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Patient Characteristics Predicting Abstinence in Substance Use Disorder Patients With Comorbid Mental Disorders

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ABSTRACT

Objective: Patients with both a substance use disorder and comorbid mental disorder, or dual diagnosis, form a heterogeneous group with complex treatment needs. Dual diagnosis patients have worse treatment outcomes compared to patients with substance use disorders alone. There is a lack of research focusing on predictors of treatment outcome in dual diagnosis patients. The aim of this study was to identify patient characteristics associated with abstinence in dual diagnosis patients. **Methods:** In a cohort design, we examined associations between baseline demographic and clinical patient characteristics and abstinence at 14-month follow-up in 102 dual diagnosis patients undergoing treatment in an addiction-psychiatry service in Amsterdam. Immigration, employment, housing, age, emotion regulation, psychiatric symptoms, and frequency and nature of substance abuse were examined as possible predictors of abstinence. Patients were considered abstinent if they had refrained from any substance use in the 30 days prior to the follow-up assessment, as measured with the Timeline Follow Back method. **Results:** In a multiple logistic regression analysis corrected for treatment utilization, being a first- or second-generation immigrant was associated with lower odds of abstinence ($OR = 5.13$; 95% CI [1.63, 18.18]), as well as higher levels of depressive and anxiety symptoms at baseline ($OR = 0.90$; 95% CI [0.81, 0.99]). Gender, age, housing, employment, emotion regulation, frequency and nature of substance abuse, and the psychiatric symptoms positive symptoms, negative symptoms, and manic excitement and disorganization did not show a significant relationship with abstinence. **Conclusions:** The results indicate that being a first- or second-generation immigrant and experiencing more symptoms of depression and anxiety are predictive of non-abstinence. Attention for linguistic and cultural congruence of dual diagnosis treatments may enhance abstinence in immigrants. Additionally, addressing symptoms of depression and anxiety in dual diagnosis treatment may be beneficial for the maintenance of abstinence. More research is needed on factors influencing treatment success in dual diagnosis patients.

KEYWORDS

Dual diagnosis; substance use disorder; abstinence; treatment outcome; predictors

Of all patients with a past year substance use disorder, around 40-45% also suffered from at least one comorbid mental disorder in the past year (Substance Abuse and Mental Health Services Administration, 2017). These patients are referred to as “dual diagnosis” (DD) patients and form a heterogeneous group with complex treatment needs (Carrà et al., 2015; Drake et al., 2001). Especially common comorbid diagnoses are posttraumatic stress disorder (PTSD), mood and anxiety disorders, psychotic disorders, attention-deficit hyperactivity disorder (ADHD), borderline personality disorder, and antisocial personality disorder (Driessen et al., 2008; Grant et al., 2016; Hasin et al., 2016;

Kessler et al., 1996; Lai, Cleary, Sitharthan, & Hunt, 2015; Lehman & Dixon, 2016; NIDA, 2018; van Emmerik-van Oortmerssen et al., 2012; Vorspan, Mehtelli, Dupuy, Bloch, & Lépine, 2015). Apart from the impairments of two or more disorders, DD patients commonly suffer from additional problems, such as homelessness (Drake, Osher, & Wallach, 1991) and victimization (de Waal, Dekker, & Goudriaan, 2017). DD patients show worse treatment outcomes compared to those with substance use disorder only, with poorer treatment adherence and higher relapse rates (Hasin et al., 2002; Ritsher, McKellar, Finney, Otilingam, & Moos, 2002; Ritsher,

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Moos & Finney, 2002; Ross, Dermatis, Levounis, & Galanter, 2003)

Although advances have been made in the past decades, treatment outcomes for DD patients are far from optimal, and the variety of co-existing problems that are present in DD patients may form a barrier for successful treatment (Carrà et al., 2015; Hunt, Siegfried, Morley, Sitharthan, & Cleary, 2013; Riper et al., 2014; Wright, Smeeth, & Heath, 2003). A complicating factor in the treatment of DD patients is the high variation in mental illness comorbidity, ranging from multiple, highly disabling illnesses such as schizophrenia, to generally less-disabling disorders such as dysthymia and anxiety disorders (Drake & Mueser, 2000; Kelly, Daley, & Douaihy, 2012). Furthermore, the severity of substance abuse varies from a single to several substance use disorders (Drake & Mueser, 2000; Kelly et al., 2012). A personalized treatment approach – tailored to individual needs – may help to improve treatment outcomes (Hunt et al., 2013; Kelly et al., 2012). More insight into factors predicting positive treatment results for DD patients supports the development of such an approach.

Some studies have examined demographic and clinical characteristics associated with treatment outcomes in DD patients (see Bradizza, Stasiewicz, & Paas, 2006 for a review); although most research on this topic has been conducted in substance use disorder-only populations (e.g., Charney, Zikos, & Gill, 2010; Gossop, Stewart, Browne, & Marsden, 2002). Bradizza et al. (2006) conducted a review of factors associated with relapse among several groups of DD patients. The authors highlighted the lack of studies focusing on a wide variety of predictors of treatment outcomes in the DD population. Most studies have examined only a small number of predictor variables in very specific DD subgroups. After this review was published, a few studies have examined predictors of abstinence in DD populations. Cather et al. (2018) found male gender and pretreatment substance use to be predictive of reduced chances of continued abstinence in a first-episode psychosis population. Furthermore, Bradizza et al. (2009) found adequate coping skills and treatment utilization to be predictive of continued abstinence in an alcohol use disorder (AUD) population with severe mental illness.

These studies provide several indications for demographic and clinical characteristics that may be related to treatment outcomes. Moreover, we can draw from studies that have been conducted in substance use disorder-only populations. There is evidence that substance use disorders are more persistent in men compared to women (Choi, Adams, Morse, &

MacMaster, 2015; Grant, 1997; Wise, Cuffe, & Fischer, 2001), although McHugh, Votaw, Sugarman, and Greenfield (2018) reported no significant gender differences in treatment outcomes. However, women substance use disorder patients have been found to suffer from higher emotional impairment and lower quality of life than patients who were men, both before and after treatment (Garg, Yates, Jones, Zhou, & Williams, 1999), and suffer from more adverse medical, psychiatric and functional consequences (McHugh et al., 2018). There is evidence that ethnic minorities tend to have more persistent substance use disorders (Breslau, Kendler, Su, Gaxiola-Aguilar & Kessler, 2005; Grant, 1997). Literature suggests that homelessness has adverse health consequences (Galea & Vlahov, 2002) and may complicate recovery for mental illness (Castellow, Kloos, & Townley, 2015); however, there is no conclusive evidence for a relationship between stable housing and abstinence (Leickly et al., 2018).

Regarding clinical characteristics, adequate coping and emotion regulation skills have found to be associated with reduced alcohol use in student problem drinkers (Ford, Grasso, Levine & Tennen, 2018) and with better treatment outcomes in patients with heroin addiction (Gossop et al., 2002). Moos & Moos (2006) found an avoidant coping style to be predictive of relapse in patients with AUD. Maisto, Connors, & Zywiak (2000) reported that changes in coping skills during treatment were associated with reduced post-treatment alcohol use. Furthermore, psychiatric symptom severity and a personality disorder diagnosis indicate an increased risk of relapse (Charney et al., 2010; Compton, Cottler, Jacobs, Ben-Abdallah, & Spitznagel, 2003). Polysubstance users have poorer treatment outcomes (Connor, Gullo, White, & Kelly, 2014; Dutra et al., 2008). Many studies on factors associated with abstinence or other treatment outcomes focused on one type of substance or excluded important comorbid diagnostic groups (e.g., Charney et al., 2010; Compton et al., 2003).

In conclusion, several demographic and clinical characteristics have been found to be related to achieving abstinence in individuals in treatment for substance use disorder. However, studies have reported contradictory findings. Furthermore, only a few studies on factors associated with achieving abstinence have been conducted in DD patients. Therefore, the present study focused on patient characteristics predicting abstinence in a heterogeneous sample of DD patients. The present study aimed to determine to what extent individual baseline characteristics regarding gender, immigration, employment,

housing, age, emotion regulation, psychiatric symptoms, and frequency and nature of substance abuse predict abstinence at follow-up in DD patients. It was expected that men, homelessness, immigration, unemployment, emotion dysregulation, symptom severity, polydrug use, and higher drug-use frequency would be associated with lower abstinence rates.

Methods

Design

This study has a cohort-design and uses data from the control group of a randomized controlled trial (RCT) in which the effectiveness of an add-on intervention to reduce victimization in DD patients was tested (de Waal et al., 2015; de Waal, et al., 2018). In the current study, we examine the relationship between baseline characteristics and abstinence at 14-month follow-up, in the subsample of the study that received care as usual (CAU), that was not interfered with by the RCT.

Participants

The sample comprises 102 participants with dual diagnosis. Dual diagnosis patients were recruited for participation in the SOS study (de Waal et al., 2015) between April 2014 and April 2016 from addiction-psychiatry clinics and an allied addiction-psychiatry outpatient care facility of Arkin Mental Health Care (division Mentrum) in Amsterdam. Men and women of 18 years and older were included if they had (1) at least one substance use disorder according to the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (DSM-IV-TR; American Psychiatric Association, 2000) and (2) at least one other DSM-IV-TR Axis I or Axis II disorder. Patients were excluded from participation if they (1) had insufficient understanding of the Dutch language; (2) were not eligible for group therapy according to one's mental health care provider, due to, for instance, severe acute psychotic symptoms or severe antisocial or psychopathic traits that could disturb the group training. Of the 121 dual diagnosis patients allocated to CAU, 19 (15.7%) did not complete the 14-month follow-up assessment. The remaining 102 participants were included in the current study. The 102 completers did not differ significantly from the 19 non-completers on demographic or clinical baseline characteristics. Demographic and clinical characteristics of the participants are shown in Table 1 and Table 2.

Procedure

Eligible patients were informed and invited by a caregiver and researcher, who explained the research procedures, after which written informed consent was obtained.

The baseline assessment comprised a face-to-face interview lasting approximately 1.5 hours, conducted at the treatment facility or at the participants' home. The assessment after 14 months comprised an interview lasting approximately 2 hours, in which abstinence was assessed. Participants received monetary compensation of €15 and €30 for completing the baseline and follow-up assessment, respectively. All assessments were conducted by a researcher or research assistant, with master's and bachelor's degrees in psychology, respectively.

Treatment

The control group of the SOS study received CAU, usually comprising pharmacotherapy and a form of case management, in either an inpatient or outpatient setting. Additionally, many patients received some form of psychotherapy, individually and/or in a group setting, for instance cognitive behavioral therapy, mindfulness, motivational interviewing or social skills training. The number of days of clinical care and the number of psychotherapy sessions received at Arkin Mental Health Care were extracted from the electronic patient file. On average, participants received 74.0 days of clinical care ($SD = 97.2$), 49.2 individual sessions of psychotherapy ($SD = 48.5$), and 16.1 sessions of group therapy ($SD = 22.0$) between baseline and 14-month follow-up. Treatment utilization was considered to be a possible confounding variable in the relationship of predictors with abstinence, as some patient characteristics might reduce therapy compliance – thereby reducing the chances of achieving abstinence. For instance, high scores on depression and anxiety might reduce chances of achieving abstinence on its own, but reduce therapy compliance as well, with a possible overestimation of the effect of depression and anxiety on chances of abstinence as a result.

Measures

Demographics

Patients' demographics were collected at baseline. Gender was defined as either man or woman, age was assessed in years, homelessness was defined as having no stable housing, and employment was defined as having paid work for at least 12 hours a week. A participant was classified as (first- or second-generation)

Table 1. Baseline Demographics, Substance-Related Characteristics, and Psychiatric Classifications of DD patients ($n = 102$).

	<i>n</i>	%	<i>M (SD)</i>
Age (years)			42.3 (10.6)
Men	72	70.6	
Stable housing	84	82.4	
Unemployed	91	89.2	
Country of birth			
Netherlands	78	76.5	
Europe other than Netherlands	7	6.9	
US, Canada, New Zealand, Japan, Indonesia	6	5.9	
Surinam	4	3.9	
Morocco	3	2.9	
Netherlands Antilles	2	2.0	
Other	2	2	
Country of mother's birth			
Netherlands	66	64.7	
US, Canada, New Zealand, Japan, Indonesia	9	8.8	
Morocco	8	7.8	
Europe other than Netherlands	7	6.9	
Surinam	6	5.9	
Netherlands Antilles	2	2	
Turkey	2	2	
Other	2	2	
Country of father's birth			
Netherlands	60	58.8	
Europe other than Netherlands	12	11.8	
Surinam	10	9.8	
Morocco	8	7.8	
US, Canada, New Zealand, Japan, Indonesia	4	3.9	
Turkey	2	2	
Netherlands Antilles	2	2	
Other	4	3.9	
Substance use disorder			
AUD only	21	20.6	
DUD only	37	36.3	
Both AUD and DUD	44	43.1	
Number of usage days of 90 days before baseline			51.5 (30.9)
Mental disorders, other than substance use disorder			
Psychotic disorder	36	35.3	
Mood disorder	22	21.6	
Anxiety disorder	26	25.5	
Attention deficit hyperactivity disorder	11	10.8	
Personality disorder	37	36.3	
Other mental disorder	12	11.8	
Intellectual disability	16	15.7	
Total number of mental disorders other than substance use disorders			1.4 (.7)

Note. DD = dual diagnosis; AUD = alcohol use disorder; DUD = drug use disorder. US = United States; SD = standard deviation.

Table 2. Psychiatric Symptoms of Patients With Dual Diagnosis ($n = 102$).

	Range	<i>M (SD)</i>
Emotion dysregulation (DERS)	46–164	101.50 (27.00)
Positive symptoms (BPRS)	5–21	6.72 (3.17)
Negative symptoms (BPRS)	7–16	8.40 (1.95)
Depression and anxiety (BPRS)	6–28	14.60 (5.66)
Manic excitement (BPRS)	9–25	11.86 (3.00)
Psychiatric symptoms (total score BPRS)	24–63	37.81 (8.25)

Note. DERS = Difficulties in Emotion Regulation questionnaire; BPRS = Brief Psychiatric Rating Scale – expanded; SD = standard deviation.

immigrant (“immigration”) when he/she was either foreign-born or had at least one parent who was foreign-born.

Substance use

Diagnoses of AUD and DUD were extracted from the electronic patient file. The Timeline Follow Back method (TLFB; Carey, Carey, Maisto, & Henson, 2004) was conducted to assess substance use frequency at baseline, defined as the number of usage days in the past 90 days. Participants reconstructed daily substance use using calendars, beginning on the day of assessment and working back in time for 90 days. The number of alcoholic beverages was assessed for each day and participants indicated whether they used cocaine, cannabis or other drugs. The TLFB is reliable and valid in DD populations (Carey et al., 2004). The TLFB was also used to assess abstinence at 14 months looking at the past 30 days. Patients were classified as abstinent if they refrained from any alcohol and drug use.

Emotion dysregulation

Emotion dysregulation was assessed with the Difficulties in Emotion Regulation questionnaire (DERS; Gratz & Roemer, 2004), defined as the total score. The DERS is a self-report questionnaire evaluating emotion regulation difficulties across multiple domains: non-acceptance of emotional responses, difficulties engaging in goal-directed behavior, impulse control difficulties, lack of emotional awareness, limited access to emotion regulation strategies, and lack of emotional clarity. The DERS has high internal consistency and is reliable and valid in patients with severe mental illness (Fowler et al., 2014; Gratz & Roemer, 2004). In the current study in patients with dual diagnosis, the internal consistency of the DERS was excellent ($\alpha = 0.93$).

Psychiatric symptoms

Psychiatric symptoms were assessed using the Brief Psychiatric Rating Scale- Expanded (BPRS-E; Lukoff, Liberman, & Nuechterlein, 1986; Ventura, Green, Shaner, & Liberman, 1993), a frequently used clinician-rated instrument to assess a wide range of psychiatric symptoms. Subscales of the BPRS-E include “Depression and Anxiety”, “Manic Excitement and Disorganization”, “Positive Symptoms”, and “Negative Symptoms”. The BPRS-E is reported as valid and reliable in the severe mental illness population, as well as DD patients (Burlingame et al., 2005; Lykke, Hesse, Austin, & Oestrich, 2008). In the current study, the overall internal consistency of the BPRS-E was rated as fair ($\alpha = 0.70$) but varied across subscales. “Depression and Anxiety” had a fair internal consistency ($\alpha = 0.77$), “Manic Excitement and

Disorganization” internal consistency was acceptable to poor ($\alpha = 0.53$), “Positive Symptoms” was acceptable ($\alpha = 0.62$) and “Negative Symptoms” was poor ($\alpha = 0.36$).

Data analysis

Statistical analyses were performed in SPSS Statistics 22.0. Pairwise deletion was used for missing data. Demographic and clinical predictors assessed at baseline were tested on predicting abstinence at 14 months after baseline using backward stepwise logistic regression analysis. Bivariate associations between each putative predictor and the dependent variable (abstinence) were examined using Fisher’s exact test (two-tailed) for categorical predictors and the Mann–Whitney U test for continuous predictors. All variables with $p < .20$ (and no zero cell frequencies for Fisher’s exact tests and logistic regression analyses) were entered in the initial model. This p -value was selected as to not exclude any potentially important variables from the model. A threshold of .05 (alpha) was used for the change in log-likelihood of the model when predictors are removed at each step in the backward stepwise logistic regression. We performed exploratory analyses to assess whether the following treatment variables were acting as confounding variables in our final model (1) the number of individual psychotherapy sessions between baseline and follow-up, (2) the number of group sessions in the same period, (3) the number of days stayed in the clinic in the same period. Treatment variables were defined as confounders if they caused >10% change in the beta coefficient of predictors that remained in the model after backward logistic regression analysis. Confounders were entered as covariates in the final model.

The following assumptions for logistic regression were considered (1) absence of multicollinearity, (2) prevention of over-fitting and under-fitting, a stepwise method to estimate logistic regression was used to ensure prevention, and (3) independence of observations. Categorization of continuous predictor variables would result in a lack of power due to small sample size; therefore, linearity of continuous predictors with the log odds of abstinence was assumed. The assumption absence of multicollinearity and the assumption of independence of observations were met.

Ethical approval

The SOS-study has been reviewed and approved by the ethics committee of the Academic Medical Center

of the University of Amsterdam, Amsterdam, The Netherlands and was conducted in accordance with the Declaration of Helsinki (World Medical Association, 2001). All patients signed informed consent and participation was voluntary.

Results

Univariate analyses of potential predictors with abstinence

Mean scores on psychiatric symptom scales are presented in Table 2. At 14 months, 22 participants (21.6%) were abstinent of alcohol and drugs during the 30 days prior to the assessment. Initially, univariate analyses were performed to examine predictors that were potentially associated with abstinence ($p < .20$). Results are presented in Table 3.

Categorical predictors were examined for associations with abstinence using Fisher’s exact tests. Of patients with both parents being born in the Netherlands, 32.7% became abstinent, while 8.5% of patients with at least one immigrant parent became abstinent ($p < .01$). Being a first- or second-generation immigrant (“immigration”) was included in the logistic regression analysis, while gender, homelessness, employment, and substance abuse group were excluded, as they did not show a relationship with abstinence (all $p > .20$). Continuous variables were examined for associations with abstinence using the Mann Whitney U test. Depression and anxiety, ($p = .03$) and age ($p = .15$) were included in the logistic regression analysis. Substance use frequency at baseline, emotion dysregulation, positive symptoms, negative symptoms, and manic excitement and disorganization were excluded, as they did not show a relationship with abstinence (all $p > .20$).

Logistic regression analysis of factors associated with abstinence

Logistic regression analysis was performed with immigration, depression, and anxiety, and age entered on the first step. Results of the analysis are presented in Table 4. Of the independent variables entered in the first step, two remained in the model as a significant predictor of abstinence: immigration, odds ratio (OR) = 5.08, 95% CI [1.56, 16.61], and depression and anxiety, OR = 0.91, 95% CI [0.83, 1.01]. This indicated that participants with both parents born in the Netherlands had 5-fold increased odds of becoming abstinent at 14 months compared to participants who were first- or second-generation immigrants and that

Table 3. Univariate Analyses of Potential Baseline Predictors of Abstinence at 14-months ($n = 102$).

Predictor	% abstinent	Fisher's exact	Mann-Whitney U
Gender		$p = .60$	
Men	23.6		
Women	16.7		
Age			$p = .15^*$
Employment		$p = .25$	
Employed	36.4		
Unemployed	19.8		
Homelessness		$p = .78$	
Not homeless	22.6		
Homeless	16.7		
Immigration		$p = .004^*$	
First or second generation immigrant	8.5		
Native Dutch	32.7		
Substance use disorder		$p = .91$	
AUD only	19		
DUD only	24.3		
AUD and DUD	20.5		
Substance use frequency			$p = .51$
Emotion dysregulation (DERS)			$p = 1.00$
Psychiatric symptoms (BPRS-E)			
Depression and anxiety			$p = .03^*$
Positive symptoms			$p = .66$
Negative symptoms			$p = .73$
Manic excitement and disorganization			$p = .64$

Note: AUD = alcohol use disorder; DUD = drug use disorder; DERS = Difficulties in Emotion Regulation questionnaire; BPRS-E = Brief Psychiatric Rating Scale – expanded.

* $p < .20$ and inclusion in logistic regression analysis.

Table 4. Logistic Regression of Predictors of Abstinence ($n = 102$).

Model	Predictors	Odds				p	R^2
		B (SE)	Ratio	95% CI			
Step 1	Immigration	1.58 (.61)	4.85	[1.48, 15.93]	.01	.40	
	Age	0.02 (0.03)	1.02	[0.97, 1.07]	.39		
	Depression and anxiety	-0.09 (0.05)	0.92	[0.83, 1.01]	.09		
	Constant	-2.07 (1.44)			.02		
Step 2	Immigration	1.63 (0.60)	5.08	[1.56, 16.61]	.01	.38	
	Depression and anxiety	-0.09 (0.05)	0.91	[0.83, 1.01]	.06		
	Constant	-1.08 (0.83)			.19		

Note. SE = standard error; CI = confidence interval.

every point higher on the depression and anxiety scale decreased the odds of being abstinent at 14 months .91-fold. Although the odds ratio for depression and anxiety is not statistically significant, the change in log-likelihood of the total model when the variable was removed, was significant ($p = .05$). The final model was statistically significant, $\chi^2(2) = 13.27$, $p = .001$, correctly classified 78.4% of the cases and explained 38% of the variance (Nagelkerke $R^2 = .38$).

Confounder analyses

The variable “number of individual psychotherapy sessions between baseline and follow-up” was added to the final model, because it caused a 20% change in the beta coefficient of depression and anxiety and 4% change in the beta coefficient of immigration, and thus had a confounding effect in the relationship between the predictors and abstinence. The number of

group sessions psychotherapy between baseline and follow up and the number of days stayed in the clinic between baseline and follow up did not cause a change in beta coefficients in the predictor variables (all $< 5\%$ change in beta coefficients). Therefore, these variables were not included as covariates in the final model. After entering the covariate, the relationships of immigration, OR = 5.13, 95% CI [1.63, 18.18], and depression and anxiety, OR = 0.9, 95% CI [0.81, 0.99] remained significant. The final model was statistically significant, $\chi^2(3) = 16.9$, $p = .001$, correctly classified 77.5% of the cases and explained 24% of the variance (Nagelkerke $R^2 = .24$). The model corrected for the number of individual psychotherapy sessions is presented in Table 5.

Discussion

To our best knowledge, this is the first study focusing on a wide set of patient characteristics as predictors of abstinence in a heterogeneous sample of DD patients including various diagnostic groups. Only 21.6% of all DD patients were abstinent at 14-month follow-up. We found that being a first- or second-generation immigrant reduced the chances of achieving abstinence. Furthermore, we found a negative association of depression and anxiety with abstinence. Both these associations were also found when controlling for treatment utilization. Contrary to our expectations, other baseline characteristics (i.e., age, gender,

Table 5. Logistic Regression of Final Predictors of Abstinence ($n = 102$) Corrected for the Number Individual Psychotherapy Sessions.

Model	Predictors	Odds B (SE)	Ratio	95% CI	<i>p</i>	<i>R</i> ²
Enter	Immigration	1.70 (0.62)	5.13	[1.63, 18.18]	.01	.24
	Depression and anxiety	−0.11 (0.05)	0.90	[0.81, 0.99]	.04	
	Number of individual psychotherapy sessions	0.01 (0.01)	1.01	[1.00, 1.02]	.06	
	Constant	0.27 (0.74)			.71	

Note. SE = standard error; CI = confidence interval.

employment, homelessness, substance use disorder, substance use frequency, emotion dysregulation, and psychiatric symptoms) did not significantly predict abstinence at follow-up.

DD patients with both parents born in the Netherlands seem to have favorable odds of achieving abstinence compared to patients that are first- or second-generation immigrants. This is in line with previous studies from the US: although substance use disorder occurs more often in Caucasians than in ethnic minority groups, some minority groups may have higher risks of substance use disorder persistence once they have a substance use disorder (Breslau et al., 2005; Grant, 1997). Another study by Wiborg, Ben-Sliman, Michalek, Tress, and Joksimovic (2016) found no differences in treatment outcomes between immigrants and non-immigrants, although this concerned psychotherapies in general, not substance use disorders specifically. These findings possibly vary for gender and age (Evans et al., 2017; Grant et al., 2012). Several explanations can be offered for our findings. Possibly, cultural incongruence makes current therapies less beneficial for immigrants. A review of Chu, Leino, Pflum, and Sue (2016) demonstrated that cultural congruence of psychotherapy increases treatment results. Cultural congruence or competency involves skills and knowledge of client's cultural background, to be taken into account at different levels (1) the kind of person the therapist is, (2) the therapeutic process, and (3) the interventions used in therapy (Chu et al., 2016). Linguistic difficulties might also play a role: immigrants possibly benefit less from therapy given in Dutch. Furthermore, studies have pointed out that immigrants may have a higher risk of developing mental health problems, due to negative life events and lack of social support (Abebe, Lien, & Hjelde, 2014; Bhugra, 2004). Although it is unclear whether immigrants within the DD population experience more negative life events and less social support compared to autochthonous DD patients, it is possible that social support, which has been reported as a predictor of abstinence (Cavaiola, Fulmer, & Stout, 2015), partly mediates the relationship between being a first- or second-generation immigrant and abstinence.

Future studies should provide more insight into the relationship between abstinence and immigration by examining mentioned potential mediators.

Symptoms of depression and anxiety contributed significantly to the model in predicting lower likelihood of achieving abstinence, consistent with previous literature suggesting a negative relationship between depressive and anxiety symptoms and abstinence (Bradizza et al., 2006; Dodge, Sindelar, & Sinha, 2005). Substance use has been suggested to function as an emotion regulation strategy (Aldao, Nolen-Hoeksema, & Schweizer, 2010). DD patients with high levels of depression and anxiety for whom substance use is a coping strategy may experience more difficulties becoming abstinent. Therefore, addressing coping strategies as well as depressive and anxiety symptoms is likely to enhance abstinence, as has also been suggested by previous research in substance use disorder populations (Dodge et al., 2005; Gossop et al., 2002). Another possible explanation is that the depression and anxiety scale of the BPRS-E in this sample acted as an overall measure of psychiatric suffering across different diagnoses. Depressive and anxiety symptoms, such as higher arousal, suicidal behavior, numbness, and avoidance are not exclusively symptoms of major depressive disorder or anxiety disorders, but also occur in PTSD, psychosis and personality disorders such as borderline personality disorder, among others (American Psychiatric Association, 2013). This hypothesis is consistent with conclusions from a review by Bradizza et al. (2006) suggesting that affect in schizophrenic-spectrum patients had a higher predictive value of abstinence than positive and negative symptoms. The authors concluded that measures of affect, depression, and stress should be included in research on predictors of substance abuse relapse.

Overall, it is notable that most examined predictors were not associated with abstinence, including most demographic factors (i.e., gender, age, employment, and homelessness) and clinical characteristics (i.e., substance use group, substance use frequency, emotion dysregulation, positive and negative schizophrenic symptoms, and manic excitement and disorganization). These findings are inconsistent with our

hypotheses and with previous literature on demographic characteristics (e.g., Cather et al., 2018; Wise, Cuffe, & Fischer, 2001) and clinical characteristics (e.g., Bradizza et al., 2009; Cather et al., 2018; Charney et al., 2010; Dutra et al., 2008; Ford et al., 2018; Moggi et al., 1999). A number of factors may explain our findings. Firstly, a consequence of the modest sample size might be that weak relationships between baseline characteristics and abstinence were not found due to lack of power. Furthermore, previous studies were performed in highly diverse samples: single substance populations (e.g., Charney et al., 2010), substance use disorder in general, but not the DD population specifically (e.g., Evans et al., 2017), or men only (Moggi et al., 1999). Moreover, outcome measures of abstinence or relapse differ in the literature regarding definition of abstinence (e.g., abstinence of the substance on which the treatment was focused on vs. all substances) and assessment period (e.g., 6 months vs. 3 years; Bradizza et al., 2006). Furthermore, there may be alternative characteristics predicting abstinence that we did not measure.

Strengths and limitations

The study has several strengths and limitations. The most important strengths are the wide range of potential predictors of abstinence that were examined, as well as the validated instruments that were used for the assessment of predictors and abstinence. Moreover, our sample included a heterogeneous sample of patients with a variety of substance use disorders and comorbid diagnoses.

There are several limitations to the study. Firstly, for achieving adequate power when comparing abstinent and non-abstinent DD patients, large sample size is required because the large majority of DD patients do not achieve abstinence. Secondly, abstinence was defined as refraining from any substance use for 30 days. Patients who consumed one drink in 30 days were classified similarly to patients who kept using the same amount or fully relapsed. However, some patients may be able to switch to moderate alcohol use (Al-Otaiba, Worden, McCrady, & Epstein, 2008; van Amsterdam & van den Brink, 2013). This way, some patients may have been classified as non-abstinent while their substance use disorders were in remission. Thus, our outcome variable is not sensitive to reduced substance use, which could have resulted in reduced power. However, Kaskutas & Ritter (2015) found that most substance use disorder patients believe recovery from substance use disorder to be

total abstinence, as well as the literature and organizations such as the World Health Organization (WHO; Worley, 2017). Thirdly, we cannot draw conclusions on the impact of treatment utilization on treatment outcome, due to the non-randomized design of the current study. However, we did incorporate treatment utilization as potential confounder of the relationship between patient characteristics and treatment outcome. Unfortunately, we did not collect data on the exact type of psychotherapy received (e.g., cognitive behavioral therapy [CBT] or mindfulness). Therefore, treatment utilization was defined as dosage of clinical care, individual psychotherapy, and group psychotherapy. Fourthly, the internal consistency of the “Negative Symptoms” scale of the BPRS-E was poor. Possibly, this could partly be explained by the low number of schizophrenia-spectrum patients ($n = 36$), and the heterogeneity in psychiatric symptoms of the rest of the group: patients with other diagnoses might score positively on some items of the negative symptoms scale, but not on others. For instance, patients with social anxiety might avoid eye contact but not experience blunted affect. Therefore, results in this study regarding this scale should be interpreted with caution. Fifthly, we did not use structured diagnostic interviews for the patients’ diagnoses; however, we find that these would be too burdensome in the current sample, as we would need multiple diagnostic interviews for the assessment of the wide range of psychiatric disorders that occurred in the sample. Sixthly, a completer sample bias might have occurred, which might have caused relationships between predictors and abstinence to be underestimated. For instance, non-abstinent patients with the highest scores on depression and anxiety symptoms might have dropped out. Finally, the assessment of abstinence may have been influenced by memory bias and social stigma. It is established that DD patients tend to underreport their substance abuse (de Beaurepaire et al., 2007; Jain, Quraishi, Majumder, & Pattanayak, 2013). However, it is likely that the current method provided the most accurate results from available methods without bringing disproportionate costs. A study by Fals-Stewart, O’farrell, Freitas, McFarlin, and Rutigliano (2000) found high agreement of TLFB usage assessment with urine assays.

Conclusions and implications

Our findings suggest that it is necessary to address the needs of first- and second-generation immigrants with a dual diagnosis. Possibly increasing attention for

cultural and linguistic factors in dual diagnosis treatment could improve treatment outcomes. Training therapists in cultural issues in substance abuse and cultural diversity among therapists could improve treatment outcomes (Chu et al., 2016), as well as offering treatment in patients' native language (Griner & Smith, 2006). In addition, depressive and anxiety symptoms across diagnostic groups may play a role in predicting abstinence (Bradizza et al., 2006; Dodge et al., 2005), which indicates that treatment addressing depressive and anxiety symptoms quickly after achieving abstinence may reduce the risk of relapse. Given the low rates of positive treatment outcomes in DD patients in both this study and other studies (Riper et al., 2014; Ritsher, McKellar, et al., 2002), more research should be conducted on factors influencing treatment success in DD patients. To our knowledge, this is the first study to examine a wide set of predictors of abstinence in a heterogeneous sample of dual diagnosis patients; therefore, replication of our study is necessary. During recruitment, specific attention should be paid to diversity in both demographic and clinical characteristics of DD patients, to create a representative sample.

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Author contributions

MW and AG participated in the design of the study. LH drafted the manuscript, which was modified by MW, CC, JD and AG. All authors read and approved the final manuscript.

Disclosure statement

None of the authors has any conflict of interest to disclose. None of the authors has any additional income to report. Netherlands Organization for Scientific Research did not have any role in the study design, data collection, analysis and interpretation of the data, writing of the report, and in the decision to submit the manuscript for publication.

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