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# Relapse after inpatient substance use treatment: A prospective cohort study among users of illicit substances



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## HIGHLIGHTS

- Younger patients were at increased risk of relapse.
- Having a co-occurring mental disorder was associated with elevated relapse risk.
- Having completed the inpatient stay was associated with a reduced relapse risk.
- Risk of relapse was related to characteristics of treatment sites.

## ARTICLE INFO

### Keywords:

Substance abuse  
Residential treatment  
Motivation  
Mental distress  
Treatment outcome  
Relapse

## ABSTRACT

**Aims:** The main aim was to investigate the relative roles of mental distress and intrinsic motivation for relapse after inpatient substance use disorder (SUD) treatment, while adjusting for demographics and treatment variables.

**Methods:** The study is based on a prospective multicenter study with a baseline gross sample of 607 patients with SUD (response rate = 84%) admitted to an inpatient stay at one of five specialized SUD treatment centers in Norway. The analytical sample consisted of patients with illicit drug use ( $n = 374$ ) who took part in a follow-up interview three months after discharge from inpatient treatment ( $n = 249$ ) (retention rate = 67%). Data were collected using information from electronic medical records, a self-report questionnaire at treatment entry, and a follow-up interview.

**Results:** Relapse occurred among 37% of the sample by three-month follow-up. Results of multivariable analysis showed that younger age and having a psychiatric diagnosis were associated with an elevated relapse risk. Patients who received treatment at a short-term clinic (2–4 months), as opposed to a long-term clinic (> 6 months) were also at increased risk of relapse, regardless of their length of stay. Reduced risk of relapse was predicted by having completed the inpatient treatment stay.

**Conclusion:** Identifying the treatment needs of young patients and patients with co-occurring psychiatric diagnoses during and following inpatient SUD treatment may contribute to reduced post-treatment relapse rates. Further research is needed to illuminate the treatment-related factors that contribute to reduced risk of relapse after inpatient SUD treatment.

## 1. Introduction

Despite the high resource inputs in inpatient substance use treatment (López-Goñi, Fernández-Montalvo, Arteaga, & Esarte, 2017) relapse to substance use is common. Relapse is the recurrence of SUD symptoms after a period of reduced substance use (Dawson, Goldstein, & Grant, 2007; Hendershot, Witkiewitz, George, & Marlatt, 2011;

Witkiewitz & Marlatt, 2007); however, return to any drinking or drug use are also common outcome measures in relapse research (Bradizza, Stasiewicz, & Paas, 2006; Suter, Strik, & Moggi, 2011). Relapse rates may vary with the definition of the concept, and in relation to type of study populations and time since treatment. Results from European studies suggest relapse prevalence rates between 40 and 75% for heroin (Gossop, Stewart, Browne, & Marsden, 2002) and other illicit drugs

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<https://doi.org/10.1016/j.addbeh.2018.11.008>

Received 31 July 2018; Received in revised form 6 November 2018; Accepted 10 November 2018

Available online 11 November 2018

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(Alterman et al., 2000; Pasareanu, Vederhus, Opsal, Kristensen, & Clausen, 2016).

Identification of patient characteristics that have putative associations with relapse risk after SUD treatment is important for the development of adjusted treatment programs for those at risk. In particular, pretreatment psychological factors such as mental distress and motivation to change substance use behavior may be potential intervention targets. Despite the focus on psychiatric comorbidity in SUD treatment settings during recent decades (Bakken, Landheim, & Vaglum, 2005; Drake, O'Neal, & Wallach, 2008; Hesse, 2009), patients' mental distress may be under-recognized and treated inadequately, leading to poorer patient outcomes (Compton III, Cottler, Jacobs, Ben-Abdallah, & Spitznagel, 2003; Read, Brown, & Kahler, 2004). Pretreatment negative emotional states, such as anxiety and depression, predict relapse after SUD treatment. For example, a systematic review indicated an association between patients' psychological symptom severity and alcohol consumption (Adamson, Sellman, & Frampton, 2009), and more recently, pretreatment depressive symptoms were reported as risk factors for early relapse to alcohol use (Suter et al., 2011). A relation between depression diagnosis and subsequent substance use outcomes was reported in a follow-up study of cocaine-dependent patients (McKay et al., 2002). In contrast, other researchers did not reveal associations between psychiatric symptoms at admission to inpatient SUD treatment and substance use at one-year follow up (Bauer, Strik, & Moggi, 2014; Conner, Pinquart, & Duberstein, 2008; Gossop, Stewart, & Marsden, 2007).

There are notable limitations within the literature regarding the temporal associations between mental health problems and inpatient SUD treatment outcomes. Although several studies have investigated the potential adverse SUD treatment outcomes associated with co-occurring psychiatric symptoms and alcohol addiction (Adamson et al., 2009; Bauer et al., 2014; Suter et al., 2011), few studies have examined whether mental distress and psychiatric problems predict relapse among the broader population of SUD treatment patients (i.e. including those addicted to different illicit drugs), despite the fact that poly-substance use is highly prevalent within the SUD treatment population (Burdzovic Andreas, Lauritzen, & Nordfjærn, 2015; Hoxmark, Nivison, & Wynn, 2010).

Previous research has provided evidence for an association between pretreatment intrinsic motivation and treatment retention and completion (Andersson, Steinsbekk, Walderhaug, Otterholt, & Nordfjærn, 2018; de Weert-van Oene, Gongora, von Sternberg, & de Jong, 2015). Furthermore, pretreatment motivation predicts various drinking outcomes after inpatient treatment for alcohol use disorders (Adamson et al., 2009; Bauer et al., 2014; Staines et al., 2003), although individuals with alcohol use disorders may have different predictors of treatment outcomes compared with those using other drugs (Calabria et al., 2010; Luchansky, Krupski, & Stark, 2007; Manning et al., 2017). Among the few studies prospectively investigating the association between pretreatment motivation and relapse among inpatient illicit drug users, no significant associations were found between readiness to change and drug use at one-year follow-up (Gossop et al., 2007).

Previous work suggested that pre-treatment psychological factors such as mental distress and motivation may predict treatment outcomes and could be potential intervention targets. To date, however, research in this area has mainly focused on alcohol treatment outcomes. The current study will extend the literature by investigating predictors of relapse in a sample representing a diverse SUD patient population.

### 1.1. Aim

The aim of this study was to investigate whether mental distress and pretreatment intrinsic motivation for changing personal substance use predicts relapse after inpatient SUD treatment for illicit drug use, after adjusting for demographics (e.g. age, education) and treatment variables (e.g. length of stay, treatment completion). We hypothesized that

(1) mental distress (Adamson et al., 2009; Suter et al., 2011) would be associated with higher risk of relapse and (2) higher pretreatment intrinsic motivation (Bauer et al., 2014) would be associated with lower risk of relapse.

## 2. Materials and methods

### 2.1. Design and setting

For this prospective, multicenter cohort study, patients with SUD were consecutively recruited from five publicly funded specialized inpatient treatment centers in Central Norway. The centers provide inpatient SUD treatment approaches common in Norway and most European countries (European Monitoring Centre for Drugs and Drug Addiction, 2014). All centers offer a combination of individual and group therapy, as well as pharmacological treatment. Three of the centers provided treatment of 2–4 months, whereas two centers provided treatment of > 6 months (see Andersson et al., 2018 for more details).

Patients were approached by a research assistant 1–2 weeks after admission to the inpatient clinics (baseline). The inclusion criteria were age of 18 years or older and referral for a new inpatient treatment episode. Patients with strong drug cravings and/or high levels of mental distress that interfered with providing written informed consent were excluded.

In accordance with the Declaration of Helsinki (World Health Organization (WHO), 2001), those who chose to participate signed a consent form, including permission for the researchers to obtain demographic and health information from their medical records and to be contacted by phone three months post-discharge (follow-up). The study protocol was reviewed and approved by the Regional Ethical Committee for Medical Research in Norway (application #2013/1733).

### 2.2. Participants

The participants in the study were patients with an illicit SUD. Criteria for inclusion were SUD diagnoses according to the International Classification of Diseases-10 (ICD-10) (World Health Organization (WHO), 1992) (F11–F19), or in cases where a SUD diagnosis was missing, information from the medical record about the type of drug used most frequently the last six months.

### 2.3. Data collection and variables

#### 2.3.1. Predictor variables

The predictor variables were collected using medical records and self-report instruments. The demographic characteristics were selected based on markers found to be important for relapse in previous work (Rollins, O'Neill, Davis, & Devitt, 2005; Xie, McHugo, Fox, & Drake, 2005). Information about each patient's gender, age at treatment entry, and educational achievement was collected from the medical records. Education level was categorized as: low education (10 years primary and secondary education or less = 1) or medium/high education (high school/vocational school or more = 0). Medical records were also used to collect information about psychiatric diagnoses, previous inpatient treatment, length of stay, and treatment completion.

A variable for injecting drug use (yes/no) was based on medical record information about whether the patient had ever injected drugs. The number of SUD diagnoses was used to establish a polysubstance use variable (yes/no). A variable indicating comorbid psychiatric disorders (yes/no) was based on recorded ICD-10 diagnoses (F20–F99), which was either registered during a previous mental health or SUD treatment stay, and/or based on the clinicians' assessments during the current stay.

Information about baseline mental distress was obtained using the self-reported Hopkins Symptom Checklist-10 (Derogatis, Lipman,

Rickels, Uhlenhuth, & Covi, 1974); patients completed the Norwegian-translated scale (Strand, Dalgard, Tambs, & Rognerud, 2003) to rate their frequency of symptoms such as “feeling hopeless about the future” and “feeling fearful” during the past seven days using a four-point scale from 1 (“not at all”) to 4 (“extremely”). The instrument showed feasible psychometric properties in the current cohort, ( $\alpha = 0.89$ ).

Intrinsic motivation for changing personal substance use was measured by self-report at baseline using the items concerning motivation from the Circumstances, Motivation, Readiness and Suitability instrument (CMRS) (Leon, Melnick, Kressel, & Jainchill, 1994). Five items from this instrument were used to obtain information about motivation ranging from 1 (“completely disagree”) to 5 (“totally agree”) ( $\alpha = 0.83$ ).

Patient satisfaction at admission was based on three items measuring how incoming patients were received, the quality of the information provided, and the extent to which the patient was prepared for the stay. Each item was rated on a five-point Likert scale from 1 (“not at all”) to 5 (“to a very large extent”) ( $\alpha = 0.61$ ).

Length of the inpatient stay was calculated based on the number of days from admission to discharge during the current inpatient treatment stay. A dichotomous item was constructed for previous inpatient treatment in specialized SUD treatment (yes/no). Information about treatment completion (yes/no) as opposed to dropout, was collected from the medical record. Treatment dropout was defined as patients who did not complete the inpatient program.

Finally, we included a treatment center variable that differentiated between centers providing short-term (2–4 months) and long-term care (> 6 months).

### 2.3.2. Relapse to substance use

At follow-up, the patients were asked whether they had used alcohol or drugs during the past four weeks. Those who responded positively were asked, “How frequently have you used alcohol/drugs during the last four weeks?” Response options included: “less than once a week,” “approximately weekly,” “2–4 times a week,” “daily or almost daily,” and “do not know.” To differentiate between relapse (i.e. return to regular use) and single use episode/irregular use (i.e. lapse), those who endorsed having used alcohol/drugs 2–4 times or more frequently were defined as having a relapse. Participants who reported readmission to treatment and/or were currently staying at an inpatient SUD treatment center were included in the relapse group (see also (Bernstein et al., 2015)).

### 2.4. Statistical analyses

Analyses were performed using IBM SPSS Statistics (version 23; IBM SPSS, Armonk, NY, USA). Proportion tests and independent samples *t*-tests were used to investigate group differences in baseline characteristics between patients who did or did not relapse and between respondents and non-respondents at follow-up. Proportion tests were used for categorical variables and independent samples *t*-tests were used for continuous variables. Effect sizes (Cohen's *d* or Cramer's *V*) were calculated. Variables found to approach significance ( $p < 0.10$ ) in bi-variable analyses were carried over as predictors in a multivariable logistic regression analysis with relapse (yes/no) at follow-up as the outcome variable. The multivariable analysis was employed to assess how well each of the independent variables predicted the outcome, when controlling for the remaining predictor variables. Potential multicollinearity was examined based on variance inflation factors (VIF). VIF scores ranged from 1.023–1.118, indicating that multicollinearity was not an issue (Hair, Anderson, Tatham, & Black, 1995).

**Table 1**  
Characteristics of baseline sample ( $N = 607$ ).

Variables	(Missing)	% or mean (SD)
Age (years) at intake	(1)	38.2 (13.8)
Female	(2)	29
Low education level	(31)	32
Psychiatric diagnosis	(0)	47
Illicit drug use	(0)	62
Polysubstance use	(26)	49
Ever injected drugs	(2)	39
Previous inpatient treatment	(7)	60
Completed treatment	(0)	75
Length stay (days)	(0)	91,4 (73.6)

Note. The frequencies of SUD diagnoses were: alcohol (F10): 59%; cannabinoids (F12): 27%; stimulants (F15): 32%; opioids (F11); sedative (F13): 29%; cocaine (F14): 3%; other (F16, F18, F19): 8%.

## 3. Results

### 3.1. Sample characteristics

Among the 724 eligible patients, 109 declined to participate and two were not approached due to poor mental functioning. In addition, six patients withdrew their consent to participate. The baseline gross sample thus comprised 607 patients (participation rate, 84%) recruited from August 2014 to December 2016, who were discharged from their inpatient SUD stay between October 2014 and September 2017. Demographic information of the gross sample is presented in Table 1.

In total, 374 patients were diagnosed with an illicit drug use disorder (ICD-10) ( $n = 364$ ) or were using an illicit drug as the main drug before admission ( $n = 10$ ). The final analytical sample for the present study comprised 249 patients with illicit drug use who participated in the follow-up interview three months post-discharge (retention rate 67%). The sample included 63 persons who did not complete the inpatient stay (treatment dropouts). Treatment dropouts tended to have lower pretreatment motivation ( $t = 1.90$ ,  $p = 0.059$ ) and to be less educated compared to treatment completers ( $\chi^2 = 2.74$ ,  $p = 0.098$ ). Otherwise, there were no significant differences between these two groups of patients.

Demographic and clinical characteristics of non-respondents at follow-up ( $n = 125$ ) were compared with those who retained in the study (Table 2).

Those who participated at follow-up were slightly older ( $M = 32.0$  years;  $SD = 10.6$ ) than non-respondents ( $M = 29.7$ ;  $SD = 9.0$ ;  $p = 0.035$ ), whereas more respondents than non-respondents completed the inpatient treatment stay (75% vs. 62%;  $\chi^2 = 6.84$ ;  $p = 0.009$ ).

Table 3 presents the number of included patients at each treatment site, and their mean length of stay. The mean number of days in treatment for patients at short-term ( $n = 188$ ) and long-term clinics ( $n = 61$ ) was 73.7 days ( $SD = 25.9$ ) and 219.9 days ( $SD = 111.7$ ), respectively.

The sample characteristics are reported in Table 4. As shown, 28% were female and the average age was 32 years (standard deviation [SD] = 10.6; range = 18–69 years). The sample included 96% with one or more SUD diagnosis. The remaining 4% had a diagnosis in the category Z00-Z99 (factors influencing health status and contact with services). The most frequently occurring ICD-10 SUD diagnoses were F12, use of cannabinoids (63%) and F15, use of stimulants (51%), followed by F13, use of sedatives (49%) and F11, use of opioids (31%). A total 82% of the patients were polysubstance users, and 61% had at least one comorbid psychiatric diagnosis, according to the International Classification of Diseases-10 (ICD-10) (World Health Organization (WHO), 1992). The three most prevalent psychiatric disorders were mood disorders (F32, F33), ( $n = 38$ ); attention deficit hyperactivity disorder (F90) ( $n = 38$ ), and personality disorders (F60) ( $n = 28$ ).

**Table 2**  
Sample characteristics among non-respondents and respondents at follow-up.

Variables	Non-respondents (N = 125)		Respondents (N = 249)		P-value	Effect size
	(n)	Percent or mean (SD)	(n)	Percent or mean (SD)		
Age	(125)	29.7 (9.0)	(249)	32.0 (10.6)	0.035	0.24
Low education level	(58)	47.9%	(93)	38.0%	0.068	0.10
Psychiatric diagnosis	(68)	54.4%	(151)	60.6%	0.248	0.06
Mental distress	(125)	2.22 (0.68)	(249)	2.27 (0.68)	0.479	0.07
Motivation	(125)	4.26 (0.67)	(249)	4.27 (0.71)	0.894	0.01
Completed treatment	(77)	61.6%	(186)	74.7%	0.009	0.14
Previous inpatient treatment	(74)	59.7%	(142)	57.5%	0.687	0.02

Notes: Proportions (%) of samples reported for categorical variables and mean  $\pm$  SD reported for categorical variables. Pairwise differences calculated with proportion tests and independent samples *t*-tests as appropriate for categorical and continuous variables. Cohen's *d* and Cramer's *V* as appropriate between non-respondents and respondents.

**Table 3**  
Number of patients in the follow-up sample and length of stay (days) for each of the five treatment sites.

Center	Treatment duration	Number of patients in sample (N = 249)	Length of stay mean (SD)
A	Short-term	125	80.9 (28.1)
B	Short-Term	57	57.9 (10.4)
C	Short-term	6	74.5 (16.1)
D	Long-term	41	188.1 (69.7)
E	Long-term	20	285.0 (150.1)

Notes: Patients with severe substance use and polysubstance use was the main target group for center A, B, D and E. Patients with alcohol use disorders and mild polysubstance use was the main the target groups for treatment center C.

### 3.2. Bivariate comparisons

A total of 93 (37%) of the participants at follow-up had experienced a relapse. Among these, 75 patients were identified as relapsing based on the frequency of substance use variable and 18 had been readmitted for inpatient treatment. Table 3 shows that patients who had a relapse were significantly younger, had a lower education level and were more likely to have a comorbid psychiatric disorders and to report somewhat higher mental distress at treatment intake, compared with those who did not relapse. Further, patients who relapsed were less likely to have completed the planned inpatient treatment stay, and relatively more had received treatment at a short-term clinic.

### 3.3. Multivariable predictors of relapse to substance use after inpatient treatment

A logistic regression model with the six variables that obtained significance in bivariate analyses ( $n = 245$ ) was found to have good fit ( $-2 \text{ Log likelihood} = 277.57$ ;  $\chi^2 = 44.62$ ;  $p < 0.001$ ). As displayed in Table 5, increased risk of relapse was predicted by younger age and having a co-occurring psychiatric disorder. Being treated at a short-term as opposed to a long-term clinic was related to increased relapse risk, whereas having completed the planned inpatient stay was related to a reduced risk of relapse. There was a tendency among those with increased relapse risk to have low education (compared to middle/higher level education).<sup>1</sup>

<sup>1</sup> In an additional analysis all subjects lost to follow-up were defined as relapsers ( $n = 218$ ) and compared to the non-relapsers ( $n = 156$ ). Multivariable analysis with variables that obtained significance in bivariate analysis, showed that relapse was predicted by younger age ( $p < 0.001$ ), a low educational level ( $p < 0.05$ ), not having completed the inpatient stay ( $p < 0.05$ ) and shorter length of stay ( $p < 0.05$ ).

## 4. Discussion

Relapse occurred among 37% of the current sample by the three-month post-discharge follow-up. This relapse rate is comparable to that reported in a recent Norwegian study (Pasareanu et al., 2016), however, relatively low compared with other studies, which have reported rates from 50% to 75% (Darke et al., 2005; Gil-Rivas, Prause, & Grella, 2009; McKetin et al., 2018; Suter et al., 2011). However, direct comparisons of relapse rates between studies are problematic due to the diversity of patient populations, treatment settings, and different follow-up intervals and definitions of relapse.

The current study has shown that having a co-occurring psychiatric disorder is associated with increased risk of relapse. This partly supports our first hypothesis which postulated that pretreatment mental distress is associated with elevated risk of relapse. Although mental distress reached significance in univariable analysis, multivariable analyses showed that having a psychiatric diagnosis surpasses self-reported mental distress in predicting relapse. This finding aligns with previous studies with more homogenous substance users (Adamson et al., 2009; McKay et al., 2002). A possible explanation for the association between psychiatric problems and subsequent relapse is that mental health problems are related to impaired areas of functioning that are important during the recovery process, which may be inadequately addressed during inpatient treatment. When patients do not receive adequate treatment for psychiatric problems during and after the inpatient treatment stay, return to substance use may become a way to cope with or relieve reoccurring emotional stress post-treatment (i.e. self-medication) (Swendsen et al., 2010).

Our second hypothesis which predicted that higher pretreatment intrinsic motivation would be associated with lower risk of relapse was not supported by the data. The current findings showed no significant pretreatment difference in intrinsic motivation between “relapsers” and “non-relapsers”. These results contrast previous findings from alcohol treatment programs (Adamson et al., 2009; Bauer et al., 2014; Staines et al., 2003) and may suggest that the importance of pretreatment intrinsic motivation for changing personal substance use may be limited to patients with alcohol use disorders.

Younger age was associated with an increased risk of relapse. The finding aligns with research demonstrating that younger age is associated with higher probability of adverse SUD treatment outcomes (Brorson, Ajo Arnevik, Rand-Hendriksen, & Duckert, 2013; Kenne, Boros, & Fischbein, 2010; Rollins et al., 2005). Previous research on predictors of relapse after inpatient SUD treatment is limited to patients with alcohol use disorder, who typically were older in age and more educated (Bauer et al., 2014) compared to the present sample. Better SUD treatment outcome may be predicted by more treatment (Teesson et al., 2006) and age at intake to SUD treatment is probably highly correlated with the number of previous treatment episodes. In the current study, previous inpatient treatment was included in the analyses. However, we did not have information about the number of

**Table 4**  
Characteristics of the follow-up sample and baseline factors associated with relapse.

Variables	Total (N = 249)		Relapse to substance use				P-value	Effect size
			Yes (n = 93)		No (n = 156)			
	(missing)	Mean (SD) or percent	(n)	Mean (SD) or percent	(n)	Mean (SD) or percent		
Age at intake	(0)	32.0 (10.6)	(93)	29.1 (9.1)	(156)	33.8 (11.1)	<b>0.001</b>	0.46
Female	(1)	27.8%	(22)	23.9%	(47)	30.1%	0.291	0.67
Low education level (yes)	(4)	38.0%	(44)	48.9%	(49)	31.6%	<b>0.007</b>	0.17
Ever injected (yes)	(2)	57.5%	(57)	61.3%	(85)	55.2%	0.348	0.06
Polysubstance use (yes)	(10)	82.0%	(77)	85.6%	(119)	79.9%	0.267	0.07
Psychiatric diagnosis (yes)	(0)	60.6%	(68)	73.1%	(83)	53.2%	<b>0.002</b>	0.20
Mental distress	(0)	2.27 (0.68)	(93)	2.37 (0.64)	(156)	2.21 (0.69)	<b>0.063</b>	0.25
Motivation	(1)	4.27 (0.71)	(93)	4.20 (0.72)	(285)	4.31 (0.71)	0.225	0.16
Previous inpatient stay (yes)	(6)	57.4%	(54)	58.1%	(88)	57.1%	0.887	0.01
Satisfaction at intake	(0)	3.82 (0.69)	(93)	3.78 (0.66)	(156)	3.84 (0.72)	0.535	0.09
Length of stay (days)	(0)	109.5 (86.6)	(93)	98 (80.3)	(156)	116 (89.7)	0.112	0.21
Completed treatment (yes)	(0)	74.7%	(60)	64.5%	(126)	80.8%	<b>0.004</b>	0.18
Short-term clinic	(0)	76.0%	(79)	84.9%	(109)	69.9%	<b>0.007</b>	0.17

Notes: Proportion (%) of sample reported for categorical variables and mean (SD) reported for continuous variables. Pairwise differences calculated with proportion tests or independent samples *t*-tests for categorical and continuous variables, respectively. Effect sizes measured using Cohen's *d* and Cramer's *V*, as appropriate, between relapse and non-relapse groups. Significant *p* values (< 0.10) are in bold.

**Table 5**  
Logistic regression examining variables associated with relapse.

Indicator	AOR	95% CI	Wald	P-value
Age (years)	0.95	0.92–0.98	11.51	<b>0.001</b>
Low education level	1.76	0.98–3.15	3.56	0.059
Psychiatric diagnosis	2.25	1.22–4.15	6.72	<b>0.010</b>
Mental distress	1.38	0.89–2.13	2.08	0.149
Completed treatment	0.47	0.25–0.89	5.31	<b>0.021</b>
Short-term clinic	2.95	1.92–6.14	8.38	<b>0.004</b>

Notes: Nagelkerke  $R^2 = 0.23$ , Cox & Snell  $R^2 = 0.17$ , AOR = adjusted odds ratio. CI = confidence interval. Significant *p* values (< 0.05) are in bold. *N* = 245.

previous exposures to SUD treatment, which could have contributed to a better understanding of the current association between age and relapse.

Patients who were discharged from short-term treatment clinics (2–4 months) were at greater risk of relapse as compared to those at long-term (6–12 months) clinics, regardless of length of stay in treatment. Previous research has shown that longer time in treatment is related to better treatment outcomes (Darke et al., 2012; Meier & Best, 2006). In the present study however, it is not duration of treatment per se that is associated with reduced relapse risk, but rather characteristics of the clinics that provide longer treatment stays. The present data do not include information on potential treatment environment outcome predictors. Treatment factors that contribute to better treatment outcomes may be related to ward atmosphere characteristics, such as intensity of personal ward relationships, and level of activity and involvement, which are features of the treatment environment shown to be associated with positive treatment outcomes in previous research (Carr & Ball, 2014).

Our study showed a reduced risk of relapse for individuals who had completed the inpatient stay. This aligns with previous research emphasizing the importance of SUD treatment completion for subsequent drug use outcomes (Brewer, Catalano, Haggerty, Gainey, & Fleming, 1998; Gossop et al., 2002; Manning et al., 2017). Treatment completion may be associated with greater service intensity and quality (Hser, Evans, Huang, & Anglin, 2004). Other important factors could be planning for further recovery initiatives, such as housing and employment, which are typically intensified towards the end of the treatment stay and may be of great importance for successful SUD recovery (Laudet & White, 2010; Lauritzen & Nordfjærn, 2018).

#### 4.1. Strengths and limitations

This study makes an important contribution to a field that has tended to focus on patients manifesting only the most severe drug use (e.g., heroin users), or exclusively alcohol use disorder treatment. Another strength is that relapse (i.e. having used alcohol/drugs 2–4 times or more frequently during the past four weeks) was operationalized to make the distinction between relapse and mere lapses (i.e. single use episode/irregular use) more clear-cut (Hendershot et al., 2011). However, some study limitations should also be considered. Our measure of relapse was based on self-reports. Although previous research has reported good reliability of self-reports (Laudet, 2007), there remains some debate about the accuracy of this information. Furthermore, the definition of relapse used in this study does not take into account that use of alcohol or illicit drugs 2–4 times per week for some could reflect a reduction in drug usage. A more accurate measurement of relapse could include information about the type of drug used, or even better subjective information about the extent to which the individual has quitted efforts to reduce substance use (DiClemente & Crisafulli, 2017). The follow-up rate of 67% is comparable to follow-up rates in other prospective drug treatment outcome studies (Adamson et al., 2009). Those who were lost to follow-up were younger and were more likely to be treatment dropouts compared to those who remained. Given that younger age and treatment dropout were associated with relapse, return to substance use may be a plausible reason for attrition at follow-up (Hansten, Downey, Rosengren, & Donovan, 2000). The ecological validity of the study should be interpreted with these limitations in mind.

#### 5. Conclusions

Identifying the treatment needs of young patients and patients with co-occurring psychiatric diagnoses during and following inpatient SUD treatment may contribute to reduced relapse rates among illicit drug users. Further research is needed to illuminate the treatment-related factors that contribute to reduced risk of relapse after inpatient SUD treatment.

#### Role of funding source

Funding for this study was provided by the Norwegian University of Science and Technology (NTNU), Trondheim, Norway, St. Olavs University Hospital, Trondheim, Norway, and Møre and Romsdal

Hospital Trust, Ålesund, Norway. The funding sources had no role in the study design, data collection, analyses, writing, or the decision to submit the manuscript for publication.

## Acknowledgements

We want to thank the research assistants of the participating clinics for their contribution to the implementation of the study: Marit Magnussen, Kristin Øyen Kvam, Snorre Rønning, Eli Otterholt, Kristian Bachmann, and Helene Tjelde. We also want to thank the patients for their contribution to this research.

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