Journal of Substance Abuse Treatment 125 (2021) 108314

Contents lists available at ScienceDirect

Journal of Substance Abuse Treatment

journal homepage: www.elsevier.com/locate/jsat

# Clinical symptoms and personality traits predict subpopulations of treatment-seeking substance users

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ARTICLE INFO

*Keywords:*
Polydrug
Treatment outcomes
Relapses
Personality
Comorbidity

ABSTRACT

*Background:* The heterogeneity of treatment-seeking substance users represents a challenge, as most studies include participants having problems with specific substances or merge polysubstance users into the same category without considering differences between profiles. Considering the inconsistent literature on predictors of treatment outcomes, this study aimed to identify subpopulations of individuals with substance use disorders (SUDs) and analyze the association among class membership, previous relapses, and treatment retention.

*Methods:* The study recruited a total of 159 participants (mean age = 40.60, *SD* = 8.70; 85.5% males) from two treatment facilities (outpatient daycare and inpatient residential centers). The baseline assessment gathered lifetime and current substance use, and personality and psychopathology measures. The study performed a latent class analysis to identify subpopulations of substance users and explored predictors of class membership using a multinomial regression analysis.

*Results:* The study found six different classes of substance users based on their diagnosis and pattern of substance use: class 1 (6.92% of participants): individuals with cannabis as primary substance, alcohol/cocaine as secondary substance and additional use of stimulants or other drugs; class 2 (30.82%): cocaine as primary substance, alcohol as secondary and additional cannabis use; class 3 (20.13%): alcohol as primary substance, cocaine as secondary and additional cannabis use; class 4 (17.61%): cocaine as primary substance, cannabis as secondary and additional alcohol/other drugs use; class 5 (16.35%): alcohol as primary and cannabis as secondary substance; class 6 (8.18%): heroin as primary substance, cocaine as secondary and additional alcohol use. Several traits and clinical symptoms predicted distinct class memberships. Participants pertaining to class 6 presented the highest number of relapses (*M* = 2.54, *SD* = 1.56).

*Conclusions:* These results have several clinical implications. Belonging to class 6 was associated with a greater number of previous relapses. Also, specific psychopathological symptoms and personality traits may impact SUD treatment response, which may help clinicians to guide initial assessment and treatment allocation.

## 1. Introduction

The concurrent use of two or more drugs in a given time period (i.e., polysubstance use) is a common pattern of substance use worldwide. Most individuals receiving treatment for substance use disorders (SUDs) in European countries reported problems with at least two substances, with prevalence rates ranging between 13% and 86% across countries (European Monitoring Center for Drugs and Drug Addiction, 2009). Consistent with these data, epidemiological evidence from the United States shows that most individuals with nonalcoholic SUD exhibited concurrent problems with other drugs (McCabe et al., 2017), and more than 10% presented with more than one SUD (Lipari & Van Horn, 2017).

Treatment attrition is a major issue as one in three individuals being treated for SUD drop out of their treatment (Lappan et al., 2020). This is especially concerning in polydrug users, as they show significantly poorer treatment outcomes and lower abstinence self-efficacy (Preti et al., 2011; Sofer et al., 2018; Timko et al., 2017). The available evidence exploring predictors of treatment dropout shows inconsistent results (Baker et al., in press; Brorson et al., 2013). The heterogeneity of this population represents a research challenge, as most studies include participants having problems with specific substances or merge polysubstance users into the same category without considering the

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https://doi.org/10.1016/j.jsat.2021.108314
Received 7 August 2020; Received in revised form 9 October 2020; Accepted 25 January 2021
Available online 30 January 2021

differences between profiles. In addition, the annual cost of substance use to the U.S. economy is estimated to be USD$ 600 billion, with treatment dropout being one of the major problems that treatment programs encounter (National Institute on Drug Abuse, 2018a).

Against this background, there is a growing interest in exploring subpopulations of substance users using a person-centered approach, such as latent class analysis, which identifies similar patterns of substance use without a priori classification based on the use of specific drugs (Bailey et al., 2019; Chan et al., 2020; Garey et al., 2020; Gjersing & Bretteville-Jensen, 2018; Martínez-Loredo et al., 2019; Salom et al., 2016; Schwartz et al., 2010). However, this approach is still underused in community treatment–seeking adults with SUDs, which may hamper clinically relevant results in terms of treatment success.

Poorer treatment outcomes among some single and polysubstance users may be related to the presence of externalizing (Bailey et al., 2019; Urbanoski et al., 2015) or internalizing (Lai et al., 2015; Silveira et al., 2019) problems. However, the evidence about the role of mental disorders in early dropout in this population is mixed, and although some studies have found personality disorders and comorbidity to be associated with dropout (Brorson et al., 2013; Huertas et al., 2019; Sofer et al., 2018) and relapse (Salazar-Fraile et al., 2010; Schellekens et al., 2015), others have found no association with treatment completion (Daigre et al., 2019; Darke et al., 2012). The same mixed evidence appears for mild psychopathology or psychological distress and treatment completion (Andersson et al., 2018; Daigre et al., 2019; Darke et al., 2012; Pasareanu et al., 2017).

More broadly, research has also suggested that certain personality traits predict treatment success. A recent meta-analysis found significant associations among agreeableness, conscientiousness, and treatment attendance (Bucher et al., 2019), while emotional-regulation process seemed more related to treatment participation and relapse. Specifically, patients showing affective temperament (Paulino et al., 2017), low positive and high negative emotionality (Leventhal et al., 2012), and high aggressive traits (Papamalis et al., 2020; Ramos, Broco, & Sánchezy Doll, 2020) present higher odds of relapse to use different substances and dropouts. Taken together, this evidence suggests the role of emotional regulation in goal-directed behaviors and the relevance of assessing emotion-related personality facets in substance use treatment facilities. Despite this general trend, the presence of different patterns of substance use and the existing differences between personality profiles of substance users (Nevid et al., 2019; Zilberman et al., 2018) make it very hard to establish definitive conclusions.

Different reviews on impulsivity have found consistent associations between several facets (e.g., decision-making, cognitive disinhibition, delay discounting) and poor treatment outcomes among individuals with SUDs (Loree et al., 2015; Stevens et al., 2014). Also, problems in decision-making and response inhibition in polysubstance users seem to predict treatment dropout and relapse, respectively (Barreno et al., 2019). Nonetheless, two recent meta-analyses found no evidence of increased impairments in decision-making (Chen et al., 2020) or inhibitory control (Liu et al., 2019) in polydrug users compared to controls. This mixed evidence suggests that the association between impulsivity and treatment outcomes may be specific to certain subpopulations or that certain facets (e.g., positive and negative urgency) may be more important than others in accounting for treatment dropout (Jara-Rizzo et al., 2019; Martínez-González et al., 2014).

Based on these studies, identifying profiles associated with early dropout and identifying predictors for these subpopulations would allow treatment providers to make early, informed decisions on interventions (Baker et al., in press) to prevent relapse and early dropout. This study aimed to explore subpopulations of substance users and to examine predictors of class membership in terms of clinical and personality variables. It also aimed to analyze the association among class membership, previous relapses, and treatment retention.

## 2. Material and methods

The data came from a naturalistic, 12-month follow-up study conducted at two clinical centers located in Spain. Both settings (outpatient daycare center and residential inpatient facility) belong to the same nongovernmental organization (Projecte Home Catalunya), which provides mutual support–oriented interventions for substance use and gambling problems. The Clinical Research Ethics Committee of the lead site (ref: CEImPA 2020.382) approved this study, in accordance with the 1975 Declaration of Helsinki and its subsequent revisions (World Medical Association, 2000). The study obtained written informed consent from all subjects prior to enrollment.

### 2.1. Participants

Projecte Home Catalunya interviews and assesses all individuals seeking treatment to gather personal information and sociodemographic data, and a clinical history and a clinical assessment. Once a month, study staff asked those who had enrolled at the center the previous month to participate in this study. Those agreeing to participate completed the questionnaires described here. The study sample comprised 159 participants (mean age = 40.60, *SD* = 8.70; 85.5% men) receiving treatment for SUDs in two treatment settings (see Table 1 for sample characteristics): 1) an outpatient daycare center ($n = 81$) and 2) a residential inpatient facility ($n = 78$). Eligibility criteria were: being at least 23 years old, presenting with an SUD and undergoing current treatment in any of the abovementioned facilities. Exclusion criteria were: presenting cognitive impairments or problems with Spanish language comprehension, presenting aggressive behavior, and being referred from another treatment program. The study also excluded those patients who discontinued treatment for more than one month. The minimum age to participate in the current study was set at 23 years old because individuals under that age were include in a special program for youths and this naturalistic study focused on adults. Also, they differ

**Table 1**
Sample characteristics.

| | Total sample | Inpatients | Outpatients |
|---|---|---|---|
| | *M* (*SD*) | *M* (*SD*) | *M* (*SD*) |
| SCL-90-R | | | |
| Somatizations[a] | 1.12 (0.96) | 1.19 (0.99) | 1.04 (0.93) |
| Obsessive compulsive symptoms[a] | 1.51 (0.93) | **1.68 (0.96)** | **1.34 (0.87)** |
| Interpersonal sensitivity[a] | 1.33 (0.95) | **1.56 (0.95)** | **1.11 (0.90)** |
| Depression[a] | 1.69 (0.91) | **1.87 (0.89)** | **1.51 (0.90)** |
| Anxiety[a] | 1.26 (0.97) | **1.45 (1.02)** | **1.08 (0.87)** |
| Anger-hostility[a] | 1.28 (1.08) | 1.23 (1.10) | 1.03 (1.07) |
| Phobic anxiety[a] | 0.81 (0.87) | 0.88 (0.83) | 0.75 (0.91) |
| Paranoid ideation[a] | 1.33 (0.94) | **1.56 (0.92)** | **1.07 (0.91)** |
| Psychoticism[a] | 1.07 (0.86) | 1.17 (0.88) | 0.97 (0.83) |
| Global severity index[a] | 1.31 (0.83) | **1.45 (0.84)** | **1.17 (0.80)** |
| UPPS-P | | | |
| Negative urgency[b] | 11.71 (3.44) | 11.87 (3.51) | 11.56 (3.39) |
| Lack of premeditation[b] | 8.96 (3.01) | 9.31 (2.88) | 8.63 (3.12) |
| Lack of perseverance[b] | 8.54 (3.25) | **9.09 (3.04)** | **8.00 (3.36)** |
| Sensation seeking[b] | 11.46 (4.63) | 10.56 (3.49) | 10.36 (5.52) |
| Positive urgency[b] | 11.52 (3.29) | 11.65 (3.20) | 11.39 (3.39) |
| ZKPQ | | | |
| Neuroticism-anxiety[c] | 10.17 (4.87) | 10.47 (4.86) | 9.89 (4.89) |
| Activity[c] | 8.60 (3.66) | 8.88 (3.44) | 8.33 (3.87) |
| Sociability[c] | 6.32 (3.25) | **6.95 (2.94)** | **5.72 (3.43)** |
| Impulsive sensation seeking[c] | 10.16 (4.37) | **11.01 (3.84)** | **9.34 (4.70)** |
| Aggression-hostility[c] | 7.80 (3.38) | 8.17 (3.44) | 7.44 (3.30) |

*Notes*. SCL-90-R: Symptoms Checklist-90-Revised; UPPS-P: UPPS-P Impulsive Behavior Scale; ZKPQ: Zuckerman-Kuhlman Personality Questionnaire.
Variables differing significantly at 0.05 level shown in **bold**.
[a] Total: $n = 158$; inpatients $n = 78$; outpatients $n = 80$.
[b] Total $n = 157$; inpatients $n = 80$; outpatients $n = 77$.
[c] Total $n = 155$; inpatients $n = 76$; outpatients $n = 79$.

from the adult group in several ways that may bias the results. For example, 80% of patients in the program for youths reported cannabis as their primary substance compared to 4% of the adult group.

### 2.2. Measures

#### 2.2.1. Substance use and clinical history

The study gathered personal information and sociodemographic data during the first assessment using a structure interview. The study assessed participants' clinical history (e.g., total years of substance use, number of previous treatments), current and previous pattern of substance use, and severity of their addiction using the European version of the Addiction Severity Index 5th Edition, EuropASI (Bobes et al., 1996; Kokkevi & Hartgers, 1995). If participants reported current use of more than one substance, the study team asked which substance they considered to be the main source of their problems. The study calculated total days of treatment using the center's records on the dates of treatment entry and discharge. Due to the heterogeneous nature of substance use disorders and related problems and relapse, we used the number of previous treatments as a proxy for the number of relapses, as they may indicate the presence of clinically relevant episodes of substance use.

#### 2.2.2. Symptom Checklist-90-R (SCL-90-R) (Derogatis, 1977; González de Rivera et al., 1989)

The SCL-90-R assesses 90 psychiatric symptoms grouped into nine dimensions (somatization, obsessive compulsive, interpersonal sensitivity, depression, anxiety, anger-hostility, phobic anxiety, paranoid ideation, and psychoticism). Each item is rated on a 5-point scale (from not at all = 0 to extremely = 4). In the current sample, Cronbach's alpha suggested good reliability for each dimensions (α = 0.83–0.93).

#### 2.2.3. UPPS-P Impulsive Behavior Scale (Lynam et al., 2006)

This study used the Spanish short version (Cándido et al., 2012). This scale assesses five impulsivity facets (negative urgency, [lack of] premeditation, [lack of] perseverance, sensation seeking, and positive urgency) using 20 items with responses from 1 (strongly agree) to 4 (strongly disagree). Higher scores in each dimension indicate greater impulsivity. The five scales showed good internal consistencies (α = 0.46–0.77) in the current sample.

#### 2.2.4. Zuckerman-Kuhlman Personality Questionnaire (ZKPQ) (Gomà-i-Freixanet & Valero Ventura, 2008; Zuckerman, 2002)

This questionnaire comprises 99 dichotomous items assessing five basic dimensions of personality and an infrequency scale to detect random responses (threshold score > 5). The traits assessed by the ZKPQ are: neuroticism-anxiety, activity, sociability, impulsive sensation seeking and aggression-hostility. All five dimensions showed good internal consistency in our sample (α = 0.63–0.82).

### 2.3. Procedure and treatment conditions

Study staff informed patients who agreed to participate about the objectives, and participants signed the informed consent and completed the three questionnaires described during the first week of the next month (UPPS-P, SCL-90-R and ZKPQ).

Both settings (outpatient daycare and inpatient residential centers) offer biopsychosocial interventions and mutual help. The outpatient daycare center is a low-to-moderate-demand center focused on individuals with substance use problems and their families, providing multidisciplinary interventions based on cognitive behavioral therapy (CBT), psycho-education, and occupational therapy to promote motivation to change. The inpatient facility is focused on the most severe profiles and offers 24-hour high-demand residential care. It offers the same mutual support–oriented intervention as the outpatient day program but covers more areas and provides more intensive care. In addition to CBT, psycho-education, and occupational therapy, it also offers medical and psychiatric services, formative services and labor guidance, physical activities, and workshops to develop specific skills (e.g., social skills, problem solving). During the first stage of treatment patients live in a substance-free therapeutic community that offers them the opportunity to develop a healthier lifestyle. Thereafter, patients move to a second stage aimed at achieving social integration and/or entry into work in a less supervised outpatient context. The treatment duration depends on patients' needs but lasts approximately 12 months in the outpatient facility and 9–12 months in the first phase of the residential center.

### 2.4. Data analysis

Three participants did not complete the ZKPQ and one also refused to complete the UPPS-P. One participant scored above the Infrequency threshold (>5) of the ZKPQ so the final sample was $n = 158$ for analyses involving drug use and SCL-90-R, $n = 155$ for those including the ZKPQ and 157 when we used the UPPS-P. With the aim of exploring subpopulations of treatment seekers and their potential predictors, this study performed a multi-group latent class analysis (LCA) with covariates based on their reported substances. The LCA assigns each individual to one of the exclusive subgroups based on the probability of being a member of that subpopulation. The study estimated parameters using the maximum likelihood method and the expectation maximization (EM) procedure with Newton-Raphson incorporated into the estimation of regression coefficients for covariates (Lanza et al., 2015).

First, the study explored the goodness of fit of several baseline models to identify an optimal baseline model. To ensure model identification, the study replicated each model estimation using 300 sets of random starting values for the rho ($\rho$) parameters (Lanza et al., 2007). We selected the number of latent classes based on the incremental model fit via Akaike's Information Criteria (AIC) and the sample-adjusted Bayesian Information Criterion (SABIC). Considering class sample size and interpretability of each class, the smallest AIC and SABIC suggested the best parsimonious and fitted model (Lanza & Rhoades, 2013).

To explore differences in class membership by treatment setting, we added setting (inpatient = 1, outpatient = 2) as a grouping variable and tested for measurement invariance by performing a likelihood ratio. A significant $p$-value suggests that the assumption of measurement invariance is violated, thus requiring a separate LCA for each setting. To facilitate the characterization of each class, the study used the following descriptors: the study reported the primary substance using the term "primary substance"; the secondary substance(s) using the term "secondary substance"; the study reported the presence of additional substance use using the expression "additional substance use".

Study staff then performed a set of multiple multinomial logistic regressions to examine if the class membership was predicted by any clinical symptomatology, impulsivity facet (i.e., negative urgency, lack of premeditation, and lack of perseverance), or personality trait. The values of the variance inflation factor (VIF $\leq$ 7.27) and the tolerance (TOL > 0.138) suggested the absence of multicollinearity (Senaviratna et al., 2019), except for the ZKPQ subscales (i.e., neuroticism, activity, aggression, and sociability). We, therefore, analyzed these subscales using independent models. The study standardized all covariates to facilitate the interpretation and performed the analyses using PRO LCA 1.3.2 for SAS 9.4 and SPSS v24.

Finally, the study performed a univariate analysis of variance to analyze differences in the total days of treatment and number of previous relapses according to participants' class membership. The study tested the homoscedasticity assumption through Levene's test, and we performed post hoc comparisons using Gabriel's test. The study calculated effect sizes using Cohen's $d$.

## 3. Results

### 3.1. Latent classes of treatment-seeking individuals

The incremental model fit criteria and the quality of the classification via entropy suggested that the 6-class model had the best fit (see Table 2). Latent class sizes were 30.82%, 20.13%, 17.61%, 16.35%, 8.18% and 6.92%, suggesting that each class was sufficiently significant. The study explored setting differences in class membership and tested measurement invariance between item-response probabilities. After running models with free and constrained estimation, the likelihood ratio test yielded nonsignificant differences ($\Delta G^2 = 25.48$, $\Delta df = 78$, $p = .999$), suggesting that measurement invariance across settings was held.

Based on the item-response probability patterns associated with each class (see Table 3), the study labeled the six classes as follows: class 1) individuals with cannabis as primary substance, alcohol/cocaine as secondary substance and additional use of stimulants or other drugs (6.92% of participants, $n = 11$); class 2) individuals with cocaine as primary substance, alcohol as secondary, and additional cannabis use (30.82%, $n = 48$); class 3) individuals with alcohol as primary substance, cocaine as secondary and additional cannabis use (20.13%, $n = 32$); class 4) individuals with cocaine as primary substance, cannabis as secondary and additional alcohol/other drugs use (17.61%, $n = 28$); class 5) individuals with alcohol as primary and cannabis as secondary substance (16.35%, $n = 26$); and class 6) individuals with heroin as primary substance, cocaine as secondary and additional alcohol use (8.18%, $n = 13$). While individuals with cocaine as primary substance, alcohol as secondary and additional cannabis use (class 2) were less likely in outpatient settings, there were more individuals with alcohol as primary and cannabis as secondary substance (class 5) than expected ($\chi^2(5) = 16.85$, $p = .005$, $V = 0.326$).

### 3.2. Predictors of class membership

The study performed separate multiple multinomial logistic regressions for the SCL-90-R, the UPPS-P scale and the four ZKPQ subscales used. The reference group for each model was the "individuals with alcohol as primary and cannabis as secondary substance" class (class 5), as it represents a subpopulation of individuals having problems with the most normative substances and arguably the less severe one. We select this class as the reference group based on three rationales: 1) The primary substance is alcohol, a legal substance and the most used worldwide; 2) the only secondary substance of class 5 is the most prevalent and most socially accepted illegal substance, which use and/or sale of is legal in an increasing number of countries; and 3) The probability of ever used any other substance is low.

Of the clinical symptoms included in the model, OC [Change in log-likelihood (ΔLL) = 23.39, degree of freedom (df) = 5, $p = .0003$], interpersonal sensitivity (ΔLL = 19.55, df = 5, $p = .002$), fear (ΔLL = 16.61, df = 5, $p = .005$), and phobic anxiety (ΔLL = 17.05, df = 5, $p = .004$) significantly predicted class membership (see Table 4). Specifically, high scores in OC and interpersonal sensitivity increased the probability of having cannabis as primary substance, alcohol/cocaine as secondary substance, and additional use of stimulants or other drugs (class 1), and a high score in phobia increased the odds of being a member of classes 1, 2, or 3. On the other hand, only high fear scores predicted having cocaine as primary substance, cannabis as secondary, and additional alcohol/other drugs use (class 4). No clinical symptoms predicted having heroin as primary substance, cocaine as secondary, and additional alcohol use (class 6).

Only negative urgency yielded significant results (ΔLL = 18.40, df = 5, $p = .003$) for impulsivity, despite the relatively high odds ratio of lack of premeditation regarding class 6 (ΔLL = 4.08, df = 5, $p = .537$), as shown in see Table 4. Finally, despite the activity trait of the ZKPQ being statistically significant (ΔLL = 11.95, df = 5, $p = .035$), only the neuroticism (ΔLL = 9.73, df = 5, $p = .083$), aggression-hostility (ΔLL = 7.34, df = 5, $p = .196$), and sociability (ΔLL = 8.19, df = 5, $p = .146$) subscales of the ZKPQ were significant predictors of specific class membership (see Table 4).

**Table 2**
Latent class models for substance use.

| | LL | AIC | SABIC | Entropy |
|---|---|---|---|---|
| Class = 1 | −841.92 | 705.92 | 704.67 | 1.00 |
| Class = 2 | −700.13 | 450.34 | 447.73 | 0.99 |
| Class = 3 | −648.23 | 374.53 | 370.56 | 0.99 |
| Class = 4 | −610.32 | 326.71 | 321.40 | 0.99 |
| Class = 5 | −591.71 | 317.49 | 310.82 | 0.99 |
| **Class = 6** | **−576.99** | **316.06** | **308.04** | **0.99** |
| Class = 7 | −566.25 | 322.58 | 313.21 | 0.99 |

*Note.* LL = log-likelihood estimator for model convergence. AIC = Akaike information criterion. SABIC = sample-adjusted Bayesian information criteria. Best fitting models shown in bold.

**Table 3**
Item-response probabilities for substance use according to latent class membership.

| Variable | Class 1 | Class 2 | Class 3 | Class 4 | Class 5 | Class 6 |
|---|---|---|---|---|---|---|
| Primary substance | | | | | | |
| Alcohol | 0.006 | 0.001 | **0.997** | 0.002 | **0.994** | 0.005 |
| Cocaine/ stimulants | 0.009 | **0.998** | 0.003 | **0.996** | 0.003 | 0.006 |
| Cannabis | **0.812** | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Heroin | 0.002 | 0.000 | 0.000 | 0.001 | 0.001 | **0.988** |
| Secondary substance | | | | | | |
| Alcohol | **0.274** | **0.996** | 0.002 | 0.003 | 0.002 | 0.156 |
| Cocaine/ stimulants | **0.275** | 0.001 | **0.984** | 0.037 | 0.008 | **0.688** |
| Cannabis | 0.002 | 0.000 | 0.001 | **0.428** | **0.193** | 0.001 |
| Heroin | 0.000 | 0.000 | 0.000 | 0.143 | 0.000 | 0.000 |
| Additional substance | | | | | | |
| Alcohol | 0.092 | 0.000 | 0.001 | **0.285** | 0.001 | **0.381** |
| Cocaine/ stimulants | **0.182** | 0.122 | 0.123 | 0.001 | 0.157 | 0.077 |
| Cannabis | 0.004 | **0.447** | **0.469** | 0.109 | 0.034 | 0.155 |
| Heroin | 0.001 | 0.081 | 0.124 | 0.036 | 0.000 | 0.001 |
| Others | **0.263** | 0.041 | 0.066 | **0.179** | 0.113 | 0.001 |

### 3.3. Differences in treatment variables according to class membership

There were significant differences between classes in the number of previous relapses [F (5, 157) = 3.58, $p = .004$]. Specifically, those participants belonging to class 6 presented significantly more relapses ($M = 2.54$, $SD = 1.56$; $Mdn = 2$, interquartile range (IQR) = 1–4) than those in classes 1 ($M = 0.73$, $SD = 0.79$, $p = .018$; $Mdn = 1$, IQR = 0–1), 4 ($M = 1.21$, $SD = 1.26$, $p = .047$; $Mdn = 1$, IQR = 0–2), and 5 ($M = 0.96$, $SD = 0.82$, $p = .009$; $Mdn = 1$, IQR = 0–1.25). Effect sizes were 1.46, 0.94, and 1.27, respectively. Classes 2 ($M = 1.67$, $SD = 1.64$; $Mdn = 1$, IQR = 1–2) and 3 ($M = 1.50$, $SD = 1.30$; $Mdn = 1$, IQR = 0.25–2) did not differ from any class in terms of relapses. Participants in different classes did not differ in their current treatment length [F(5, 157) = 0.681, $p = .158$].

## 4. Discussion

The heterogeneous profile of SUD treatment-seekers has contributed to mixed evidence about the predictors of treatment success. Using a person-centered approach, the current study aimed to identify subpopulations of treatment-seekers and to test a wide range of potential predictors of class membership to improve intake assessments. The study also tested the association of class membership with previous relapse episodes and treatment retention. We found six latent classes of treatment-seekers and specific symptoms and personality traits that

**Table 4**
Multinomial logistic regressions to predict latent class membership.

| | Class 1 | | Class 2 | | Class 3 | | Class 4 | | Class 6 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | β | OR | β | OR | β | OR | β | OR | β | OR |
| SCL-90-R | | | | | | | | | | |
| OC | 2.26 | **9.56** | −0.34 | 0.71 | −0.74 | 0.48 | −0.14 | 0.87 | −0.54 | 0.58 |
| | (0.96) | (1.45, 63.23) | (0.54) | (0.25, 2.04) | (0.78) | (0.10, 2.19) | (0.63) | (0.25, 2.98) | (0.78) | (0.23, 2.68) |
| Sens | 3.28 | **26.51** | 0.91 | 2.48 | 1.32 | 3.74 | 1.27 | 3.54 | −0.20 | 0.82 |
| | (1.21) | (2.50, 281.56) | (0.62) | (0.74, 8.29) | (0.80) | (0.78, 17.90) | (0.69) | (0.92, 13.69) | (0.84) | (0.16, 4.24) |
| Fear | 1.05 | 2.87 | 0.63 | 1.88 | 0.32 | 1.38 | 1.18 | **3.27** | 0.71 | 2.03 |
| | (0.71) | (0.71, 11.58) | (0.41) | (0.84, 4.21) | (0.54) | (0.48, 3.97) | (0.45) | (1.34, 7.97) | (0.54) | (0.71, 5.83) |
| Phob | 2.32 | **10.19** | 1.38 | **3.96** | 1.58 | **4.84** | 0.54 | 1.71 | 0.71 | 2.04 |
| | (0.81) | (2.07, 50.22) | (0.56) | (1.31, 11.94) | (0.68) | (1.27, 18.42) | (0.62) | (0.51, 5.71) | (0.71) | (0.50, 8.24) |
| UPPS-P | | | | | | | | | | |
| NU | 0.18 | 1.20 | 0.65 | **1.91** | 0.38 | 1.46 | 1.20 | **3.32** | 1.14 | **3.13** |
| | (0.35) | (0.61, 2.37) | (0.26) | (1.14, 3.20) | (0.29) | (0.84, 2.55) | (0.35) | (1.69, 6.54) | (0.49) | (1.20, 8.17) |
| Prem | −0.05 | 0.95 | 0.30 | 1.35 | 0.35 | 1.42 | 0.51 | 1.66 | 0.98 | 2.67 |
| | (0.48) | (0.37, 2.45) | (0.35) | (0.67, 2.69) | (0.40) | (0.65, 3.12) | (0.41) | (0.75, 3.70) | (0.53) | (0.94, 7.59) |
| ZKPQ | | | | | | | | | | |
| N | 0.19 | 1.21 | −0.20 | 0.82 | −0.09 | 0.92 | 0.34 | 1.40 | 1.63 | **5.11** |
| | (0.45) | (0.51, 2.91) | (0.28) | (0.47, 1.42) | (0.39) | (0.43, 1.95) | (0.35) | (0.70, 2.80) | (0.76) | (1.14, 22.86) |
| A | 0.45 | 1.56 | 0.34 | 1.41 | 0.24 | 1.28 | 0.76 | **2.13** | −0.01 | 0.99 |
| | (0.44) | (0.66, 3.69) | (0.30) | (0.79, 2.53) | (0.40) | (0.58, 2.80) | (0.36) | (1.06, 4.28) | (0.43) | (0.42, 2.31) |
| S | 0.13 | 1.14 | −0.21 | 0.81 | 0.08 | 1.08 | 0.51 | 1.67 | 2.87 | **17.72** |
| | (0.71) | (0.28, 4.63) | (0.46) | (0.33, 2.01) | (0.60) | (0.33, 3.51) | (0.54) | (0.58, 4.78) | (1.05) | (2.24, 139.98) |

*Notes*. β: estimate (standard deviation); OR: odd ratio (95% confidence interval); SCL-90-R: Symptoms Checklist-90-Revised; OC: obsessions and compulsions; Sens: interpersonal sensitivity; Phob: phobic anxiety; NU: negative urgency; Prem: lack of premeditation; Pers: lack of perseverance; ZKPQ: Zuckerman-Kuhlman Personality Questionnaire; N: neuroticism; A: aggression-Hostility; S: sociability.
Reference latent class: Class 5. Significant odd ratios shown in bold

predicted membership in each class. These results may help clinicians to guide their initial assessments and treatment allocation, as having heroin as primary substance, cocaine as secondary and additional alcohol use (i.e., belonging to class 6) was associated with a greater number of previous relapses.

The classes identified in this study are consistent with most previous studies (Bailey et al., 2019; Hedden et al., 2010; Schwartz et al., 2010), despite differences in sampled facilities. The largest subpopulation was made up of individuals with cocaine as primary substance, alcohol as secondary (class 2), followed by individuals with alcohol as primary substance, cocaine as secondary (class 3), both with additional use of cannabis. Research has most commonly reported of a large group of individuals with a high probability of alcohol or cocaine use disorder (Hedden et al., 2010; Schwartz et al., 2010), and this group represents the vast majority of treatment seekers in the Spanish context (EMCDDA, 2019). The presence of classes characterized by cocaine as primary substance, cannabis as secondary, and additional alcohol/other drugs use (class 4) and by alcohol as primary and cannabis as secondary substance (class 5) is also in line with previous studies (Bailey et al., 2019; Chan et al., 2020; Hedden et al., 2010; Timko et al., 2017). Last, individuals with heroin as primary substance, cocaine as secondary and additional alcohol use (class 6) represent a subpopulation, which, considering the current low prevalence of heroin use in Spain (Plan Nacional Sobre Drogas, 2019), may be related to the so-called heroin epidemic that happened during the 1980s (Sánchez-Niubò et al., 2009), but may also be of interest to other countries in light of the upward trend of heroin use and overdose in the United States and Europe (NIDA, 2018b).

Several variables predicted each class membership. Notably, anxiety-related symptoms, such as obsessive-compulsive, interpersonal sensitivity, and phobic anxiety, were highly associated with having cannabis as primary substance, alcohol/cocaine as secondary substance, and additional use of stimulants or other drugs (class 1). Previous studies have suggested the role of cannabis misuse as a dysfunctional coping motive under negative affect (Wycoff et al., 2018), obsessive-compulsive symptoms (Spradlin et al., 2017), or social interactions (Buckner et al., 2016), which support the perception of self-medication (Lowe et al., 2019). To a lesser extent, phobic anxiety was also a significant predictor of having either cocaine or alcohol as primary substances, alcohol or cocaine as secondary, and additional use of cannabis (classes 2 and 3). Despite this scale having been designed to measure phobic-related fears (e.g., travels away from home, public places, social interactions), individuals undergoing treatment for SUD may report fear of everyday situations that may represent potential risk of relapse. Thus, we do not find it surprising that phobic anxiety yielded the largest effect size when comparing SCL-90-R dimensions between clinical samples of substance users and nonusers (Heath et al., 2018).

In addition to phobic anxiety, negative urgency appeared as a significant predictor of having cocaine as primary substance, alcohol as secondary, and additional use of cannabis (class 2); having cocaine as primary substance, cannabis as secondary, and additional alcohol/other drugs use (class 4); and having heroin as primary substance, cocaine as secondary, and additional alcohol use (class 6). Research has posited that negative urgency is one key transdiagnostic variable implied in the shift from impulsive to compulsive behavior and particularly in the maintenance of addictive behaviors through negative reinforcement (Zorrilla & Koob, 2019). The importance of negative urgency in predicting classes of individuals with cocaine as the primary substance is in line with studies relating cocaine dependence severity to negative urgency (Albein-Urios et al., 2012; Cándido et al., 2012). Also, a recent study reported a significant association between the medial orbitofrontal volume and higher negative urgency, which suggests that alterations in the neural integrity within this area may drive mood-related impulsivity in cocaine-dependent individuals (Irizar et al., 2020). Impairments in neural subtracts of motor inhibition (Garavan et al., 2008), which may affect the ability of response inhibition in cocaine users (Torres et al., 2013), may also explain the observed association among fear, negative urgency, aggression-hostility, and being a member of class 4 (cocaine as primary substance, cannabis as secondary, and additional alcohol/other drugs use). Additionally, having cocaine as primary substance also seems to be associated with error-related activity in the dorsolateral prefrontal cortex, too, suggesting its relationship with anger expression (Moeller et al., 2014). Finally, negative urgency together with neuroticism and sociability were significant predictors of

individuals with heroin as primary substance. Several previous studies have found significant associations between high neuroticism and heroin use (Delic et al., 2017; Kornør & Nordvik, 2007; Raketic et al., 2017; Sutin et al., 2013). Interestingly, one study showed that neuroticism was not directly associated with heroin use but indirectly via depressive symptoms (Lee & Yen, 2018). Current evidence on negative urgency may help to explain this indirect effect, as the combination of high neuroticism (i.e., the tendency to respond to frustration with negative emotions) and negative urgency (i.e., the tendency to act rashly in the context of negative affect) may place individuals at higher risk of relapse. Previous studies support the neuroticism-urgency association in relation to hazardous drinking (Bold et al., 2017; Papachristou et al., 2016) and suggest the role of emotional dysregulation and negative urgency on positive expectancies (Dir et al., 2016). Thus, individuals with concurrent high levels of emotional dysregulation or emotional liability and negative urgency may be prone to use substances as a coping strategy in the presence of negative affect and, therefore, more prone to relapse. Individuals with heroin as primary substance (class 6) also presented longer treatment histories, so they might be more acclimated to group interaction with unfamiliar people, which could explain the association between sociability and class 6 membership. Nonetheless, this explanation is speculative and more research on this issue is needed.

The large number of personality and clinical predictors that this study tested provides valuable findings with clinical implicationsg (Rodríguez-Muñoz & Al-Halabí, 2020). One interesting finding is the significant association of negative urgency with classes reporting more previous treatment attempts. This emotion-related facet of impulsivity has been of increasing interest in research (Halcomb et al., 2019) but is underused in clinical practice. Based on these results, practitioners may want cover this area when performing the treatment entry assessment. Current data on treatment retention suggests that the presence of different SUD diagnoses may not affect the effectiveness of substance use treatment. Indeed, SUDs represent one of the best examples of the dimensionality of mental health issues (Helzer et al., 2006; Kirisci et al., 2016), as all SUDs may share the same psychological processes, thus the specific substance/activity used/engaged in is less important (Shaffer et al., 2004).

The current study offers an interesting and useful approach to identify different at-risk subpopulations before treatment onset. Considering the pattern of use of the different identified subpopulations, these results may generalize to other therapeutic realities. However, we cannot guarantee this generalizability, as the result also depends on the substances included in the analysis. In this sense, future studies might include tobacco use, as it is one of the most prevalent substance used among individuals with SUDs (Wang et al., 2018; Weinberger et al., 2018). Despite successful existing treatments for smoking cessation (NICE, 2018), abstinence rates decrease dramatically at follow-ups (González-Roz et al., 2020). Against this background, several studies have suggested certain emotion-related and personality variables as predictors of treatment success (Pérez-Pareja et al., 2020), which could be gathered together with sociodemographic data and motivation and attitude toward the treatment as part of the assessment process (Becker et al., 2018). Another therapeutic reality not explored in the current study to which these results could be exported is psychotic populations. Previous studies report that patients with schizophrenia are 5 times more likely to present with SUD compared to the general population and that 65% of these SUDs concern tobacco use (Al-Halabí et al., 2016). Identifying classes of treatment-seekers would allow treatment providers to focus on high-risk profiles and use therapeutic strategies aimed at preventing relapses, such as mindfulness-based relapse prevention for SUDs (Grant et al., 2017), outpatients group treatment (Grundmann et al., 2020), or mobile-enhanced prevention support (Edwards et al., 2020).

The findings from this study should be interpreted in the context of the study's strengths and limitations. The study's main objective was to identify subpopulations of substance users and, therefore, the study's cross-sectional design means that we cannot establish the directionality of the reported predictors. In addition, the role of other important variables was out of the scope of this study and future studies should address prospective associations between classes of substance users and other treatment outcomes. Also, the vast majority of participants were male and all were 23 years old or older, which may preclude the generalization of results to other populations, such as youths or females. The current results should be replicated in female samples or with a balance proportion of males and females.

## 5. Conclusion

Despite the aforementioned and other potential limitations, this study presents results from a relatively large sample of participants recruited from substance treatment facilities in the community, and offers results with high ecological validity, as the study included almost all participants attending these facilities and agreeing to participate. The analytical approach that this study used allowed us to capture the heterogeneity of treatment-seeking individuals based on their differing patterns of substance use.

## Author contributions

VM: collected the data; VML y SA: conceptualized the study; VML: performed the data analyses and wrote the original draft; JMEP and SA: reviewed and edited the final version. All authors approved the final manuscript.

## Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Declaration of competing interest

None.

## Acknowledgments

The authors would like to thank to Asociación Proyecto Hombre for their assistance on this proyect.

## References

Albein-Urios, N., Martinez-Gonzalez, J. M., Lozano, O., Clark, L., & Verdejo-Garcia, A. (2012). Comparison of impulsivity and working memory in cocaine addiction and pathological gambling: Implications for cocaine-induced neurotoxicity. *Drug and Alcohol Dependence, 126*, 1–6. https://doi.org/10.1016/j.drugalcdep.2012.03.008.

Al-Halabí, S., Fernández-Artamendi, S., Díaz-Mesa, E. M., García-Álvarez, L., Flórez, G., Martínez-Santamaría, E. … Bobes, J. (2016). Tobacco and cognitive performance in schizophrenia patients: the design of the COGNICO study. Tabaco y rendimiento cognitivo en pacientes con esquizofrenia: diseño del estudio COGNICO. *Adicciones, 29*(1), 6–12. doi: 10.20882/adicciones.724.

Andersson, H. W., Steinsbekk, A., Walderhaug, E., Otterholt, E., & Nordfjærn, T. (2018). Predictors of dropout from inpatient substance use treatment: A prospective cohort study. *Substance Abuse: Research and Treatment, 12*, 1–10. https://doi.org/10.1177/1178221818760551.

Bailey, A. J., Farmer, E. J., & Finn, P. R. (2019). Patterns of polysubstance use and simultaneous co-use in high risk young adults. *Drug and Alcohol Dependence, 205*, 107656. https://doi.org/10.1016/j.drugalcdep.2019.107656.

Baker, D. E., Edmonds, K. A., Calvert, M. L., Sanders, S. A., Bridges, A. J., Rhea, M. A., & Kosloff, K. (in press). Predicting attrition in long-term residential substance use disorder Treatment: A Modifiable Risk Factors Perspective. *Psychological Services*. doi: https://doi.org/10.1037/ser0000333.

Barreno, E. M., Domínguez-Salas, S., Díaz-Batanero, C., Lozano, Ó. M., Marín, J. A. L., & Verdejo-García, A. (2019). Specific aspects of cognitive impulsivity are longitudinally associated with lower treatment retention and greater relapse in therapeutic community treatment. *Journal of Substance Abuse Treatment, 96*, 33–38. https://doi.org/10.1016/j.jsat.2018.10.004.

Becker, D., van Breda, W., Funk, B., Hoogendoorn, M., Ruwaard, J., & Riper, H. (2018). Predictive modeling in e-mental health: A common language framework. *Internet Interventions, 12*, 57–67. https://doi.org/10.1016/j.invent.2018.03.002.

Bobes, J., González, M. P., Sáiz, P., & Bousoño, M. (1996). Índice Europeo de Severidad de la Adicción: EuropASI. *Versión española. Actas de la IV Reunión Interregional de Psiquiatría*, 201–218.

Bold, K. W., Fucito, L. M., DeMartini, K. S., Leeman, R. F., Kranzler, H. R., Corbin, W. R., & O'Malley, S. S. (2017). Urgency traits moderate daily relations between affect and drinking to intoxication among young adults. *Drug and Alcohol Dependence, 170*, 59–65. https://doi.org/10.1016/j.drugalcdep.2016.10.035.

Brorson, H. H., Ajo Arnevik, E., Rand-Hendriksen, K., & Duckert, F. (2013). Drop-out from addiction treatment: A systematic review of risk factors. *Clinical Psychology Review, 33*, 1010–1024. https://doi.org/10.1016/j.cpr.2013.07.007.

Bucher, M. A., Suzuki, T., & Samuel, D. B. (2019). A meta-analytic review of personality traits and their associations with mental health treatment outcomes. *Clinical Psychology Review, 70*, 51–63. https://doi.org/10.1016/j.cpr.2019.04.002.

Buckner, J. D., Zvolensky, M. K., Ecker, A. H., & Jeffries, E. R. (2016). Cannabis craving in response to laboratory-induced social stress among racially diverse cannabis users: The impact of social anxiety disorder. *Psychopharmacology, 30*, 363–369. https://doi.org/10.1177/0269881116629115.

Cándido, A., Orduña, E., Perales, J. C., Verdejo-García, A., & Billieux, J. (2012). Validation of a short Spanish version of the UPPS-P impulsive behaviour scale. *Trastornos Adictivos, 14*, 73–78. https://doi.org/10.1016/S1575-0973(12)70048-X.

Chan, G., Connor, J., Hall, W., & Leung, J. (2020). The changing patterns and correlates of population-level polysubstance use in Australian youth: A multi-group latent class analysis of nationally representative samples spanning 12 years. *Addiction, 115*, 145–155. https://doi.org/10.1111/add.14761.

Chen, S., Yang, P., Chen, T., Su, H., Jiang, H., & Zhao, M. (2020). Risky decision-making in individuals with substance use disorder: A meta-analysis and meta-regression review. *Psychopharmacology, 237*, 1893–1908. https://doi.org/10.1007/s00213-020-05506-y.

Daigre, C., Perea-Ortueta, M., Berenguer, M., Esculies, O., Sorribes-Puertas, M., Palma-Alvarez, R., … Grau-López, L. (2019). Psychiatric factors affecting recovery after a long term treatment program for substance use disorder. *Psychiatry Research, 276*, 283–289. https://doi.org/10.1016/j.psychres.2019.05.026.

Darke, S., Campbell, G., & Popple, G. (2012). Retention, early dropout and treatment completion among therapeutic community admissions. *Drug and Alcohol Review, 31*, 64–71. https://doi.org/10.1111/j.1465-3362.2011.00298.x.

Delic, M., Kajdiž, K., & Pregelj, P. (2017). Association of the five-factor model personality traits and opioid addiction treatment outcome. *Psychiatria Danubina, 29*, S289–S291.

Derogatis, L. R. (1977). *SCL-90-R: Administration, Scoring & Procedures*. Clinical Psychometric Research: Manual II. Towson.

Dir, A. L., Banks, D. E., Zapolski, T. C. B., McIntyre, E., & Hulvershorn, L. A. (2016). Negative urgency and emotion regulation predict positive smoking expectancies in non-smoking youth. *Addictive Behaviors, 58*, 47–52. https://doi.org/10.1016/j.addbeh.2016.02.014.

Edwards, G. G., Reback, C. J., Cunningham, W. E., Hilliard, C. L., McWells, C., Mukherjee, S., … Harawa, N. T. (2020). Mobile-enhanced prevention support study for men who have sex with men and transgender women leaving jail: Protocol for a randomized controlled trial. *JMIR Research Protocols, 9*(9), Article e18106. https://doi.org/10.2196/18106.

European Monitoring Center for Drugs and Drug Addiction, & Union, P. O. of the E. (2009). *Polydrug use: Patterns and responses*. Luxembourg: Publications Office of the European Union.

European Monitoring Centre for Drugs and Drug Addiction. (2019). *European Drug Report 2019*. Luxembourg: Publications Office of the European Union.

Garavan, H., Kaufman, J. N., & Hester, R. (2008). Acute effects of cocaine on the neurobiology of cognitive control. *Philosophical Transactions of the Royal Society B: Biological Sciences, 363*, 3267–3276. https://doi.org/10.1098/rstb.2008.0106.

Garey, L., Rogers, A. H., Manning, K., Smit, T., Derrick, J. L., Viana, A. G., Schmidt, N. B., & Zvolensky, M. J. (2020). Effects of smoking cessation treatment attendance on abstinence: The moderating role of psychologically based behavioral health conditions. *Journal of Substance Abuse Treatment, 109*, 1–7. doi; https://doi.org/10.1016/j.jsat.2019.10.006.

Gjersing, L., & Bretteville-Jensen, A. L. (2018). Patterns of substance use and mortality risk in a cohort of "hard-to-reach" polysubstance users. *Addiction, 113*, 729–739. https://doi.org/10.1111/add.14053.

Gomà-i-Freixanet, M., & Valero Ventura, S. (2008). Spanish normative data of the Zuckerman-Kuhlman Personality Questionnaire (ZKPQ) in a general population sample. *Psicothema, 20*, 318–324.

González de Rivera, J. L., Derogatis, L. R., de las Cuevas, C., Gracia Marco, R., Rodríguez-Pulido, F., Henry-Benítez, M., & Monterrey, A. L. (1989). *The Spanish version of the SCL-90-R*. Clinical Psychometric Research: Normative data in the general population. Towson.

González-Roz, A., Weidberg, S., García-Pérez, A., Martínez-Loredo, V., & Secades-Villa, R. (2020). One-year efficacy and incremental cost-effectiveness of contingency management for cigarette smokers with depression. *Nicotine & Tobacco Research, Online ahead of print.*. https://doi.org/10.1093/ntr/ntaa146.

Grant, S., Colaiaco, B., Motala, A., Shanman, R., Booth, M., Sorbero, M., & Hempel, S. (2017). Mindfulness-based relapse prevention for substance use disorders: A systematic review and meta-analysis. *Journal of Addiction Medicine, 11*(5), 386–396. https://doi.org/10.1097/ADM.0000000000000338.

Grundmann, J., Lotzin, A., Sehner, S., Verthein, U., Hiller, P., Hiersemann, R. Schäfer, I. (2020). Predictors of attendance in outpatient group treatment for women with posttraumatic stress disorder and substance use disorder. *Psychotherapy research*, 1–12. Advance online publication. doi: https://doi.org/10.1080/10503307.2020.1817604.

Halcomb, M., Argyriou, E., & Cyders, M. A. (2019). Integrating preclinical and clinical models of negative urgency. *Frontiers in Psychiatry, 10*, 324. https://doi.org/10.3389/fpsyt.2019.00324.

Heath, L. M., Laporte, L., Paris, J., Hamdullahpur, K., & Gill, K. J. (2018). Substance misuse is associated with increased psychiatric severity among treatment-seeking individuals with borderline personality disorder. *Journal of Personality Disorders, 32*, 694–708. https://doi.org/10.1521/pedi_2017_31_307.

Hedden, S. L., Martins, S. S., Malcolm, R. J., Floyd, L., Cavanaugh, C. E., & Latimer, W. W. (2010). Patterns of illegal drug use among an adult alcohol dependent population: Results from the National Survey on Drug Use and Health. *Drug and Alcohol Dependence, 106*, 119–125. https://doi.org/10.1016/j.drugalcdep.2009.08.002.

Helzer, J. E., van den Brink, W., & Guth, S. E. (2006). Should there be both categorical and dimensional criteria for the substance use disorders in DSM-V? *Addiction, 101* (Suppl. 1), 17–22. https://doi.org/10.1111/j.1360-0443.2006.01587.x.

Huertas, E., López-Moreno, J. A., Fernández, V., Echeverry-Alzate, V., & Bühler, K. M. (2019). Associations between experimental substance use, FAAH-gene variations, impulsivity and sensation seeking. *Psicothema, 31*, 239–245. https://doi.org/10.7334/psicothema2019.27.

Irizar, P., Albein-Urios, N., Martínez-González, J. M., Verdejo-Garcia, A., & Lorenzetti, V. (2020). Unpacking common and distinct neuroanatomical alterations in cocaine dependent versus pathological gambling. *European Neuropsychopharmacology, 33*, 81–88. https://doi.org/10.1016/j.euroneuro.2020.01.019.

Jara-Rizzo, M. F., Navas, J. F., Steward, T., Lopez-Gomez, M., Jimenez-Murcia, S., Fernandez-Aranda, F., & Perales, J. C. (2019). Impulsivity and problem awareness predict therapy compliance and dropout from treatment for gambling disorder. *Adicciones, 31*, 147–159. doi: 10.20882/adicciones.1041.

Kirisci, L., Tarter, R. E., Reynolds, M., & Vanyukov, M. M. (2016). Item response theory analysis to assess dimensionality of substance use disorder abuse and dependence symptoms. *International Journal of Person Centered Medicine, 6*, 260–273.

Kokkevi, A., & Hartgers, C. (1995). EuropASI: European adaptation of a multidimensional assessment instrument for drug and alcohol dependence. *European Addiction Research, 1*, 208–210. https://doi.org/10.1159/000259089.

Kornør, H., & Nordvik, H. (2007). Five-factor model personality traits in opioid dependence. *BMC Psychiatry, 7*, 1–6. https://doi.org/10.1186/1471-244X-7-37.

Lai, H. M. X., Cleary, M., Sitharthan, T., & Hunt, G. E. (2015). Prevalence of comorbid substance use, anxiety and mood disorders in epidemiological surveys, 1990-2014: A systematic review and meta-analysis. *Drug and Alcohol Dependence, 154*, 1–13. https://doi.org/10.1016/j.drugalcdep.2015.05.031.

Lanza, S. T., Dziak, J. J., Huang, L., Wagner, A. T., & Collins, L. M. (2015). Proc LCA and Proc LTA users' guide (version 1.3.2). University Park: The Methodology Center, Penn State. Retrieved from https://metho dology.psu.edu/.

Lanza, S. T., & Rhoades, B. L. (2013). Latent class analysis: An alternative perspective on subgroup analysis in prevention and treatment. *Prevention Science, 14*, 157–168. https://doi.org/10.1007/s11121-011-0201-1.

Lanza, S. T., Collins, L. M., Lemmon, D. R., & Schafer, J. L. (2007). PROC LCA: A SAS procedure for latent class analysis. *Structural Equation Modeling, 14*, 671–694. https://doi.org/10.1080/10705510701575602.

Lappan, S. N., Brown, A. W., & Hendricks, P. S. (2020). Dropout rates of in-person psychosocial substance use disorder treatments: A systematic review and meta-analysis. *Addiction, 115*, 201–217. https://doi.org/10.1111/add.14793.

Lee, K. H., & Yen, C. F. (2018). The relationships between depression, neuroticism, and attitudes (NDA model) in heroin abusers in Taiwan. *American Journal on Addictions, 27*, 139–143. https://doi.org/10.1111/ajad.12691.

Leventhal, A. M., Japuntich, S. J., Piper, M. E., Jorenby, D. E., Schlam, T. R., & Baker, T. B. (2012). Isolating the role of psychological dysfunction in smoking cessation failure: Relations of personality and psychopathology to attaining smoking cessation milestones. *Psychology of Addictive Behaviors, 26*, 838–849. https://doi.org/10.1037/a0028449.

Lipari, R. N., & Van Horn, S. L. (2017). *Trends in substance use disorders among adults aged 18 or older*. The CBHSQ Report: June 29, 2017. Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration, Rockville, MD.

Liu, Y., van den Wildenberg, W. P. M., de Graaf, Y., Ames, S. L., Baldacchino, A., Bø, R., … Wiers, R. W. (2019). Is (poly-) substance use associated with impaired inhibitory control? A mega-analysis controlling for confounders. *Neuroscience and Biobehavioral Reviews, 105*, 288–304. https://doi.org/10.1016/j.neubiorev.2019.07.006.

Loree, A. M., Lundahl, L. H., & Ledgerwood, D. M. (2015). Impulsivity as a predictor of treatment outcome in substance use disorders: Review and synthesis. *Drug and Alcohol Review, 34*, 119–134. https://doi.org/10.1111/dar.12132.

Lowe, D. J. E., Sasiadek, J. D., Coles, A. S., & George, T. P. F. (2019). Cannabis and mental illness: A review. *European Archives of Psychiatry and Clinical Neuroscience, 269*, 107–120. https://doi.org/10.1007/s00406-018-0970-7.

Lynam, D. R., Whiteside, S. P., Smith, G. T., & Cyders, M. A. (2006). *The UPPS-P: Assessing five personality pathways to impulsive behavior*. Purdue University.

Martínez-González, J. M., Albein-Urios, N., Lozano-Rojas, O., & Verdejo-García, A. (2014). Differential aspects of treatment dropout risk in cocaine dependent patients with and without personality disorders. *Adicciones, 26*, 116–125. doi: 10.20882/adicciones.13.

Martínez-Loredo, V., Grande-Gosende, A., Fernández-Artamendi, S., Secades-Villa, R., & Fernández-Hermida, J. R. (2019). Substance use and gambling patterns among adolescents: Differences according to gender and impulsivity. *Journal of Gambling Studies, 35*, 63–78. https://doi.org/10.1007/s10899-018-09824-x.

McCabe, S. E., West, B. T., Jutkiewicz, E. M., & Boyd, C. J. (2017). Multiple DSM-5 substance use disorders: A National Study of U.S. Adults. *Human Psychopharmacology, 32*, 139–148. https://doi.org/10.1002/hup.2625.

Moeller, S. J., Froböse, M. I., Konova, A. B., Misyrlis, M., Parvaz, M. A., Goldstein, R. Z., & Alia-Klein, N. (2014). Common and distinct neural correlates of inhibitory dysregulation: Stroop fMRI study of cocaine addiction and intermittent explosive disorder. *Journal of Psychiatric Research, 58*, 55–62. https://doi.org/10.1016/j.jpsychires.2014.07.016.

National Institute on Drug Abuse. (2018a). *Principles of drug addiction treatment: A research-based guide* (Issue January).

National Institute on Drug Abuse. (2018b). *Heroin Research Report* (Issue June).

Nevid, J. S., Gordon, A. J., Barris, A., Sperber, J. E., & Haggerty, G. (2019). Personality profiles of patients with alcohol use disorder and opioid use disorder in an inpatient treatment setting. *Journal of Substance Abuse Treatment, 97*, 91–96. https://doi.org/10.1016/j.jsat.2018.11.013.

NICE. (2018). Stop smoking interventions and services. Retrieved from https://www.nice.org.uk/guidance/ng92/resources/stop-smoking-interventions-and-services-pdf-1837751801029.

Papachristou, H., Nederkoorn, C., & Jansen, A. (2016). Neuroticism and negative urgency in problematic alcohol use: A pilot study. *Substance Use & Misuse, 51*, 1–5. https://doi.org/10.1080/10826084.2016.1178294.

Papamalis, F. E., Kalyva, E., Teare, M. D., & Meier, P. S. (2020). The role of personality functioning in drug misuse treatment engagement. *Addiction, 115*, 726–739. https://doi.org/10.1111/add.14872.

Pasareanu, A. R., Vederhus, J. K., Opsal, A., Kristensen, Ø., & Clausen, T. (2017). Mental distress following inpatient substance use treatment, modified by substance use: Comparing voluntary and compulsory admissions. *BMC Health Services Research, 17*, 1–9. https://doi.org/10.1186/s12913-016-1936-y.

Paulino, S., Pombo, S., Ismail, F., Figueira, M. L., & Lesch, O. (2017). The role of affective temperament as a predictor of relapse in alcohol dependence. *Personality and Mental Health, 11*, 278–289. https://doi.org/10.1002/pmh.1373.

Pérez-Pareja, F. J., García-Pazo, P., Jiménez, R., Escalas, T., & Gervilla, E. (2020). Dejar de Fumar, Terapia Cognitivo-conductual y Perfiles Diferenciales con Árboles de Decisión. *Clínica y Salud, Online ahead of print.*. https://doi.org/10.5093/clysa2020a12.

Plan Nacional Sobre Drogas. (2019). Informe 2019: Encuesta sobre alcohol y drogas en España (EDADES) 1995–2017. In Salud PSeI Ministerio de (Ed.), Report 2019: National Survey on Alcohol and Drugs Spain (EDADES) 1995–2017. Retrieved from https://pnsd.sanidad.gob.es/profesionales/sistemasInformacion/sistemaInformacion/pdf/2019_Informe_EDADES.pdf.

Preti, E., Prunas, A., Ravera, F., & Madeddu, F. (2011). Polydrug abuse and personality disorders in a sample of substance-abusing inpatients. *Mental Health and Substance Use: Dual Diagnosis, 4*, 256–266. https://doi.org/10.1080/17523281.2011.577751.

Raketic, D., Barisic, J. V., Svetozarevic, S. M., Gazibara, T., Tepavcevic, D. K., & Milovanovic, S. D. (2017). Five-factor model personality profiles: The differences between alcohol and opiate addiction among females. *Psychiatria Danubina*, *29*, 74–80. doi: 10.24869/psyd.2017.74.

Ramos, J. M., Broco, L., & Sánchezy Doll, A. A. (2020). Personality as unidimensional and bidimensional vulnerability: The mediator role of cognitive variables in symptom severity in a sample of people with severe personality disorder. *Clínica y Salud, 31*, 1–12. https://doi.org/10.5093/clysa2019a18.

Rodríguez-Muñoz, M. F., & Al-Halabí, S. (2020). A Pathway to Excellence. *Clínica y Salud, 31*(3), 125–126. https://doi.org/10.5093/clysa2020a31.

Salazar-Fraile, J., Ripoll-Alandes, C., & Bobes, J. (2010). Open Narcissism, covered narcissism and personality disorders as predictive factors of treatment response in an out-patient drug addiction unit. *Adicciones, 22*, 107–112. doi: 10.20882/adicciones.199.

Salom, C. L., Betts, K. S., Williams, G. M., Najman, J. M., & Alati, R. (2016). Predictors of comorbid polysubstance use and mental health disorders in young adults-a latent class analysis. *Addiction, 111*, 156–164. https://doi.org/10.1111/add.13058.

Sánchez-Niubò, A., Fortiana, J., Barrio, G., Suelves, J. M., Correa, J. F., & Domingo-Salvany, A. (2009). Problematic heroin use incidence trends in Spain. *Addiction, 104*, 248–255. https://doi.org/10.1111/j.1360-0443.2008.02451.x.

Schellekens, A. F. A., de Jong, C. A. J., Buitelaar, J. K., & Verkes, R. J. (2015). Co-morbid anxiety disorders predict early relapse after inpatient alcohol treatment. *European Psychiatry, 30*, 128–136. https://doi.org/10.1016/j.eurpsy.2013.08.006.

Schwartz, B., Wetzler, S., Swanson, A., & Sung, S. C. (2010). Subtyping of substance use disorders in a high-risk welfare-to-work sample: A latent class analysis. *Journal of Substance Abuse Treatment, 38*, 366–374. https://doi.org/10.1016/j.jsat.2010.03.001.

Senaviratna, N. A. M. R., Cooray, A., & T. M. J.. (2019). *Diagnosing multicollinearity of logistic regression model* (pp. 1–9). October: Asian Journal of Probability and Statistics. https://doi.org/10.9734/ajpas/2019/v5i230132.

Shaffer, H. J., LaPlante, D. A., LaBrie, R. A., Kidman, R. C., Donato, A. N., & Stanton, M. V. (2004). Toward a syndrome model of addiction: Multiple expressions, common etiology. *Harvard Review of Psychiatry, 12*, 367–374. https://doi.org/10.1080/10673220490905705.

Silveira, M. L., Green, V. R., Iannacone, R., Kimmel, H. L., & Conway, K. P. (2019). Patterns and correlates of poly-substance use among U.S. youth ages 15–17 years: Wave 1 of the Population Assessment of Tobacco and Health (PATH) Study. *Addiction, 114*, 907–916. https://doi.org/10.1111/add.14547.

Sofer, M. M., Kaptsan, A., & Anson, J. (2018). Factors associated with unplanned early discharges from a dual diagnosis inpatient detoxification unit in Israel. *Journal of Dual Diagnosis, 14*, 1–11. https://doi.org/10.1080/15504263.2018.1461965.

Spradlin, A., Mauzay, D., & Cuttler, C. (2017). Symptoms of obsessive-compulsive disorder predict cannabis misuse. *Addictive Behaviors, 72*, 159–164. https://doi.org/10.1016/j.addbeh.2017.03.023.

Stevens, L., Verdejo-García, A., Goudriaan, A. E., Roeyers, H., Dom, G., Vanderplasschen, W., & L.. (2014). Impulsivity as a vulnerability factor for poor addiction treatment outcomes: A review of neurocognitive findings among individuals with substance use disorders. *Journal of Substance Abuse Treatment, 47*, 58–72. https://doi.org/10.1016/j.jsat.2014.01.008.

Sutin, A. R., Evans, M. K., & Zonderman, A. B. (2013). Personality traits and illicit substances: The moderating role of poverty. *Drug and Alcohol Dependence, 131*, 247–251. https://doi.org/10.1016/j.drugalcdep.2012.10.020.

Timko, C., Ilgen, M., Haver, M., Shelley, A., & Breland, J. Y. (2017). Polysubstance use by psychiatry inpatients with co-occurring mental health and substance use disorders. *Drug and Alcohol Dependence, 180*, 319–322. https://doi.org/10.1016/j.drugalcdep.2017.08.018.

Torres, A., Catena, A., Megias, A., Maldonado, A., Candido, A., Verdejo-Garcia, A., & Perales, J. C. (2013). Emotional and non-emotional pathways to impulsive behavior and addiction. *Frontiers in Human Neuroscience, 7*, 43. https://doi.org/10.3389/fnhum.2013.00043.

Urbanoski, K., Kenaszchuk, C., Veldhuizen, S., & Rush, B. (2015). The clustering of psychopathology among adults seeking treatment for alcohol and drug addiction. *Journal of Substance Abuse Treatment, 49*, 21–26. https://doi.org/10.1016/j.jsat.2014.07.004.

Wang, T.W., Asman, K., Gentzke, A.S., Cullen, K.A., Holder-Hayes, E., Reyes-Guzman, C. … King, B.A. (2018). Tobacco product use among adults—United States, 2017. *Morbidity and Mortality Weekly Report, 67,* 1225–1232. doi: 10.15585/mmwr.mm6744a2.

Weinberger, A. H., Gbedemah, M., Wall, M. M., Hasin, D. S., Zvolensky, M. J., & Goodwin, R. D. (2018). Cigarette use is increasing among people with illicit substance use disorders in the United States, 2002–14: Emerging disparities in vulnerable populations. *Addiction, 113*, 719–728. https://doi.org/10.1111/add.14082.

World Medical Association. (2000). Declaration of Helsinki. Ethical principles for medical research involving human subjects. Retrieved at http://www.wma.net.

Wycoff, A. M., Metrik, J., & Trull, T. J. (2018). Affect and cannabis use in daily life: A review and recommendations for future research. *Drug and Alcohol Dependence, 191*, 223–233. https://doi.org/10.1016/j.drugalcdep.2018.07.001.

Zilberman, N., Yadid, G., Efrati, Y., Neumark, Y., & Rassovsky, Y. (2018). Personality profiles of substance and behavioral addictions. *Addictive Behaviors, 82*, 174–181. https://doi.org/10.1016/j.addbeh.2018.03.007.

Zorrilla, E. P., & Koob, G. F. (2019). Impulsivity derived from the dark side: Neurocircuits that contribute to negative urgency. *Frontiers in Behavioral Neuroscience, 13*, 136. https://doi.org/10.3389/fnbeh.2019.00136.

Zuckerman, M. (2002). Zuckerman-Kuhlman Personality Questionnaire (ZKPQ): An alternative five-factorial model. In B. de Raad, & M. Perugini (Eds.), *Big five assessment* (pp. 376–392). Boston: Hogrefe & Huber Publishers.