Predicting Readmission To Detoxification In Clients With Alcohol- and Drug Dependence

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Contents

Abstract

Introduction: This study examined factors which could possibly predict readmission to detoxification. We specifically analyzed the role of co-morbid disorders, demographic factors, social- and environmental problems and substance use behavior. Only a few studies have examined this relationship so far. Most research focused on relapse rather than on readmission. Identifying specific risk groups can help staff from the detoxification departments to prevent readmission of clients.

Methods: We employed a medical record study and investigated factors included in existing client charts from Tactus addiction treatment. Data from 610 clients who participated at least one time in a detox program between January 1st 2012 and 30st june 2014 were analyzed. The following variables were measured: Readmission, depressive symptoms before and after detox, co-morbid mood disorders, personality disorders, attention deficit disorders, demographic factors, psychosocial-and environmental problems and substance use behavior (frequency, duration of use, substance, polydrug use)

Results: 29.5% of the clients were readmitted to detox within the research period. Several risk groups could be identified. Heroin addicts displayed the highest risk of readmission, closely followed by polydrug users – and cocaine addicts. Moreover, clients with mood disorders were more often readmitted, especially in the group of cannabis users. Eventually, clients with problems related to the social environment displayed higher chances of readmission. The results of this study also indicated that co-morbid disorders were either not accurately measured or not recorded completely. Either way the subgroups were conspicuously smaller than literature on this topic suggests. This might have lead to a problem of underdetection of co-morbid disorders and might explain why some effects were not significant.

Conclusion: We recommend more accurate assessment or a more complete recording of co-morbid disorders in clients who participate in detoxification. We suggest to take all identified risk factors into account when evaluating a clients readmission risk. A prevention plan should be designed in these cases. Future research on risk of readmission to detox should not only focus on personal risk factors, but should examine program-level factors such as the continuity of service between detoxification programs and subsequent addiction treatment as well.

Samenvatting

Inleiding: In deze studie werden factoren onderzocht, die mogelijk kunnen voorspellen of een cliënt wordt heropgenomen op de detox afdeling. Het focus van dit onderzoek werd gelegd op co-morbide stoornissen, depressieve symptomen voor en na detox, demografische gegevens, psycho-sociale- en omgevings problemen en verslavings gedrag. In de literatuur was weinig informatie over heropname naar detox te vinden. De meeste studies waren gericht op terugval. Wanneer hulpverleners inzich krijgen in welke factoren gerelateerd zijn aan heropname op de detox afdeling, kunnen ze een heropname mogelijk voorkomen.

Methode: Een dossieronderzoek is uitgevoerd op de data van 610 cliënten die in de periode tussen januari 2012 en juni 2014 ten minste een detox hebben gehad. De volgende variabelen werden daarbi onderzocht: Co-morbide stoornissen, depressieve symptomen voor- en na detox, demografische gegevens, psycho-sociale- en omgevings problemen en verslavings gedrag (middel, frequentie, duur en co-gebruik).

Resultaten: 29.5% van de cliënten werden heropgenomen. Verschillende risico groepen konden worden geïdentificeerd. Cliënten met een heroïne verslaving hadden het grootste risico op heropname. Daarnaast hadden polydrug gebruikers en cliënten met een cocaïne verslaving een hogere risico op heropname dan singledrug gebruikers en cliënten, die verslaaft waren aan andere middelen. In de groep van de ´polydrug users´ hadden vooral cliënten met een heroïne verslaving, die daarnaast cocaïne gebruikten een hoog risico op heropname. Ook werden cliënten met een stemmingsstoornis vaker heropgenomen, in het bijzonder in de groep van cannabis gebruikers. Opvallend was dat co-morbide stoornissen blijkbaar niet accuraat werden gemeten of ze niet werden opgenomen in het data set. De subgroepen in deze categorieën waren kleiner dan in de literatuur gevonden. Dat heeft mogelijker wijze geleidt tot het probleem van onderdetectie en zou een verklaring kunnen zijn daarvoor dat sommige effecten niet significant waren.

Conclusie: Het is aan te bevelen dat er bij opname van cliënten meer accuraat wordt onderzocht of de betreffende cliënt een co-morbide stoornis heeft. Verder adviseren wij om alle risico factoren, die binnen dit onderzoek geïdentificeerd werden mee te nemen in de evaluatie van het risico op heropname tijdens het intake gesprek. In deze gevallen zou het handig zijn om een preventie plan te ontwerpen. In toekomstig onderzoek is het aan te

bevelen om niet alleen persoonlijke risico factoren te onderzoeken, maar ook factoren zoals de continuïteit tussen de detox behandeling en vervolgbehandelingen te analyseren.

Introduction

Studies on substance dependence and addictive behaviors reveal notoriously high relapse rates, indicating that maintaining behavioral change over time and across situations is a problematic issue, especially in this type of disorders (Chung & Maisto, 2006). Many studies have focused on factors that are related to relapse in general. However, only a few studies have examined factors that could possibly be related to readmission to detoxification programs. Detoxification is often the first step addiction treatment for clients with severe withdrawal symptoms and in addition to that a fairly expensive form of treatment (Spear, 2015). Within our present study we analyze factors that might possibly be related to readmission to detoxification. We focus on demographic factors, co-morbid disorders, depressive symptoms, substance related factors and psycho-social and environmental problems. First, we outline some current facts with regard to addiction and on the process of detoxification. Afterwards, we give a review of the literature concerned with factors that have been associated with readmission to detox programs and with relapse in general. Eventually, we present our research questions and hypotheses.

Addiction

Today, addiction is seen as one of the major health problems worldwide (Spear, 2015). The Netherlands government spent 480,2 million dollar in the year 2011 on addiction care and with 355.6 million dollar in the year 2014 almost as much on drug crime (Trimbos Instituut, 2015). Moreover addiction has numerous negative consequences to the individual and its social environment. In her book Bernard (2007) noted that '*drug abuse hits the families like a tidal wave, leaving those involved floundering in a sea of anger, frustration, fear and isolation*'. Eventually addiction to alcohol and drugs has a seriously negative impact on all the different dimensions.

Because our data is based on the fourth edition of the Statistical Manual of Mental Disorders (DSM-IV), we decided to use the definition of substance dependence according to this edition. Substance dependence is defined as a '*maladaptive pattern of substance use leading to clinically significant impairment or distress, as manifested by three (or more) of the following criteria, occurring any time in the same 12-month period*': Tolerance, withdrawal symptoms, substance taken for a larger amount and for a longer period of time than intended, persistent desire or repeated unsuccessful attempts to quit, much time/activity to obtain, use and recover, important social, occupational, or recreational activities are given

up or reduced and use continues despite knowledge of adverse consequences (American Psychological Association, 2000). In the fifth edition of the DSM some changes were made.

The term substance dependence got replaced by the term substance use disorder. The term 'substance abuse' was deleted completely and instead, the DSM-V distinguishes three types of severity of substance use disorders. When a person met 2-3 criteria the disorder is seen as mild, 4-5 criteria indicate a moderate disorder and when a person meets six or more criteria the substance use disorder is labeled as severe.

Next, gambling disorder got included in the section of behavioral disorders based on the fact that gambling addiction apparently activates similar brain reward systems like drug- or alcohol related addictions do. In the DSM-IV substance abuse was diagnosed when a person met only one or two of the criteria. In the DSM-IV this distinction was deleted.

Detoxification

Detoxification treatment belongs to the most intensive and expensive kinds of treatment (McKay, 2009). It is defined as "a medical intervention that manages an individual safely through the process of acute withdrawal" (Lee, et al., 2015). The primary goal of the detoxification process is to achieve abstinence from the substance to resolve the problem of physical dependence. Detoxification is a step a in treatment process. It is not designed to resolve the long-standing psychological, social, and behavioral problems associated with alcohol and drug abuse. Detoxification can include the use of medications to reduce withdrawal symptoms. Many people with substance use disorders suffer from withdrawal symptoms as soon as they quit using the substance. The major withdrawal symptoms are autonomic hyperactivity; increased hand tremor; insomnia; nausea or vomiting; transient visual, tactile, or auditory hallucinations or illusions; psycho-motor agitation; anxiety and grand mal seizures (American Psychological Association, 2000). One to five percent of the alcohol dependent patients suffer from delirium tremends (DT's) which is the most severe form of alcohol withdrawal. DT's are characterized by hallucinations, mental confusion and disorientation (Trevisan, Boutros, Petrakis, & Krystal, 1998). DT's is a severe medical condition with a high mortality rate and if risk is presumed to be high medication is almost always given. People with substance use disorders who cannot manage become abstinent by themselves are regularly admitted to in- and – outpatient programs. In the Netherlands addiction care seems to shift from clinical treatment to outpatient programs (Polman, 2014). Readmission rates to detoxification are fairly high, suggesting that detoxification programs may not always promote long-term abstinence sufficiently. If clients do not have the

opportunity or are not willing to participate in subsequent treatment programs, the risk of being readmitted to detoxification treatment is high.

Readmission

Only few studies focus specifically on readmission rates to detoxification programs. However, a recently published study found that 50.8 percent of 132 older male alcoholics were readmitted to detoxification within one year (Van den Berg, Van den Brink, Kist, Hermes, & Kok, 2015). Other studies on adult populations found lower rates for readmission. Booth, Yates, Petty and Brown (1991) found that 38.4 percent were readmitted to detoxification within a period of 15 months. Because studies examine different populations and have different follow-up times, it is difficult to compare readmission rates. The majority of studies is concerned with relapse rather than with readmission to detoxification specifically. Relapse rates are also difficult to compare, because the term is defined differently across studies. Some studies consider any violation against abstinence a relapse, whereas others define relapse in terms of amount of use (Heinz, Beck, Mir, Grüsser, Grace, & Wrase, 2010; Foster, Mashall, & Peters, 2000). Despite of methodological concerns regarding the estimation of relapse rates which clearly need to be solved, examining factors that are related to relapse is a crucial matter for providing clinical practice with valuable information for treatment. In our study we defined relapse as readmission to detoxification in a one year follow-up. In the next section we will review literature on factors that are related to readmission to detoxification and on relapse in its broad sense.

Factors related to readmission and relapse

Studies on readmission to detox are focused on either personal-level factors or program-level factors. Personal- level factors related to detox readmission include severity of use, being single, alcohol as the primary drug problem, unemployment and older age (Spear, 2015). According to results of another study on risk factors for detox readmission, only 'spending most leisure time alone' predicted readmission to detoxification in an older male population within one year (Van den Berg, Van den Brink, Kist, Hermes, & Kok, 2015). Studies on program-level factors revealed that continuity of service between detox and subsequent addiction treatment is an important factor in reducing readmission rates to detox (Lee, et al., 2015). That underlines the point that detoxification should be a step in addiction treatment and not the only treatment. Spear (2015) noted that especially two factors have an impact on whether a client will continue addiction treatment after detoxification. First, a close proximity

between detox and subsequent addiction treatment facilities is associated with continued treatment. Second, careful discharge planning and supporting a client in finding and applying for the right treatment program is increasing client's engagement. However, according to some studies only 20-50 percent of clients receive post-detoxification service (Chuatape, Jasinski, Fingerhood, & Stitzer, 2001).

Most other studies have focused on relapse rather than on readmission to detoxification. Because we analyzed personal-level factors that could be related to readmission to detoxification, we focused our literature research on personal-level factors of relapse in its broad sense. One study aimed at discriminating relapsers from nonrelapsers by identifying independent predictors for alcohol relapse within the 1st year after inpatient treatment. (Walter, Gerhard, Duersteler-MacFarland, Weijers, Boening, & Wiesbeck, 2006). Unmarried alcoholics showed a nearly twofold risk of relapse than married alcoholics. The latter is in line with results from another study that also found that being single predicted relapse (Walton, Blow, Bingham, & Chermack, 2003)

Studies which examined the role of specific substances in relapse display different results. Spear (2015) found that heroin users were more likely to be readmitted to detoxification than patients with another substance related addiction. However, other studies found that alcohol as a primary addiction predicted relapse (Callagan & Cunningham, 2002). While there is controversy about which substance is related to an increased risk of relapse, most studies show that polydrug using clients are more likely to relapse than clients with only one substance related dependency (Stinson, Grant, Dawson, Ruan, Huang, & Sasha, 2005). Especially the co-use of heroin and cocaine is very common and associated with higher relapse rates (Leri, Bruneau & Stewart, 2002). Another factor that stand out when we searched for factors related to relapse are co-morbid axis-1 and axis-2 disorders. In the Netherlands approximately 41 percent of the clients diagnosed with a mental disorder were also diagnosed with a substance related disorder (Wamel & Neven, 2015). The most prevalent co-morbid disorders are mood disorders (Quello, Brady, & Sonne, 2005), personality disorders (Morgenstern, Langenbucher, Labouvie, & Miller, 1997) and attentiondeficit disorders (Wilens & Spencer, 2013). In sum, it is still uncertain which of these factors contribute most to relapse. However, certain co-morbid disorders seem to be very prevalent among substance dependent clients and therefore deserve special attention. In the following section, we present information on co-morbid disorders and their relationship to relapse.

Mood disorders

Prevalence rates of co-morbidity between substance related disorders and mood disorders vary throughout literature. This might be due to the fact that depressive symptoms are measured at different times. Quello, Brady and Sonne (2005) found that depressive symptoms in early treatment were much less predictive of relapse than depressive symptoms after a period of abstinence. Time of assessment seemed to be a crucial factor to distinguish symptoms of affective disorders from symptoms of intoxication or withdrawal. Based on their literature review Bradizza, Stasiewicz and Paas (2006) concluded that co-morbid disorders are significant predictors of relapse. The researchers also noted that mood disorders are more prevalent among clients with alcohol dependency than among clients with any other substance related dependence. In addition, alcohol dependent clients with a co-morbid mood disorder were more likely to relapse than clients alcohol dependence alone or clients with another addiction combined with a mood disorder.

Personality Disorders

Bradizza, Stasiewicz and Paas (2006) presented an overview of the literature concerned with co-morbid disorders and relapse to substance use. With regard to personality disorders (PD), they concluded that borderline PD and anti-social PD are the most common types of PD's in clients with substance dependence. A study on substance dependent clients in treatment revealed that approximately 58 % of the sample was diagnosed with at least one personality disorder (Morgenstern, Langenbucher, Labouvie, & Miller, 1997). There is no literature with regard to PD and readmission to detoxification. A few studies have examined the role of PD in relapse to substance use. Tomasson and Vaglum (2000) found that clients with a PD were more likely to relapse than substance dependent clients without a PD.

Attention Deficit Disorders

Lee et al. (2014) meta-analyzed longitudinal studies on the association between attention deficit/hyperactivity disorder (ADHD) and the development of addiction. According to the results children with ADHD were more likely to become dependent on substances such as nicotine, alcohol, marijuana and cocain. Because the onset of ADHD is earlier than the onset of a substance related disorder, it follows logically that ADHD is in some way increasing the risk for developing addiction. ADHD in adulthood seems to be not only related to the initiation of use and to the transition of developing a dependence, but also seems to influence the recovery from it. Wilens and Spencer (2013) found that individuals with ADHD needed 3 years more for remission and more readmissions to treatment than those without ADHD.

Present Study

The detox department of Tactus addiction treatment asked us to examine factors that could predict readmission to detox. We used a data set from Tactus with files of clients who participated in the detox program. In an exploratory manner we investigated factors that could possibly be related to readmission. The main focus of this study was the relationship between co-morbid disorders and readmission. Based on prevalence rates, we specifically analyzed the relation of mood disorders, personality disorders and attention deficit disorders to readmission. Moreover we analyzed the role of depressive symptoms before and after treatment. Our main research question was :

'*Do co-morbid disorders predict an increased risk of readmission to detox?'* In addition, we examined the association between demographic factors, substance use behavior and psycho-social- and environmental problems and readmission to detox.   We assumed that clients with severe depressive symptoms after detox and clients with a co-morbid disorder would be more likely to be readmitted to detox. Regarding demographic factors, we presumed unmarried clients and those not living together with a partner to have a higher risk of readmission. We expected that substance use behavior such as polydrug use, heroin and alcohol dependence would be associated with a higher likelihood of readmission. Eventually, we supposed that clients with psycho-social and environmental problems to be more often readmitted.

Methods

Participants and Setting

Participants were 610 clients who participated for the first time in a detoxification program at Tactus addiction treatment between January 1st 2012 and 30st of June 2014. Clients were followed up for at least one year. Clients who were admitted before the research period were excluded. An inclusion criterion was that clients had to be diagnosed with a substance dependence according to the DSM-IV criteria. To assess substance related disorders MATE 2.1 (Measurements in the Addictions for Triage and Evaluation) was administered. The youngest client in this sample was 14 years old and the oldest 74.

Research Design and Procedure

A retrospective chart review was employed to examine individual risk factors of readmission. This design is also commonly referred to as a medical record study. The data were originally

not gathered for research purposes, but routinely collected by well-trained employees from Tactus. Client files were anonymized prior to our analysis. All clients were admitted to an inpatient detoxification program at Tactus within the research period. Clients were initially enrolled by their primary care physician. Afterwards they received an invitation letter from Tactus and were admitted at any day during the week for a period of five to ten days depending on the substance used. Each client participated in an intake in which diagnostic assessment was performed.

Measurement

Dependent variable

As a dependent variable we chose readmission to detox within the research period. We created a dummy variable with '0' for 'no readmission and '1' for 'readmission'.

Independent variables

Demographic Factors

Client files contained information on gender, age, educational level, nationality, housing and marital status. Educational level was recoded into a dichotomous variable with '0' representing 'lower level of education' and '1' representing 'higher education'. The same was done for marital status with '0' standing for 'being married or living together with a partner' and '1' for 'not married or living together with a partner'. Housing was recoded into '1' for 'living in an own house/apartment', '2' for 'living together with family or friends', '3' for 'homeless' and '4' representing 'other'. All sample characteristics are shown in table 1.

Mood disorders

Some clients were already diagnosed with a mood disorder. This diagnosis was taken from the client chart. If the clinical view of the psychologist indicated a possible mood disorder, the M.I.N.I (MiniNeuropsychiatric Interview) was administered. For our analysis, we used diagnoses that were as close as possible to the date of first admission to detox. Because some types of mood disorders were very rarely represented in this sample, we created a dichotomous variable with '0' standing for 'no mood disorder' and '1' representing 'mood disorder'. Mood disorders consisted of all types of depressive disorders (e.g. mild, moderate, severe and dysthymic disorder), all types of bipolar disorders (e.g. type I&II and cyclothymic disorder) and of substance-induced mood disorders.

Depressive Symptoms before and after detox

Tactus used the short version of the Depression Anxiety Stress Scale (DASS-21). This scale was designed to measure the core symptoms of depression and anxiety and stress (Disord, 2008). For our analysis we only used the depression scale consisting of 7 items. The depression subscale has good internal consistency (α=.87.) (Disord, 2008), a sensitivity of 57.0 % and it correlates excellent with the Brief Symptom Inventory Depression Subscale (r=.70.) (Chan, 2013). Pre- and post -detox measurements of depression were used as timing seemed to be a crucial factor in predicting relapse. Two dichotomous variables were created. '0' indicated 'no depressive symptoms' and '1' indicated 'depressive symptoms. A cut-off score of 20 was set to measure the presence of depressive symptoms.

Personality disorders and attention deficit disorders

Tactus did not assess PD's and attention-deficit disorders. A number of clients were diagnosed with disorders of these types before detoxification treatment (n=195). 127 clients were assessed with a PD and 68 clients were diagnosed as having no current PD. Tactus took these diagnoses into their own client records. However, the majority of clients had never been assessed for PD's either by Tactus or by another institution. As a result the diagnosis of PD's was delayed for most clients (n=415).

Substance Use Behavior

We analyzed only the most frequently occurring substances which were: Alcohol, cocaine, heroin, amphetamine, nicotine, cannabis and GHB. First, we created dichotomous variables for each substance. For example we created a variable for alcohol addiction with '0' representing 'other addiction' and '1' standing for 'alcohol addiction'. Moreover we created a nominal variable for primary substance with seven categories representing each substance. Next to that we wanted to know whether a client was diagnosed with more than one substance related dependency. Clients were diagnosed with up to three substance related dependencies. We constructed one dichotomous variable with '0' representing 'single drug use' and '1' for 'polydrug use'. Because polydrug use usually does not include substances such as nicotine, we coded nicotine with '0' for no addiction. Next to that we generated variables for duration of use (0-12 months, 1-5 years, >5 years) frequency of use (daily, weekly, irregular) and age of onset.

Psycho-Social and Environmental Problems

Psycho-social and environmental problems represented the diagnoses of the fourth axis of the DSMIV. We analyzed only the most frequently occurring problems which were: Problems related to work, financial problems, problems related to crime, housing problems, problems with the primary support group and problem in the social environment. We dichotomized these variables. For example, we created a dummy variable for problems in the primary support group with '0' representing 'no problems in the primary support group' and '1' standing for 'problems in the primary support group'. The same was done for all other mentioned psycho-social problems.

Statistical Analysis

We analyzed our data with SPSS version 23 (Statistical Package for the Social Science). We used descriptive statistics to analyze demographic data. Frequency analysis was conducted to measure readmission rate, co-morbid disorders, depressive symptoms before and after detox and substance use behavior.

For our main analysis we used phi-coefficients which are equivalent to Pearson's r and are used for categorical data to measure the degree of association between readmission and our independent variables. Logistic regression was performed to evaluate significant risk factors associated with readmission to detox. Backward elimination method was used to find the best set of predictors. In the original model, all variables that displayed a significant association with readmission were entered. Odds ratios with 95% confidence intervals were calculated and Nagelkerkes R^2 was reported to show the overall predictive value of the model. Finally, moderated regression analyses were conducted to examine whether there was an interaction between substances and co-morbid disorders in the prediction of readmission. The reference category was always 1. For example polydrug use was coded with '0' standing for 'no polydrug use' and '1' for 'polydrug use'. Subsequently we chose '1' as a reference. Except of age and age of first use, all variables were nominal. All statistical tests were considered to be significant at an alpha level of 0.05 on a two-tailed test.

Results

In Table 2 demographic characteristics, readmission rate, frequency of co-morbid disorders and depressive symptoms before and after detox of are summarized. 29.9 % of the 610 (n=180) clients were readmitted for a second and/or third detox within the research period. The mean age was 37 years (M=37.7, SD=12.9) with an age range spanning from 14 to 74

years of age. Of the 610 respondents 77,4 % were male (n=472), 82.3 % were from the Netherlands (n=502), 81.8 % had a low educational status, 59.2 % lived in an own apartment (n=361) and 84,4 % were not married or living together with a partner. 20.8 % of the clients were diagnosed with a co-morbid personality disorder (n=127), 6.6% were diagnosed with attention-deficit types of disorders (n=40) and 5.9 % were diagnosed with a mood disorder (n=36). Depressive symptoms were more prevalent before detoxification than afterwards. 26.7 % of the clients reported depressive symptoms before detox (n=163) and only 10 % after detox (n=61). However, for both variables there were missing values: For 157 clients (n=157) we found no information on depressive symptoms before detox. Similarly, for 49 of the 180 clients who participated in a second detox we found no information on depressive symptoms after detox. This means that depressive symptoms were either not measured at all in these cases or that the data was not recorded in the dataset.

Table 2-Sample characteristics (N=610)

		N	%
Readmission[a]	Yes	180	29.5
	No	430	70.5
Age		M 37.7	SD 12.9
Gender	Man	472	77.4
	Woman	138	22.6
Educational Level[b]	High	50	8.2
	Low	499	81.8
Nationality	Netherlands	502	82.3
	Other European country	32	5.2
	Rest	45	4.7
	Unknown	31	5.1
Housing	Living alone	361	59.2
	With Family/friends/parents	120	19.7
	Homeless	42	6.9
	Rest	87	14.3
Marital status	Married/living together	95	15.6
	Not married/living together	515	84.4
	Unknown	23	3.8
Co-morbid disorders[c]	Personality disorder	127	20.8
	Attention deficit disorder	40	6.6
	Mood disorder	36	5.9
Depressive symptoms before treatment (DASS21 – subscale depression)[d]	No depressive symptoms	290	47.5
	Depressive symptoms	163	26.7
	Unknown	157	25.7
Depressive symptoms after treatment (DASS-21-subscale depression)	No depressive symptoms	320	52.5
	Depressive symptoms	61	10.0
	Unknown	229	37.5

[a]readmission to detox at Tactus within the research period [b] High level includes all higher educational levels such as college or university (in the Netherlands this includes VWO, HBO and WO), lower level secondary education (in the Netherlands VMBO or Mbo); [c] assessed with MATE 2.1 (DSM,4th edition); [d] Depression Anxiety Stress Scale-21 item depression scale with cut-off=20

Association between independent variables and readmission

Of all demographic factors, only marital status was significantly negative associated with readmission (φ=0.080, p=0.049). Clients who were married or living together with a partner were less likely to be readmitted than clients who were not married or living together with a spouse.

Several substance behavior factors were significantly associated with readmission. The strongest positive association was found for heroin dependence and readmission (φ=0.117, p=0.004), indicating that clients with heroin addiction were more often readmitted to detox than clients with another addiction. A similar effect was found for clients with cocaine dependence (φ=0.114, p=0.005). Furthermore, we found a positive association between polydrug use and readmission. (φ=0.112, p=0.006), meaning that polydrug users were more often readmitted than clients without such a diagnosis.

Of all co-morbid disorders only mood disorders were significantly positively associated with readmission (φ=0.082, p=0.043). Clients with a co-morbid mood disorder were more often readmitted than clients without such a diagnosis. Neither depressive symptoms before detox (φ=-0.039, p=0.407), nor depressive symptoms after detox (φ=-0.040, p=0.433) were significantly associated with readmission.

The only factor from the most frequently occurring psycho-social and environmental problems included in the axis-IV diagnosis which was associated with readmission were problems related to the social environment (φ= 0.080, p=0.048). The positive association suggests that clients with problems related to the social environment were more likely to be readmitted to detox.

In order to decide which variables to include in our regression model, we examined the association between independent variables, too. The correlation matrix in table 2 gives an overview. The strongest positive effect was found between polydrug use and cocaine addiction (φ=0.445, p<0.01), indicating that cocaine dependence was more prevalent in polydrug use than any other substance addiction.

Table 3- Association between independent variables and readmission

	Independent Variable	1	2	3	4	5	6	7
1	**Readmission[a]**	**1**	**.117****	**.114***	**.112***	**.082***	**-.080***	**.080***
2	Heroin addiction	.117**	1	.107**	.083*	-.042	.011	.101*
3	Cocaine addiction	.114*	.107**	1	.445**	.011	.093*	-.006
4	Polydrug use	.112*	.083*	.445**	1	.004	.042	.138**
5	Mood disorder[b]	.082*	-.042	.011	.004	1	.028	.027
6	Problems related to social environment	-.080	.011	-.006	.042	.028	1	-.060
7	Marital Status	.080*	.101*	.093*	.138**	.027	-.060	1

*significant at an alpha-level of p >0.05; **significant at an alpha-level of p > 0.01; [a] readmission to detox at Tactus within the research period; [b] assessed with MATE 2.1 (DSM,4th edition)

Regression Analysis

A logistic regression analysis was conducted to predict readmission to detox using heroin dependence, cocaine dependence, polydrug use, mood disorders, problems related to the social environment and marital status as predictors. By using stepwise backward elimination, it was tested whether any of the predictors could be removed without significantly affecting the model fit. One non-significant predictor was removed at each step, starting with the one that had the least impact on how well the model fit the data. Three models were automatically produced. As table 4 shows, cocaine dependence was removed at step 2 and marital status was removed at step three. The optimal predictive model, after excluding non-significant predictors, consisted of heroin addiction (β=.888, p<.001), polydrug use (β=.519, p=0.011), mood disorders (β=.778, p=0.029) and problems related to the social environment (β=.446, p=0.033). Logistic regression analysis showed that heroin addiction was the strongest predictor of readmission. The 'odds ratio' of the heroin coefficient was 2.429 with a 95 % confidence interval of [1.282,4.601]. This suggests that heroin users were more than two times more likely to be readmitted to detox than clients without heroin addiction. The second best predictor was polydrug use with an odds ratio of 1.680 and a 95% confidence interval of [1.129-2.501]. Readmission risk was almost twofold as high for polydrug users, in comparison with single drug users. The 'odds ratio' for clients with a mood disorder was 2.177 with a 95% confidence interval of [1.085, 4.376.]. The least strong predictor was problems related to the social environment with an odds ratio of 1.562 and a 95% confidence interval of [1.035-2.357]. That indicates that clients who reported problems in their social environment were more than 1.5 times more likely to be readmitted to detox, in comparison to

clients who did not have problems in their social environment. The overall model was significant at the .01 level according to the model chi-square statistic. Overall, 5.3 % of the variance of readmission to detox was explained by these variables ($p<.001$). This is only a small proportion of the variance in the dependent variable which indicates that the predictive power of the model is very low. Based on this, we can conclude that other factors not included in the model are of greater importance with regard to readmission risk.

Table 4- Risk factors identified in logistic regression model on readmission to detox

Predictor Variable	β_b	SE	Wald test	Df	p-value	OR (95% CI)
Step 1						
Heroin addiction	.805	.329	5.972	1	0.015	2.237 (1.173-4.266)
Cocaine addiction	.364	.253	2.069	1	0.150	1.438 (0.877-2.361)
Polydrug use	.332	.229	2.099	1	0.147	1.393 (0.889-2.183)
Mood disorder[a]	.791	.359	4.863	1	0.027	2.206 (1.092-4.457)
Problems related to social environment	.463	.211	4.811	1	0.028	1.588 (1.050-2.401)
Marital status	.429	.276	2.410	1	0.121	1.536 (0.893-2.640)
Step 2						
Heroin addiction	.838	.327	6.587	1	0.010	2.313 (1.219-4.388)
Polydrug use	.476	.205	5.407	1	0.020	1.609 (1.078-2.404)
Mood disorder[a]	.796	.357	4.959	1	0.026	2.217 (1.100-4.467)
Problems related to social environment	.465	.210	4.878	1	0.027	1.592 (1.054-2.404)
Marital status	.436	.276	2.494	1	0.114	1.546 (0.900-2.655)
Step 3						
Heroin addiction	.888	.326	7.417	1	0.006	2.429 (1.282-4.601)
Polydrug use	.519	.203	6.534	1	0.011	1.680 (1.129-2.501)
Mood disorder	.778	.355	4.791	1	0.029	2.177 (1.085-4.367)
Problems related to social environment	.446	.210	4.521	1	0.033	1.562 (1.035-2.357)

[a] assessed with MATE 2.1 (DSM,4th edition); Model 1: Nagelkerke R^2=.063, Model 2:Nagelkerke R^2=.058, Model 3: Nagelkerke R^2=.053

Moderation Analysis

Table 4 gives an overview of significant interaction effects and those with a trend toward significance between predictors and readmission. In this text, we only report significant

effects. The strongest interaction effect was found for heroin addiction and cocaine addiction. Heroin users who co-used cocaine were more than 4.5 times as often readmitted than heroin addicts without cocaine dependence [OR=4.474, 1.478-13.541]. The 'odds ratio' for cannabis dependence and mood disorders was 3.672 with a 95% confidence interval of [1.024-13.174]. In other words, readmission risk for cannabis addicts with a comorbid mood disorder was more than three times higher than for cannabis addicts without a co-morbid mood disorder.

Table 5- Moderation effects on readmission to detox

Predictor Variables	β[b]	SE	Wald test	Df	p-value	OR (95%CI)
Heroin addiction*cocaine addiction	1.498	.565	7.030	1	0.008	4.474 (1.478-13.541)
Mood disorders[b]*cannabis addiction	1.301	.652	3.984	1	0.046	3.672 (1.024-13.174)
Mood disorders*alcohol addiction	.736	.420	3.076	1	0.079	2.088 (0.917-4.753)

Dependent variable: readmission to detox at Tactus within the research period; [a] Depression Anxiety Stress Scale-21 item depression scale [b] assessed with MATE 2.1 (DSM,4th edition)

Discussion

The aim of this study was to investigate factors that would predict relapse which was defined as readmission to detoxification treatment. We were particularly interested in the role of co-morbid disorders. In addition, we examined demographic factors, substance related factors and social- and environmental problems.

Almost 1/3 of the clients who participated in detox within the research period were readmitted. Of all co-morbid disorders that were taken into the analysis, only the presence of a mood disorder predicted an increased risk of readmission. Especially cannabis users with a co-morbid mood disorder displayed a higher risk of readmission. However, as it turned out, other substance related factors were more predictive of readmission than the occurrence of co-morbid disorders. First, heroin addicts were at the highest readmission risk. Secondly, polydrug users and clients with cocaine dependence were significantly more often readmitted to detoxification treatment than clients with other substance related addictions. Finally, clients

who reported psycho-social and environmental problems could be identified as an at-risk group.

Eventually, a high number of clients were readmitted to detoxification treatment. The results of the regression analysis revealed that the included predictors could only explain a small proportion of the variance in our dependent variable. This suggests that other factors, not included in the current study might be of greater importance to the evaluation of the readmission risk. In the following section, we will discuss the results in more detail.

Co-morbid disorders

Mood disorders
Clients with co-morbid mood disorders were more often readmitted to detoxification treatment than clients without this diagnosis. This is in line with our hypothesis. Especially cannabis users with a co-morbid mood disorder displayed a higher relapse risk than cannabis addicts without co-morbid mood disorders. According to the best of our knowledge, there is no support for this finding in the literature yet. In addition, there was a trend for alcohol dependence and mood disorders. Some studies support this finding, suggesting that alcoholics with co-morbid mood disorders have a higher readmission risk (e.g Bradizza, Stasiewicz, & Paas, 2006). However, the prevalence rates of mood disorders in this sample was remarkably low with only 5.9 percent. Quello, Brady and Sonne (2005) found that among treatment seeking alcoholics 20-67 percent were diagnosed with a mood disorder. It seems reasonable to believe that mood disorders were underdetected in this study. In addition, we merged all kinds of mood disorders into one variable, because the subgroups were too small to be taken into analysis. This might have affected the results, since some mood disorders (e.g. bipolar disorder) are more prevalent in substance dependent clients than others (Bradizza, Stasi and Paas, 2006). This might also explain why mood disorders were predictive of readmission, but depressive symptoms were not.

Depressive Symptoms
Depressive symptoms after detox were not associated with readmission risk. This in not in line with our hypothesis. Several studies revealed that depressive symptoms after a period of abstinence were predictive of relapse (e.g. Quello, Brady & Sonne, 2005; Bradizza, Stasiewicz & Paas, 2006). Bradizza, Stasiewicz and Paas (2006) pointed out that inappropriate timing of assessment was a frequently occurring problem within studies that found no relationship between depressive symptoms and relapse. In this study, however, depressive symptomatology was monitored at different times. For depressive symptoms

before detox the scores closest to the beginning of the first detox were used in the analysis. For depressive symptoms after detox scores that were closest to client's second detox were used. Therefore inappropriate timing of assessment of depressive symptoms can be ruled out as an explanation for our findings. However, in almost 1/3 of the clients who were readmitted for a second detoxification treatment depressive symptomatology was either not assessed or not recorded in the data set which seems to be the most plausible explanation for our findings.

Personality disorders

Personality disorders were not associated with an enhanced risk of readmission. The literature we based these hypotheses on was related to prevalence rates of co-morbidity and to relapse rather than to readmission to detox. Therefore we cannot conclude that clients with PD's did not relapse to substance use more often than clients without PD's. Perhaps clients with such disorders were just less likely to readmit themselves to detoxification after they had relapsed to substance use. Bender (2005) proposed that building up a stable work alliance is more difficult in clients with various types of PD's.

Especially clients with narcistic and anti-social PD's are described as a difficult to treat population. They generally engage themselves much less in therapy and if they do problems in building up a relationship with the therapist are very common. However, another possible explanation for our finding is that for most clients the diagnosis of a PD was delayed, meaning they had never been assessed for PD. In this study only 20.8 percent of the clients were diagnosed with a PD. Prevalence rates in the literature suggest that this rate is usually higher in substance dependent individuals. In addition, we created one variable for all kinds of PD which might have caused problems, because some PD's such as anti-social are more prevalent among substance abusers than others. In sum, if the subgroup for co-morbid PD had been larger the association with readmission might have turned out to be significant.

Attention deficit disorders

Clients with ADHD were not readmitted more often than clients without ADHD. This is not in line with our hypothesis. Most studies examined substance use disorders in clients with ADHD and proposed that clients with this type of disorder were more likely to abuse substances and to relapse to substance abuse due to their impulsive behavior. In addition, ADHD is associated with poorer decision making. One possible explanation could be the small number of clients in this subgroup. In a larger sample the association between ADHD and readmission could turn out significant. However, it is difficult to conclude that ADHD is underrepresented in this sample, because of the lack of comparable studies. Different studies

have shown that substance dependence is common among people with ADHD, but according to the best of our knowledge, there are no studies that examined the prevalence of ADHD in a population of substance dependence.

Substance Use Behavior

Heroin addicts could be identified as the group with the highest risk of readmission, closely followed by polydrug users and cocaine addicts. We presumed that heroin users and alcoholics would be more often readmitted. The results of this study, could confirm the hypothesis regarding heroin addiction only. One recent study particularly concerned with the prediction of readmission to detox also found that heroin addicts were more frequently readmitted to detoxification than clients with any other substance dependence (Spear, 2014). This might be explained by the fact that heroin is the most physically addicting substance. Alcohol addiction might not be associated with an increased readmission risk, because it is less physically addicting and even after relapse clients with alcohol dependence might not always need to be readmitted to detox. As hypothesized, polydrug users were more often readmitted than single substance users. This is is line with the research on this topic (e.g. Stinson et al., 2005). In addition, the results of this study confirmed the hypothesis that heroin users who co-use cocaine would have a higher readmission risk than heroin addicts who co-use any other substance. This is in line with results from a study conducted by Downey, Herlmus and Schuster (2000) who found that the co-use of cocaine was associated with higher relapse rates in heroin dependent polydrug abusers.

Demographic Factors

We found an association between being married/ living together with a partner and readmission, this association did not turn out to be significant when other variables were controlled for. This is not in line with our hypothesis and with research on this topic. Walitzer and Dearing (2006) proposed that having a partner is a protective factor against relapse. Having a partner might be associated with more social support and serve as a stress -buffering system making an individual more capable of maintaining abstinence. However, the group of married clients was very small when compared to the group of clients who were not married or living together with a partner. In a sample with a larger subgroup of married/living together with a partner this effect might be significant.

Psycho-social and Environmental Problems

Only problems related to the social environment were predictive of readmission. Clients with problems related to the social environment were more often readmitted to detox than clients

without such problems. This is in line with our hypothesis. It seems reasonable to believe that problems related to the social environment are associated with less (perceived) social support and social support is supposed to be a protective factor against relapse.

Strengths and Limitations

The present study had various strengths and weaknesses. There was only little information in the literature on factors associated with readmission particularly to detoxification. Most studies were concerned with readmission to various kinds of treatment or with relapse in general. Relapse was defined quite differently across studies making it impossible to compare results. Our hypotheses were mainly based on research on relapse in its broad sense. Relapse and readmission to detoxification are hardly the same thing. Several factors could influence whether a client who had relapsed would readmit him- or herself to detoxification again. Clients with personality disorders, for example, are generally believed to engage in therapy less often than clients with co-morbid axis 1 disorders (Benda and Donna, 2005). Moreover clients with other addictions than heroin and cocaine may have relapsed just as often, but because symptoms of withdrawal are not as severe in these clients, they may have not returned to detoxification for that reason.

Some subgroups were conspicuously small in this sample. Personality disorders were not directly assessed by staff from Tactus resulting in delayed diagnoses for most clients. Only if clients were diagnosed as having a PD or were diagnosed as having no PD by another psychiatric facility, this information was included in the client chart.

In addition, for many clients depressive symptoms before and/or after detox were not measured or not recorded in the data set. Therefore, it is conjecturable that assessment of depressive symptoms and co-morbid disorders was not accurately performed by staff from Tactus. Another explanation could be that documentation of these disorders was incomplete or unrecorded. The latter is a disadvantage of many medical record studies. Pan et al., (2005) state that there is a high variance in the quality of information recorded by medical professionals. Although, we had a large sample (n=610) which usually produces a high reliability, missing information lowered the reliability of the results tremendously making it difficult to generalize results to clinical practice. The advantage of this study's design was that data were gathered in a 'real life setting' and not for research purposes. For that reason, we were not confronted with the typical biases most other study designs are faced with. Clients were not manipulated in any way leading to good external validity.

Another limitation was that the method of statistical analysis made it impossible to establish cause and effect relationships. We used stepwise backward elimination method to find the best set of predictors. This technique is recommended for explorative research. However, other researchers who have used this technique argue that the usual .05 criterion for statistical significance is too low and the risk of failing to find a relationship when one exists is high. Considering the fact that predictors in our model were only able to explain a small proportion of the variance in readmission, it seems reasonable to believe that many relationships remained uncovered. Despite the explorative nature of this study, we decided to formulate hypotheses with regard to several variables and their relationship to readmission in advance. This might have affected the results negatively, because stepwise techniques in logistic regression are not suitable for hypotheses or testing. Menard (2009) argued that the use of computer-controlled stepwise procedures to select variables is inappropriate for theory testing, because it capitalizes on random variation in the data and produces results that are difficult to replicate in any other sample. However, we decided to use this procedure, because only few studies examined factors associated with readmission to detox and we were concerned with theory construction rather than with theory testing. Another point of critique is that we conducted a moderation analysis for each interaction term separately, instead of taking all interactions into the main regression analysis. We decided to do that to reduce the models complexity. As a result, in our moderation analysis other variables were not controlled for. For that reason, results in this section should be interpreted carefully and might be difficult to replicate.

Recommendations

Most importantly, we recommend more accurate assessment of co-morbid disorders or a more accurate recording of these. Because assessment of PD's might be difficult to realize in the context of detoxification, we recommend to measure personality traits instead. Literature on this topic revealed that personality traits are associated with relapse and give insight into specific cognitions which should be addressed in treatment (Bradizza, Stasiewicz, & Paas, 2006). We were able to identify a number of risk factors associated with a readmission to the detox department. We recommend to take each of these factors into account when evaluating a client's risk of readmission. Special attention should be drawn to heroin addicts, polydrug users- and cocaine dependent clients. Particularly, heroin addicts who co-use cocaine are at a high risk of getting readmitted to detoxification. We found some evidence that participation in

methadone substitution programs may help heroin dependent clients to maintain abstinent. However, such substitution programs seem to have more positive influence on heroin intake, than on cocaine use. The risk of drug habit shifting is embedded in this complex problem. Because detoxification programs can hardly help clients to solve all these problems, long-term therapy might be advised especially in this group. In his book *'Treating Substance Use Disorders with Adaptive Continuing Care'* James R. McKay (2009) points out several factors associated with more effective disease management in the sector of substance use related disorders. Factors such as longer interventions, active efforts to reach and retain clients, the use of incentives and the linkage to other sources of support in the community do matter in the improvement of addiction care. Most importantly, it is crucial to realize that substance use disorders are chronic in nature and with regard to course and outcome comparable to physical chronic health problems such as diabetes. Adaptive continuing care is believed to reduce the need for acute care episodes like detoxification treatments and can help reduce high readmission rates. During detox treatment, clients can be motivated to participate in these programs for example by using motivational interviewing techniques. Moreover, special attention should be drawn to clients with mood disorders, particularly when those clients use cannabis or alcohol. Eventually, clients with problems related to the social environment were identified as a risk group. Lack of social support may be an underlying cause. Clients could be motivated to participate in several programs including self-help groups to gain more social contact and support.

Future Directions

In this study, we focused on several personal-level factors which were possibly associated with an increased risk of readmission to detoxification. Nevertheless, future research should take program-level factors into account, too. Studies on program-level factors reveal that continuity of service between detox and subsequent addiction treatment is an important factor in reducing readmission rates to detox (Campell et al.,2010). However, according to some studies only 20-50 percent of clients receive post-detoxification service (Chutuape et al., 2001). A recent study examined the influence of interorganizational networks on detox readmissions (Spear, 2014). According to the results network efficiency was associated with lower odds for readmission to detox. The interorganizational context in which detox programs operate may be important for improving continuity of service within addiction care facility systems. Relapse often occurs within the first few months after treatment. Post-detoxification treatment should therefore take place as soon as possible after discharge from detox. Further

research is also needed to examine how many dual-diagnosis clients who participated in a detox programs actually were transferred to subsequent treatment programs. A study conducted by Wamel and Neven (2015) in the Netherlands showed that integrated care for dual-diagnosis clients is still in the fledgling stage. Clients are often tossed back and forth between addiction care facilities and psychiatric care institutions. For future research, we recommend to further investigate program-level factors and the impact of the structure of interorganizational networks on detox readmission.

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