychological problems. An alternative explanation might be that these associations are due to the existence of a common factor that underlies both SMA and psychopathology, such as personality. Nowadays, the most accepted framework by personality psychologists is the Five-Factor Model (FFM) (John, 2021), which comprises the basic personality dimensions of neuroticism, extraversion, openness to experience, agreeableness and conscientiousness (Costa & McCrae, 1992). From this framework, personality is considered an important dispositional variable that makes individuals more vulnerable to a wide range of psychological outcomes, including externalizing and internalizing symptoms (Etkin et al., 2022), and addictive-related behaviors like problematic patterns of substance use (Ibáñez et al., 2008), gambling (Sharpe, 2002), video gaming (López-Fernández et al., 2020), Internet use (Brand et al., 2016) and SMA. Accordingly, two meta-analyses showed a significant relation between SMA and high neuroticism ($r = .17 - .21$) and low conscientiousness ($r = -.15 - .16$) and, to a lesser extent, to low agreeableness ($r = -.07$), low openness ($r = -.03 - .04$) and extraversion ($r = .01 - .03$) (Huang, 2022; Meynadier et al., 2024). However, the vast majority of studies recruit adult samples and do not differentiate between males and females. This is an important gap in the literature because of the possible differences in the role of personality in SMA between youngster and adults (Meynadier et al., 2024), and between boys and girls, as the evident sex differences in the SMA prevalence rates suggest (Su et al., 2020).

Most of the above-described studies employ the Bergen Social Media Addiction Scale (BSMAS; Andreassen et al., 2016) to assess SMA. This 6-item questionnaire, rooted in a previous scale that assesses Facebook addiction (Andreassen et al., 2012), measures general SMA without focusing on particular SNSs, based on addictive symptomatology (Griffiths, 2005). The scale is well-validated in western and eastern countries, especially among university students. In this sense, a recent meta-analysis based on BSMAS psychometric properties confirmed its unidimensionality and provided evidences for the reliability of its scores and construct validity among 17 languages (Bottaro et al., 2025). With regards to adolescence, the instrument has also demonstrated sound psychometric properties in some countries, including measurement invariance across gender at different levels (Arrivillaga et al., 2024; Lin et al., 2017; Monacis et al., 2017). One objective of the current research was to validate the BSMAS among Spanish adolescents, yet a validation of the instrument in this specific population (Arrivillaga et al., 2024) was published during the peer-

review process of the present manuscript. We will compare our results to theirs in order to establish solid evidence on this population.

To summarize, despite this extensive research into the associations of SMA with diverse psychological problems and with FFM personality traits, it is worth highlighting some important gaps. First, despite adolescence being a crucial life stage for regular (Kemp, 2024) and addictive social media use (Cheng et al., 2021), there is scarce examination in adolescents of the most used questionnaire for assessing problematic social media use, the BSMAS. Second, most research works on the negative consequences of SMA include adult population samples, and usually focus on a limited range of psychological outcomes, such as depression, anxiety and well-being. Other psychopathological symptoms of interest, especially for adolescents, such as alcohol, eating or bullying problems, require more research attention. Third, most of these studies are cross-sectional and, therefore, directional links are not well-established in adolescents. Fourth, despite the relevant role of basic personality traits in a wide range of psychological outcomes (John, 2021), including SMA (Huang, 2022; Meynadier et al., 2024), only a few studies explore the role of this variable in adolescent SMA. Fifth, personality is a relevant factor for psychopathology and well-being (Etkin et al., 2022) and should, consequently, be taken into account when exploring associations between SMA and mental health. Last, gender differences consistently appear in personality traits (Costa et al., 2001), psychopathology (Etkin et al., 2022) and other technological addictions (Su et al., 2020) and should, therefore, also be considered in the SMA field.

The present study aims to explore the psychometric properties of the BSMAS in Spanish adolescents. The psychometrical analyses included, among others, internal consistency reliability, factor structure and the measurement invariance among genders. It also examines the role of FFM personality traits in SMA, including the possible moderating role of gender. In addition, it cross-sectionally and longitudinally examines the interrelations between SMA and a large set of psychological outcomes by considering the influence of personality and gender. Despite the exploratory nature of the current study, some general findings are expected. The BSMAS will present sound psychometric properties in Spanish adolescents, including gender measurement invariance. SMA will be related to personality, especially to neuroticism and low conscientiousness. In addition, a large number of cross-sectional and longitudinal associations will be exhibited between SMA and psychological outcomes such as disordered gaming, anxiety and depression; and most of them will be vanished when considering personality. Finally, gender will emerge as a relevant moderator in the link between SMA and other psychological variables.

Method

Participants and procedure

The researchers contacted two public high schools from Castelló de la Plana (an urban area on the eastern coast of Spain) to form the convenience sample, which participated in a larger project that examined the psychosocial risk and protective factors involved in mental health in adolescence. Trained research assistants administered the paper-pencil battery of questionnaires in the classroom in group and gave the students detailed instructions, highlighting the confidentiality of the data and the importance of giving honest responses. Once the questionnaires were returned, research assistants checked the proper completion of tests. The university's Ethical Committee approved this research work and regional authorities authorized it. The parents or legal guardians of the participants gave written informed consent in accordance with the Declaration of Helsinki.

Of the 1272 high school students invited to participate in this study, 616 completely answered the instruments related to social networking behavior and formed the final sample. Their mean age was 15.01 years ($SD = 1.17$) and 309 were girls. The follow-up of a subsample of 222 adolescents (mean age of 14.39, $SD = 1.02$; 50% girls) lasted 1 year to conduct Cross-Lagged Panel Models (CLPMs).

Measures

Social media related-behaviors. The participants reported the number of daily hours they spent on WhatsApp, Facebook, Instagram and other SNSs on weekdays and at weekends. In addition, this study applied the BSMAS (Andreassen et al., 2016) to measure the addictive use of social media (e.g., '... felt an urge to use social media more and more'). Each item, from the six composing the scale, scored on a 5-point scale using anchors from 1: *Never or Very rarely* to 5: *Very often*. The authors of this study translated into Spanish the original items. Then a bilingual speaker did a back-translation of the resulting Spanish version to check comparability. The instrument has been previously validated in Spanish adults (Brailovskaia & Margraf, 2022) and adolescents (Arrivillaga et al., 2024).

FFM personality traits. The study employed the 60-item version (Ortet-Walker et al., 2020) of the Junior Spanish version of the NEO-PI-R (Ortet et al., 2010) to measure the five-factor structure of personality (neuroticism, e.g., 'I often feel tense and restless'; extraversion, e.g., 'I really enjoy talking with people'; openness to experience, e.g., 'I have a lot of imagination'; agreeableness, e.g., 'I become distrustful when someone is nice to me'; and conscientiousness, e.g., 'I don't take my class obligations very seriously') to represent the majority of lower-order facets in youths aged between 12 and 17 years. Items are responded on 5-point Likert scales ranging from 0 (*Strongly disagree*) to 4 (*Strongly agree*). Once reversed items were computed, the scores of each

dimension were obtained by summing its corresponding items (12 per dimension). The scale has shown adequate psychometric properties (Ortet-Walker et al., 2020).

Disordered gaming. This study assessed pathological gaming (e.g., ‘You have stopped doing your household chores to spend more time playing video games’) using a scale for youths (Gentile, 2009) which was previously adapted and validated in Spanish adolescents (López-Fernández et al., 2020). The instrument comprises 11 items assessed on a 4-point Likert scale (0 = *never or almost never*; 3 = *almost always or always*).

Alcohol-related problems. This study also included the Alcohol Use Disorders Identification Test (AUDIT) (Babor et al., 2001), whose psychometric properties have been supported among Spanish adolescents (Boubeta et al., 2017). It is a 10-item instrument that measures alcohol consumption (items 1-3; e.g., ‘How often do you consume alcoholic beverages?’), alcohol dependence (items 4-6; e.g., ‘How often in the past 12 months have you been unable to do what was expected of you because you had been drinking?’) and harmful alcohol (items 7-10; e.g., ‘How often in the past 12 months have you had regrets or feelings of guilt after drinking?’). The items are responded on a 5-point Likert scales, except for items 9 and 10, on a 3-point Likert scale. The total score was employed in the present study.

Disordered gambling. This work employed a validated Spanish version (Becona, 1997) of the South Oaks Gambling Screen revised for adolescents (SOGS-RA) (Fisher, 1993) to assess gambling-related problems (e.g., ‘In the past 12 months, how often have you returned the next day to play to recover the lost money?’). The scale consists of 12 dichotomic items.

Psychopathological symptoms. The present work used the Assessment System for Children and Adolescents (SENA) (Sánchez-Sánchez et al., 2016), which assesses behavioral and emotional problems in child and adolescent populations. The inventory is a 5-point scale that goes from 0: *Never or almost never* to 4: *Always or almost always*. For the present study, the selection of subscales was as follows: aggressiveness (7 items; e.g., ‘I annoy the people I don’t like’), antisocial behavior (8 items; e.g., ‘I sneak into places without paying’) and defiant behavior (3 items; e.g., ‘I do whatever I want, even if I get punished’) (from the externalizing spectrum); anxiety (10 items; e.g., ‘My worries last a long time’), social anxiety (8 items; e.g., ‘I feel uncomfortable when others look at me’) and depression (14 items; e.g., ‘I enjoy things less than before’) (from the internalizing spectrum); eating problems (8 items; e.g., ‘I think about food too much’). Furthermore, this study also employed a subscale of victimization (8 items; e.g., ‘Some classmates force me to do things I don’t want to’), which assesses problems with classmates consisting in falling victim of physical and psychological violence.

Bullying. This paper uses a 7-item scale with 5 points (from 0: *Never or almost never* to 4: *Always or almost always*) to assess bullying behavior as a bully (e.g., ‘My friends and I have hit or attacked some classmate’). The scale emerged as a valid tool in a previous study (Etkin et al., 2020).

Cyberbullying and cybervictimization. This work used an *ad hoc* 5-point scale from 0: *Never or almost never* to 4: *Always or almost always* to measure cyberbullying —e.g., ‘I have annoyed a classmate over the phone or the Internet (i.e., insulting, threatening, mocking, criticizing, etc.)’— and cybervictimization —e.g., ‘I have been annoyed over the phone or the Internet (i.e., being insulted, threatened, mocked, criticized, etc.)’— with six items for each one.

Life satisfaction. It also employed the Spanish version (Galindez & Casas, 2010) of the Student’s Life Satisfaction Scale (SLSS) (Ash & Huebner, 1998) to evaluate life satisfaction (e.g., ‘My life is going well’). It is a 7-item inventory that measures life satisfaction of youths aged between 8 and 18 years who come from different life areas. The Spanish version has shown proper psychometric properties (Galindez & Casas, 2010).

Academic performance. The participants informed about their academic grades by answering with a 5-point scale format that ranged from 0: *Normally failed* to 4: *Normally outstanding* the question: ‘What grades did you obtain for the last school year?’.

Statistical analyses

In order to provide evidences about the internal structure of the questionnaire and the relationships of its scores with other variables, we followed the guideline for test validation pointed out by Sireci and Benítez (2023) on these topics.

To examine the internal structure of the Spanish version of the BSMAS, we conducted a confirmatory factor analysis (CFA). In order to compare with previous studies in adolescents (Bányai et al., 2017; Islam et al., 2022), we used the Maximum Likelihood with Robust Standard Error (MLR) estimator in Mplus 8.4 (Muthén & Muthén, 2018), what implies the treatment of variables as continuous and non-normally distributed data. We explored the one-dimensionality of the BSMAS, highly supported in different socio-cultural contexts (Bottaro et al., 2025). We applied the following to evaluate the overall model fit: Comparative Fit Index (CFI) > 0.90 (acceptable) (Marsh et al., 2004) and Root Mean Square Error of Approximation (RMSEA) < 0.10 (acceptable) (Weston & Gore, 2006). We ran multigroup confirmatory factor analyses (MG-CFA) to determine the configural, metric and scalar invariance of the BSMAS across gender to see if the construct could be meaningfully tested across groups. We used the model comparison criteria of $\Delta\text{CFI} \geq 0.01$ (Cheung & Rensvold, 2002) and $\Delta\text{RMSEA} \geq 0.015$ (Chen, 2007) to indicate any significant decrement in fit when testing for measurement invariance.

Then we conducted descriptive statistics, internal consistency indices (including McDonald's ω estimated with a macro for SPSS, Hayes & Coutts, 2020), correlations and regression analyses using version 21 of IBM SPSS Statistics. Those missing values from participants that represented less than 5% in a questionnaire were replaced with the mean score for the items remaining in that scale.

To compare the direct and partial correlations controlling for personality between the BSMAS and other psychological outcomes (i.e., psychopathological symptoms, life satisfaction or academic performance), we performed Pearson bivariate correlations and partial correlations by controlling for gender, age and personality.

Next we conducted hierarchical multiple linear regression analyses to explore the associations between FFM personality traits and SMA by controlling for gender and age in a first step. We also explored if gender moderated the associations between personality and SMA. In other words, if the relations between SMA and personality differed according to gender. Thus we included all the possible interactions between gender and personality traits in the regression model in a last step to control for potential confounders following the recommendations by Keller (2014). An interaction between gender and personality (gender $\times$ neuroticism, $\beta = .10$; $p = .007$) appeared and, consequently, we performed regression analyses separately for boys and girls.

We conducted two-wave CLPMs 1 year apart to explore the longitudinal links between SMA and other psychological outcomes in Mplus 8.4 (Muthén & Muthén, 2018) by controlling for age, gender, and with and without personality. We tested the models by gender separately.

Results

Factor structure and gender invariance of the BSMAS

We ran the BSMAS CFA with the whole sample (Model 1) and in each gender separately (Models 2 and 3). The fit indices were acceptable (see Table 1). The factor loadings of the CFA from Model 1 ranged from .57 to .81 (see Figure 1). The MG-CFA across genders showed good fit indices and minimal changes in the CFI and RMSEA when including constraints across loadings, which suggests metric invariance (Model 5). However, the comparison criteria were poor when including constraints across intercepts (Model 6). Consequently, scalar invariance was not fulfilled. Therefore, we tested partial invariance by releasing constraints to keep invariance across intercepts and by meeting the invariance of most items (Steenkamp & Baumgartner, 1998; Vandenberg & Lance, 2000). Thus minimal changes indices were satisfactory when freely estimating the intercepts from items 1 and 3, which suggests partial scalar invariance (Model 7).

Correlations to the BSMAS, descriptive statistics and internal consistencies

Table 2 depicts the correlations to the BSMAS, descriptive statistics and internal consistencies of all the study variables. The Spanish version of the BSMAS for adolescents presented good internal consistency indices (Cronbach's α and McDonald's $\omega = .82$). All the discrimination indices (item-total correlations) were over .52.

The participants reported spending a mean of 2.82 daily hours on weekdays and of 3.78 hours at weekends for WhatsApp, and 2.50 hours on weekdays and 2.77 hours at weekends for Instagram. Moreover, 8.6% and 15.8% of the WhatsApp users indicated spending more than 6 daily hours of use on weekdays and at weekends, respectively.

Table 1
Model fit and measurement invariance testing results of the BSMAS across gender

SNS users	Model		χ^2_{S-B} (df)	CFI	RMSEA	90%CI	Ref	Δ CFI	Δ RMSEA
1-factor model	1	Whole sample	50.646(9)*	.946	.087	.065 .111	-	-	-
	2	Boys	30.258(9)*	.938	.088	.055 .123	-	-	-
	3	Girls	30.221(9)*	.939	.088	.055 .124	-	-	-
Invariance testing across gender	4	Configural	60.485(18)*	.938	.088	.064 .113	-	-	-
	5	Metric	63.340(23)*	.941	.076	.054 .098	M4	.003	-.012
	6	Scalar	80.969(28)*	.923	.079	.059 .099	M5	-.018	.003
	7	Partial Scalar [#]	66.953(26)*	.940	.072	.051 .093	M5	-.001	-.004

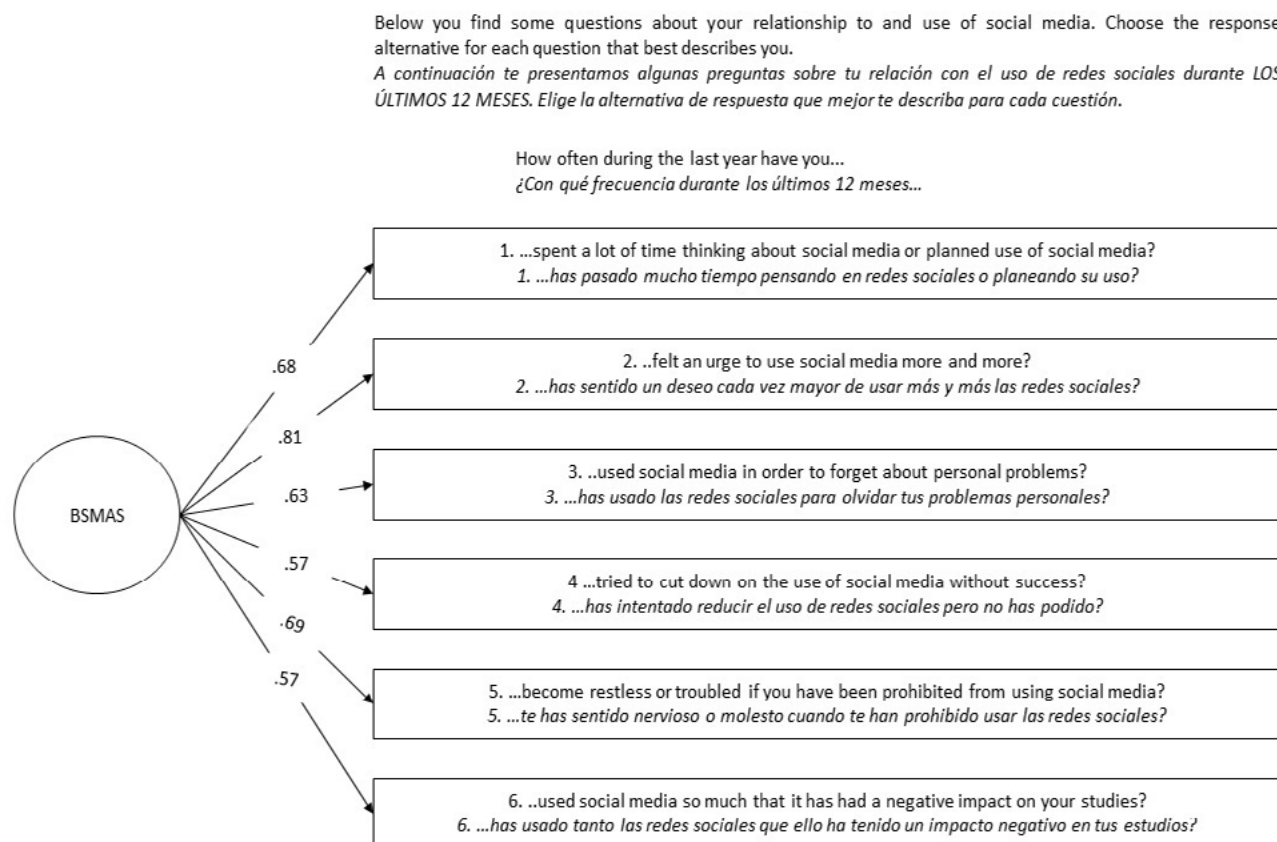
Note. χ^2_{S-B} = Satorra-Bentler scaled chi-square; df = degrees of freedom; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; 90% CI = 90% confidence interval of RMSEA; Ref = reference model; Δ CFI = change in CFI; Δ RMSEA = change in RMSEA.

[#] Intercept items 1 and 3 freely estimated across groups.

* $p < .001$.

Figure 1

Factors loadings from the 6 items of the Spanish version of the BSMAS for adolescents



Note. The instructions and items in Spanish are displayed in italics.

These percentages were respectively 7.8% and 13.6% for Instagram users. The use of Facebook and other SNSs was low compared to the other two SNSs, with .17 daily hours spent on weekdays and .23 hours at weekends for Facebook and .60 and .89 hours for other SNSs, respectively.

The BSMAS scores presented moderate correlations with Instagram and WhatsApp uses (.43 and .38, p .001, respectively), and associated significantly with all the negative outcomes, except disordered gambling and victimization, with small to moderate effect sizes. In addition, the effect sizes of such associations were different according to gender. In this way, the highest association for boys appeared with disordered gaming, whereas eating problems emerged as the strongest one in girls. When controlling for gender, age and personality, only the associations with eating problems, cyberbullying and anxiety were still significant for the whole sample. When controlling for personality in the sample split by gender, the relations with disordered gaming and cyberbullying

remained in boys, and the relation with depression did so for girls (see Table 2).

Users at risk and addicts

Some cut-offs have been proposed for the BSMAS in adolescents, which indicate high risk of social media engagement with a 19-point cut-off (Bányai et al., 2017) and SMA with a more stringent 24-point cut-off based on clinical diagnosis (Luo et al., 2021). Accordingly, 12.2% of the social media users from our sample would be at risk for problematic use, whereas 2.4% would be classified as addicts. It is worth stressing the substantial differences found between boys and girls, with 18.4% of girls at risk for problematic use (vs. 6.3% for boys) and 4.2% considered addicts (vs. 0.6% in boys).

SMA and personality

The hierarchical multiple linear regression analyses showed that personality related remarkably to SMA (see Table

Table 2*Correlation coefficients to the BSMAS, descriptive statistics, and the internal consistency of the study variables*

	BSMAS			Mean (SD)			Internal consistency		
	Total	Boys	Girls	Total	Boys	Girls	<i>d</i>	ω	α
BSMAS	—	—	—	12.09 (5.04)	10.47 (4.43)	13.77 (5.10)	.69	.82	.82
Gender	.33^c	—	—	—	—	—	—	—	—
Age	.01	—	—	15.01 (1.17)	15.03 (1.15)	14.99 (1.18)	.03	—	—
Neuroticism	.34^c	.19^b	.37^c	21.20 (8.84)	19.04 (8.40)	23.38 (8.79)	.50	.84	.84
Extraversion	.21^c	.25^c	.13^a	32.35 (7.68)	31.35 (7.46)	33.33 (7.75)	.26	.83	.84
Openness to experience	-.08^a	-.08	-.24^c	25.24 (8.00)	23.56 (7.51)	26.90 (8.19)	.43	.77	.76
Agreeableness	-.17^c	-.21^c	-.31^c	36.32 (7.36)	34.98 (7.69)	37.73 (6.73)	.38	.83	.82
Conscientiousness	-.15^c	-.14^a	-.29^c	29.76 (8.34)	28.17 (8)	31.27 (8.40)	.38	.87	.86
Alcohol-related problems	.24^c/.04	.20^b/.07	.24^c/.02	2.37 (3.57)	2.05 (3.61)	2.70 (3.55)	.18	.82	.80
Disordered gaming	.22^c/.12	.41^c/.28^b	.21^b/.04	4.73 (5.15)	5.76 (5.49)	2.65 (3.54)	.67	.86	.85
Disordered gambling	.03/.00	.12^a/.07	.01/-.03	0.12 (0.56)	0.18 (0.70)	0.04 (0.31)	.26	.69	.70
Aggressiveness	.10^a/.10	.13^a/.11	.26^c/.15	2.19 (3.15)	2.66 (3.68)	1.65 (2.36)	.33	.74	.74
Antisocial behavior	.14^b/.01	.21^b/.04	.17^b/.14	2.03 (3.26)	2.40 (3.75)	1.62 (2.69)	.24	.79	.78
Defiant behavior	.27^c/.13	.25^c/.09	.30^c/.05	1.41 (1.81)	1.29 (1.81)	1.48 (1.76)	.11	.61	.61
Anxiety	.32^c/.14^a	.15^b/.04	.28^c/.22	12.83 (9.13)	9.63 (7.53)	16.24 (9.48)	.77	.90	.90
Social anxiety	.18^c/.01	.08/.01	.16^a/.06	8.61 (6.72)	7.44 (6.25)	9.90 (7.02)	.37	.86	.86
Depression	.29^c/.13	.17^b/.05	.29^c/.22^a	9.86 (9.39)	8.08 (8.10)	11.90 (10.31)	.41	.91	.91
Eating problems	.39^c/.17^a	.30^c/.14	.33^c/.17	6.40 (6.10)	4.24 (4.62)	8.70 (6.55)	.79	.81	.82
Victimization	.08/.05	.18^b/.04	.03/.00	0.80 (2.30)	0.99 (2.61)	0.65 (2.04)	.15	.85	.84
Bullying	.11^b/.03	.15^a/.04	.24^c/.18	1.25 (2.39)	1.65 (2.86)	0.79 (1.67)	.37	.78	.77
Cybervictimization	.17^c/.08	.23^c/.09	.08/.06	0.91 (2.15)	0.69 (1.79)	1.15 (2.47)	.21	.82	.80
Cyberbullying	.15^c/.15^a	.25^c/.22^b	.15^a/.09	0.59 (1.36)	0.76 (1.56)	0.43 (1.12)	.24	.65	.64
Life satisfaction	-.17^c/.01	.05/.20 ^a	-.26^c/.19	21.10 (6.14)	21.94 (5.52)	20.19 (6.60)	.29	.80	.78
Academic performance	-.11^b/.05	-.18^b/.09	-.19^b/.02	2.21 (1.08)	2 (1.07)	2.41 (1.06)	.38	—	—

Note. Gender; 1 = boys, 2 = girls; BSMAS = Bergen Social Media Addiction Scale.

Values on the left of the slash are direct correlations.

Values on the right of the slash are for the partial correlations controlling for age and personality.

In **bold** ^a $p < .05$; ^b $p < .01$; ^c $p < .001$.

Effect size (Cohen, 1992):

For correlations; .10 = small, .30 = medium, .50 = large;

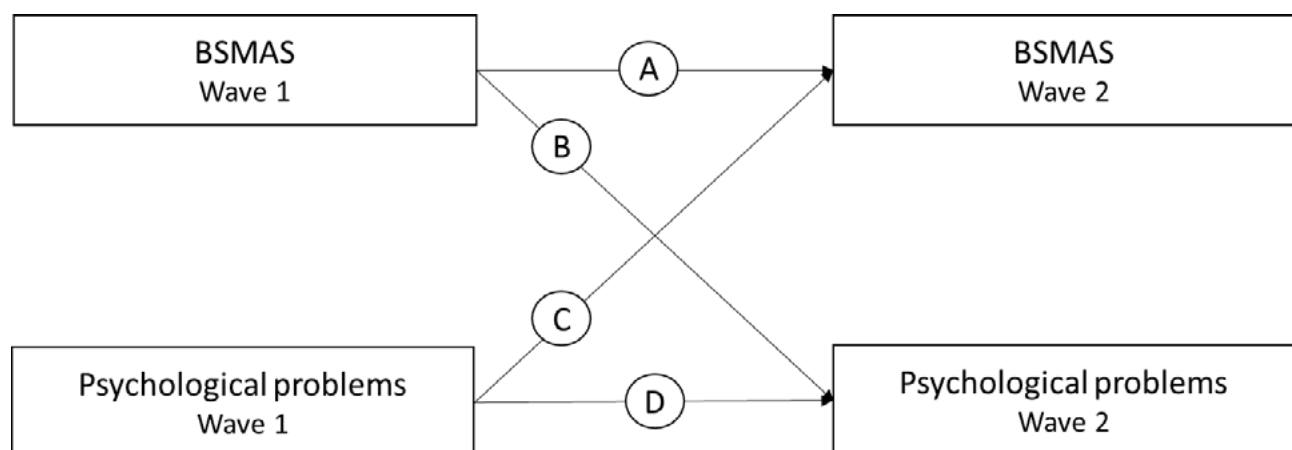
For mean differences (Cohen's *d*); .20 = small, .50 = medium, .80 = large.

Table 3
Multiple linear regression analyses of gender, age and Big-Five personality traits on the BSMAS

		BSMAS		BSMAS Boys		BSMAS Girls	
Step 1		β	ΔR	β	ΔR	β	ΔR
	Gender	.32***		—		—	
	Age	.02	.10***	.11	.01	-.05	.00
Step 2							
	Neuroticism	.27***		.17**		.35***	
	Extraversion	.25***		.31***		.24***	
	Openness to experience	-.16***	.20***	-.09	.16***	-.18***	.31***
	Agreeableness	-.12**		-.13*		-.14**	
	Conscientiousness	-.15***		-.09		-.20***	

Note. Gender; 1 = boys, 2 = girls;
* $p < .05$; ** $p < .01$; *** $p < .001$.

Figure 2
CLPMs between the BSMAS and psychological problems



Note. For clarify, the errors of the variables and their intercorrelations in each wave are not depicted in the figure.
Path A represents the stability between the waves of the BSMAS; Path B represents the effect of the BSMAS at Wave 1 on psychological problems at Wave 2; Path C represents the effect of psychological problems at Wave 1 in the BSMAS at Wave 2; Path D represents the stability between the waves of psychological problems.

3). The found association of SMA was mainly with high neuroticism and extraversion and, albeit to a lesser extent, with low openness to experience and conscientiousness. Finally, a minor relation appeared with low agreeableness. Apart from this, a strong association emerged between SMA and the female gender. Accordingly, in girls the associations between SMA and the personality traits of neuroticism, conscientiousness and openness to experience became more important.

SMA and psychological problems

The CLPMs (see Figure 2) revealed that, without controlling for personality, disordered gaming, defiant behaviors, eating

problems and anxiety predicted SMA 1 year later, whereas SMA predicted higher cybervictimization and lower academic performance. All the sizes of these cross-lagged effects were large: .12 (Orth et al., 2024). In contrast when contemplating personality, the only associations to remain were those with disordered gaming and defiant behaviors (see Table 4). Despite the small sample size, the CLPMs conducted for each gender tended to exhibit gender-dependent longitudinal links (see S1 Table).

Table 4
Regression weights of the CLPMs

	Path A	Path B	Path C	Path D
Alcohol-related problems	.48 ^c /.46 ^c	.08/.06	.06/.05	.57 ^c /.56 ^c
Disordered gaming	.43 ^c /.40 ^c	-.06/-.09	.18^b/.17^a	.56 ^c /.53 ^c
Disordered gambling	.52 ^c /.47 ^c	.05/.09	-.04/-.05	.42 ^c /.52 ^c
Aggressiveness	.53 ^c /.48 ^c	.05/-.03	.04/.00	.54 ^c /.43 ^c
Antisocial behavior	.52 ^c /.48 ^c	.03/-.03	.08/.05	.59 ^c /.56 ^c
Defiant behavior	.50 ^c /.47 ^c	.07/.02	.18^b/.15^b	.48 ^c /.43 ^c
Anxiety	.53 ^c /.49 ^c	-.05/-.05	.12^a/.05	.61 ^c /.53 ^c
Social anxiety	.53 ^c /.47 ^c	-.06/-.08	.07/.03	.69 ^c /.61 ^c
Depression	.51 ^c /.47 ^c	.10/-.05	-.04/.01	.58 ^c /.45 ^c
Eating problems	.50 ^c /.48 ^c	-.04/-.03	.15^a/.09	.73 ^c /.70 ^c
Victimization	.54 ^c /.50 ^c	.09/.04	.08/.05	.39 ^c /.37 ^c
Bullying	.52 ^c /.48 ^c	.04/.00	.04/-.01	.51 ^c /.46 ^c
Cybervictimization	.55 ^c /.50 ^c	.15^a/.14	.00/-.03	.35 ^c /.34 ^c
Cyberbullying	.54 ^c /.49 ^c	.11/.10	.02/-.02	.45 ^c /.44 ^c
Life satisfaction	.53 ^c /.47 ^c	-.02/.03	-.06/-.01	.62 ^c /.56 ^c
Academic performance	.53 ^c /.47 ^c	-.13^a/.05	-.06/-.01	.62 ^c /.51 ^c

Note. Estimator is maximum likelihood. Significant cross-lagged relations are shown in **bold**.

Values on the left of the slash are for the model when controlling for age and gender.

Values on the right of the slash are for the model when controlling for age, gender and personality.

^a $p < .05$; ^b $p < .01$; ^c $p < .001$.

Effect size (Orth et al., 2024); .03 = small, .07 = medium, .12 = large.

Discussion

The present study aimed to test the psychometric properties of the BSMAS in a sample of Spanish adolescents. This research also focused on showing relations between FFM personality traits and SMA, which may largely explain the numerous cross-sectional and longitudinal associations between SMA and other psychological problems found in the literature and also herein explored. Finally, it examined gender-dependent influences in such interrelations.

The Spanish version of the BSMAS replicated a one-factor solution with acceptable fit indices for the model performed by the CFA, providing essential evidence of construct validity and, therefore, reflecting that the test properly represents the conceptual variable, as well as excellent reliability. These findings are consistent with previous studies in adults (Bottaro et al., 2025) and adolescents (Arrivillaga et al., 2024; Lin et al., 2017; Monacis et al., 2017). In MG-CFA terms, the results of testing invariance across gender showed that both boys

and girls similarly interpreted the BSMAS construct, which provided configural invariance, metric invariance and partial scalar invariance (Putnick & Bornstein, 2016). In another sample of Spanish adolescents, Arrivillaga et al. (2024) followed different criteria to explore gender invariance measurement of the BSMAS. As for scalar invariance, the authors found that most of the indicators supported invariance and suggested the suitability of gender comparisons, as we do. In any case, some methodologists have recently argued that full invariance as prerequisite for valid group comparisons is somehow overstated (Robitzsch & Lüdtke, 2023). Currently, in the assessment of Internet-related addictions on Spanish adolescents, researchers have validated the gold-standard instruments that are commonly employed in the literature. That is the case of the BSMAS for SMA, the Compulsive Internet Use Scale to measure problematic Internet Use (Ortuño-Sierra et al., 2024), and the Internet Gaming Disorder Scale–Short Form for IGD (Beranuy et al., 2020; Sánchez-Iglesias et al., 2020).

Some studies have estimated cut-offs for risky and addictive uses for the BSMAS in representative samples of adolescents from western and eastern countries. For example, 4.5% of Hungarian adolescents were at risk of problematic use (Bányai et al., 2017), whereas 3.5% of Chinese adolescents were clinically considered addicts with a stricter cut-off (Luo et al., 2021). When taking these cut-offs as a framework, the data from our adolescent sample showed that 12.2% and 2.4% of Spanish adolescents could be considered at risk of problematic use and addiction, respectively. These data fall in line with the results from a meta-analysis based on SMA prevalences from 32 nations, which found a general 5% SMA prevalence when adopting conservative classifications, and 13% for less severe classifications (Cheng et al., 2021). In line with previous research (Andreassen et al., 2017; Kircaburun et al., 2018b; Su et al., 2020), it was noteworthy that there were important gender differences in such prevalences, with 18.4% and 4.2% of girls from our sample at risk for problematic use and addiction respectively, unlike the prevalences in boys respectively with 6.3% and 0.6 %.

Concerning the link between SMA and specific uses of SNSs, Instagram was the most associated SNS with SMA, which is consistent with previous research (Kircaburun et al., 2018b). Thus Instagram may present structural characteristics that make it more addictive than other SNSs, such as focusing on self-expression by sharing editable photos and stories to reflect, being rewarded, and leading a satisfying life that does not have to match real life. In line with this, self-presentation gratifications have been closely related to problematic social media use (Chen & Kim, 2013; Tang et al., 2022). Further research should include other SNSs with strong self-expression features, such as TikTok, which is closely related to SMA in adolescents (Marengo et al., 2022).

Regarding personality, SMA was related to neuroticism, extraversion, low agreeableness and low conscientiousness, as it was in previous meta-analyses mainly focused on adult samples (Huang, 2022; Meynadier et al., 2024) but to a greater extent (except for the link with low conscientiousness, which virtually presents the same value). These stronger relationships between personality and SMA in adolescents may reflect how adolescence is a sensitive stage for regular and addictive social media use (Cheng et al., 2021; Kemp, 2024). More interestingly, and as with disordered gaming (López-Fernández et al., 2020), a differential pattern of associations between SMA and personality appeared according to gender with: girls showing significant associations between SMA and neuroticism, extraversion, low conscientiousness, low openness and low agreeableness; boys presenting significant relations with extraversion, neuroticism (to a lesser extent than girls) and low agreeableness. These data suggest that, especially for girls, problematic social media

use is developed mainly to cope with daily problems and internalizing symptoms, such as anxiety and depression (Andreassen et al., 2016; Hussain & Griffiths, 2018; Keles et al., 2019; Kircaburun et al., 2018b; Marino et al., 2018). Furthermore, both boys and girls tend to participate in social networks due to the social interaction that their use entails by, for example, employing likes, comments or instant messaging (Choi et al., 2017). This leads extrovert teenagers to have more friends on social media, to perform more disclosure activity, and to have more frequent status updates (Kim & Chock, 2017), which may develop problematic engagement at these ages. Additionally, there was a link between low openness and SMA in girls, which suggests that girls with more intellectual curiosity spend more time with unconventional or infrequent alternative activities than social networking (Schwaba et al., 2018). Low conscientiousness was also relevant in SMA in girls, which implies that more disinhibited females might have difficulties with self-regulating the time spent on social media and reconciling this leisure activity with life obligations, as with other addictive behaviors (López-Fernández et al., 2020). Last, previous studies explain a significant association between SMA and low agreeableness for both genders, which suggests that agreeable people may construct offline social relationships easily, which may prevent them from problematic social media use (Huang, 2022; Kircaburun, 2016).

Regarding the association between SMA and psychopathological outcomes, SMA showed significant associations with a large set of psychopathological symptoms and life problems, as previously reported, such as: disordered gaming (Bottaro et al., 2025); anxiety, social anxiety, depression and ADHD symptoms (Bottaro et al., 2025; Chen et al., 2019; Hussain & Griffiths, 2018; Keles et al., 2019; Marino et al., 2018); eating problems (Imperator et al., 2021); aggression, bullying, cyberbullying and cybervictimization (Kircaburun et al., 2018a; Longobardi et al., 2020; Martínez-Ferrer et al., 2018); life satisfaction (Boer et al., 2021; Duradoni et al., 2020); academic performance (Luo et al., 2021; Tsitsika et al., 2011). The present study also reports relations between SMA and other psychopathological problems scarcely explored in the literature, specifically alcohol-related problems and defiant and antisocial behavior.

However, when controlling those relations for personality, they were strongly attenuated and most of them disappeared. Some of the small, but significant, associations between SMA and psychological problems that remained were eating problems with SMA, with a tendency observed in both boys and girls. Anxiety and marginally depression were also associated with SMA, but the effect was mainly for girls. A relation between disordered gaming and cyberbullying and SMA appeared, but only in boys. These results suggest that most of the

association between SMA and negative outcomes usually described in the literature may be attributed to common personality characteristics that affect both SMA and other psychopathological variables. For instance, irresponsible and disinhibited adolescents' academic performance is poorer (Mammadov, 2021) and their SNSs use is more unregulated (Meynadier et al., 2024). Likewise, adolescents high in neuroticism present more internalizing symptoms, such as depression and anxiety (Etkin et al., 2022; Williams et al., 2021), along with more problematic SNSs use (Meynadier et al., 2024).

Longitudinal analyses replicate, in part, these data and add information about the possible directionality of associations. Without considering personality traits, disordered gaming, defiant behaviors, eating problems and anxiety predicted SMA 1 year later, whereas SMA predicted cybervictimization and poorer academic performance, which fall in line with some previous studies (Boer et al., 2021; van den Eijnden et al., 2018). However, when controlling for personality, only relationships disordered gaming to SMA (with a similar effect size for both genders) and defiant behaviors to SMA (only in girls) remained significant (see S1 Table). Thus in the present sample, disordered video game engagement would reinforce problematic social networking, probably because of the social interaction motives that underlie both behaviors (Kircaburun et al., 2018b; López-Fernández et al., 2022). Moreover, girls with a strong disposition against authority may develop SMA, in part, because of their lack of submission in front of parental control and higher parent-adolescent conflict (Khodarahmi et al., 2023). Thus working on a satisfactory parent-adolescent relationship, based on mutual confidence, may be essential to prevent and treat SMA (Shek et al., 2018). In this vein, caregivers' reactive restrictions toward the Internet is a risk factor for SMA (Geurts et al., 2022), and an increase in the quality of communication about smartphone use with parents reduces adolescents' problematic smartphone use (Efrati et al., 2024).

As for specific theoretical models in Internet addictive disorders, the Interaction of Person-Affect-Cognition-Execution (I-PACE) model (Brand et al., 2016) emerges as an integrative framework where different components interact to explain the development and maintenance of these addictive behaviors. Within the model, personality is considered a vulnerable psychological factor that, as we have empirically demonstrated in the present study, may substantially explain the high comorbidity between Internet addictions and other psychopathology forms found in the literature. In this line, some personality traits may be common risk factors to Internet addictions, such as higher neuroticism linked to coping motives of use and impulsivity related to more loss of control; whereas other personality traits may be vulnerable factors to certain

Internet behaviors and contexts (such as the case of extraversion in adolescent SMA).

This study is not without its limitations. First, the high schools that participated in the research were selected at convenience. Second, our longitudinal sample was somewhat limited in number, especially when split by gender. So these results should be taken cautiously. Third, the use of self-report instruments is subjected to biases like memory recall or social desirability, and future research could collect data directly from smartphones to obtain more reliable results.

This present research shows the psychometric properties of the BSMAS scores in a sample of Spanish adolescents, including sound evidence for internal consistency, invariance across gender, and satisfactory evidence of construct and criterion validity. This latter comprised an extensive nomological network including SNSs uses, gender, personality traits and psychological problems. In this manner, the current study also unravels the role of personality in SMA, and its relevance for explaining cross-sectional and longitudinal associations between SMA and other negative outcomes widely found in the literature. Furthermore, gender-dependent effects in such associations appear. Overall, although our data suggests a small or negligible role of SMA in psychological problems and other outcomes, it is possible to better identify some of these subtle effects when contemplating gender differences. Hence the present study underscores the role of gender and personality when exploring the associations between SMA and different psychopathological symptoms and other psychosocial outcomes. These findings can be useful for developing personalized preventive and intervention programs for SMA in adolescence. In this context, educational centers are paramount for conducting primary preventive programs and, consequently, averting the development of Internet-related addictions, so prevalent at younger ages.

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Conflict of interests

The authors declare no conflicts of interests.

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LETTER TO THE EDITOR

Drug Dependency Units: What information do they provide for epidemiological surveillance?

Unidades de Atención a las Drogodependencias: Qué información proporcionan a la vigilancia epidemiológica

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Drug use surveillance and monitoring is one of the main challenges for healthcare services and public health (European Monitoring Centre for Drugs and Drug Addiction, 2024a).

Galicia has 17 Drug Dependency Units (DDU) and six Alcoholism Units, integrated into the second level of specialisation (Red de atención pública a las drogodependencias en España, n.d.). These units, under agreement with the Galician Health Service (SERGAS), provide coverage for the entire autonomous community and comprise multidisciplinary teams. Access is through referrals from primary care, emergency departments, mental health units, or even through direct request by the interested party (Xunta de Galicia, 2010).

The aim of this study was to describe the changes in the number of consultations at Galicia's Drug Dependency Units between 2015 and 2024 for treatment initiation or follow-up for addictive problems arising from the use of illicit substances.

Method

We analysed the records of the 17 DDU of Galicia from 2015 to 2024 (Xunta de Galicia, 2012). Four substance categories were considered: 1) Central nervous system (CNS) stimulants — cocaine (cocaine and freebase cocaine), amphetamines, synthetic drugs, sports performance enhancers, and other stimulants; 2) CNS depressants — heroin, other opiates (codeine or derivatives, methadone, buprenorphine), volatile inhalants, benzodiazepines, and cannabis; 3) psychodysleptics — LSD and other hallucinogens; and 4) depressants-stimulants — mixtures of heroin and cocaine. Records of “other” or “unknown” were excluded since it was not possible to identify the substance involved (145 and 16,175). The analysis was carried out by year. Results are presented overall and by sex.

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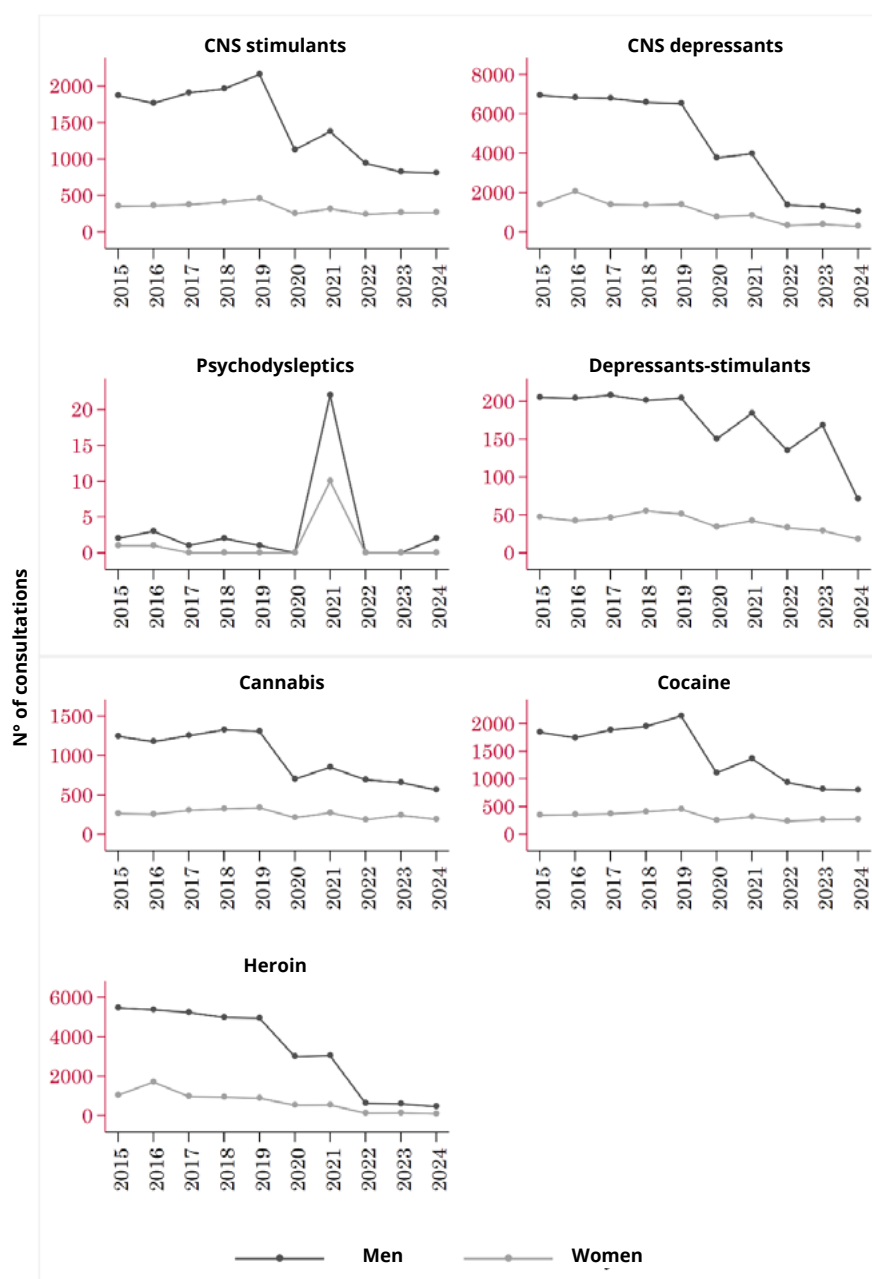
Results

Between 2015 and 2024, 75,343 consultations were performed for the initiation or follow-up of treatment relating to addictive problems associated with the four above-mentioned substance categories, at an average of 7,534 consultations per year. Men accounted for 81.6% of those receiving care. In both sexes, the substance category generating the most consultations was CNS depressants (73.2% in men and women), with heroin the main substance of abuse involved. Consultations for psychodysleptics were infrequent.

In men, the number of consultations remained stable until 2019, when it began to decrease, but stayed constant in women throughout the period for all four categories of substances. A decrease was observed in the difference in the number of consultations made by men and women. Thus, the male-female ratio of the number of consultations fell from 5.0 in 2015 to 3.3 in 2024. In each category, regardless of sex, there was a decrease in the number of consultations in 2020 and a subsequent rise in 2021, although previous levels were not reached (Figure 1).

Figure 1

Changes in the number of consultations performed for treatment initiation or follow-up for problems arising from illicit substance use in the Drug Dependency Units of Galicia from 2015 to 2024, by sex



Discussion

The Galician Drug Dependency Units handled an average of 7,534 consultations annually between 2015 and 2024. These were primarily for men and those using heroin.

Heroin has historically been the drug generating the highest number of consultations in Galicia, although this has decreased (Xunta de Galicia, 2010). This trend has also been observed in other autonomous communities, such as the Basque Country (Iraurgi Castillo & Vielva Pérez, 2000).

An increase in the number of consultations for problems arising from CNS stimulant use, particularly cocaine, was observed from 2015 to 2019. Cocaine is the illicit drug that generates the most admissions to treatment in Spain (Observatorio Español de las Drogas y las Adicciones, 2023) as well as in Europe (European Monitoring Centre for Drugs and Drug Addiction, 2024b).

For every initial or follow-up visit for addiction problems related to cannabis use, there were 3.3 visits for heroin and 1.4 for cocaine. This fact could be linked to the dependence created by and diseases associated with cannabis use, since cannabis cannot be administered parenterally, and depending on dosage and time span of use, withdrawal symptoms are usually asymptomatic and less intense (Fernández-Artamendi et al., 2011).

As in Spain overall, the number of consultations fell in 2020, which may be related to the closure of rehabilitation centres due to the COVID-19 pandemic (Observatorio Español de las Drogas y las Adicciones, 2023).

The limitations of this study relate to the data source, including the lack of information on sociodemographic variables, such as the age of people treated.

Understanding the treatment demands for substance use problems and, indirectly, how patients' needs change over time is crucial for healthcare administration. Combined with data from other sources, such as population surveys or the results of wastewater analysis, DDU-based data could become a powerful tool for surveillance, monitoring, and characterisation of addictions. Improved data collection is needed, however, to obtain more detailed data.

Acknowledgements

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Author contributions

C. Guerra-Tort: analysis, interpretation, editing. S. Correia: writing the original draft, editing. M.I. Santiago-Pérez: analysis, critical review. A. Teijeiro: edition, critical review. M. Carou: interpretation, editing, critical review. A. Montes: edition, critical review. M. Pérez-Ríos: conceptualisation, funding, interpretation, critical review. All authors have read and accepted the final manuscript.

Conflict of interests

The authors declare no conflicts of interest.

Ethical aspects

This research has been approved by the Research Ethics Committee of the University of Santiago de Compostela.

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AUTHOR GUIDELINES

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EDITORIAL

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