Title: Factors associated with ongoing criminal engagement while in Opioid Maintenance Treatment

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Abstract

Introduction: This study examines factors associated with criminal engagement among patients in opioid maintenance treatment (OMT).

Methods: Questionnaire data recorded annually among 5 654 patients in the Norwegian OMT programme between 2005 and 2010 from seven regional treatment centres were available for analyses. Each patient answered approximately 4 times (mean: 4.11, SD: 1.46) generating a total of 18 538 questionnaires. The outcome variable of the study, engagement in criminal activity, was defined as whether a patient had been arrested, put in custody, been charged and/or convicted of a crime within the last 12 months prior to the completion of the questionnaire. Three types of covariates were included: demographical, psychosocial and drug use-related. Missing data were imputed using Multivariate Imputation by Chained Equations and regression parameters were estimated by Generalized Estimation Equations to account for correlated measurements.

Results: Having a full-time job (aOR: 0.47, CI: 0.34-0.64) or being a student/having a part-time job (aOR: 0.72, CI: 0.59-0.88) was negatively associated with ongoing criminal involvement, as did having a stable living situation (aOR: 0.70, CI: 0.57-0.87). On the other hand, being male (aOR: 1.83, CI: 1.59-2.10), younger (aOR: 0.96, CI: 0.95-0.97) and using illicit drugs regularly (aOR: 3.00, CI: 2.56-3.52) was positively associated with ongoing criminal activity while in OMT.

Conclusions: Stable accommodation and participation in meaningful daily activity was found to be protective in terms of ongoing criminal engagement. Focus on these modifiable, psychosocial factors should therefore be an important and integral aspect of opioid maintenance treatment.

Keywords: Maintenance Treatment; Crime; Psychosocial rehabilitation; Opioids

1. Introduction

The association between substance use disorders and elevated levels of crime has been established through extensive research (Bennett, Holloway, & Farrington, 2008). More specifically heroin use disorders have been strongly associated with criminal engagement (Bukten et al., 2011b; Marel et al., 2013). Despite extensive research in the field, the way substance use disorders and crime are connected is still unclear: drug use may cause crime, crime may cause drug use or drug use and may be linked through a third variable (Bennett & Edwards, 2015), illustrating the complexity of the topic. In addition, the use of opioids itself, is defined as an illegal behaviour in many countries, complicating the picture further.

Opioid Maintenance Treatment (OMT) is the most widely used treatment for opioid use disorders and harms related to opioid use, such as criminal engagement (EMCDDA, 2012; SAMHSA, 2014; WHO, 2009). OMT has been expansively evaluated during the past decades and has been found to be effective in reduction of opioid use (Ball & Ross, 1991; Mattick, Breen, Kimber, & Davoli, 2009), mortality (Bell, Butler, Lawrance, Batey, & Salmelainen, 2009; Clausen, Anchersen, & Waal, 2008; Degenhardt et al., 2011) and criminal engagement (Bukten et al., 2012; Gossop, Marsden, Stewart, & Rolfe, 2000; Lind, Chen, Weatherburn, & Mattick, 2005; Marsch, 1998).

However, not all patients receiving OMT are prone to reduce or totally abandon criminal engagement. Research has shown that a subgroup of patients in OMT persists with criminal behaviour (Bukten et al., 2012; Sidwell, Best, & Strang, 1999), and that characteristics such as being younger, male, continuation of drug use during treatment and having poor treatment retention is linked to continued criminal engagement (Ball & Ross, 1991; Teesson et al., 2008). Traditionally, treatment research in the addiction field has focused mainly on the reduction of drug consumption and the need for an alternative focus has been highlighted (Tiffany, Friedman, Greenfield, Hasin, & Jackson, 2012).

With the large financial consequences for society, in addition to the damage crime causes its victims, the identification of new factors associated with continued criminal behaviour while in OMT is important, as these factors may be modifiable. In addition, finding such factors is vital to improving the long-term outcomes of OMT.

Because of the high number of patients participating in this study, we are able to include a range of covariates and therefore simultaneously analyse different factors potentially associated with criminal behaviour. The main objective of the paper is to investigate a wide variety of factors potentially associated with ongoing criminal activity among patients in the Norwegian OMT programme during the years 2005-2010. The factors are divided into three groups: demographic, psychosocial and drug use-related.

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2. Materials and methods

The data available for this study was collected in a six-year period (2005-2010) as part of an annual monitoring of the Norwegian OMT programme. Every year between October and December a questionnaire is filled out for all patients who have been part of the programme during the year. The person who had the closest clinical contact with the patient filled out the questionnaire and staff were encouraged to discuss the questions with the patients before completing the questionnaire.

2.1 Setting

The Norwegian OMT programme was initiated in 1998 as an optional treatment for persons with opioid use disorders whom had no benefit from other types of treatment (Waal, 2007) and it has since been integrated into the general health and social security system and has expanded significantly (Skretting & Rosenqvist, 2010). Studies have shown large differences between the regional OMT centres in Norway (Bukten et al., 2011a; Gjersing, Waal, Røislien, Gossop, & Clausen, 2011). The questionnaire used in this study was developed to monitor the current status of OMT patients and includes questions regarding the patients' current situation (treatment status, employment, and housing), treatment information (type of medication, medication dose, by whom it is prescribed, and use of urine testing), psychological situation, and substance use behaviours (frequency of drug and alcohol use during the previous 30 days and the last year) (Riksheim, Gossop, & Clausen, 2014).

2.2 Study sample and follow-up

Patient data from seven regional treatment centres covering 14 out of 19 counties in Norway, collected in a six-year period (2005-2010) were available for analysis. All patients were opioid dependent persons currently receiving OMT. The counties included constitute approximately 85% of the national patient population. The response rate varied between 74.3% and 83.1% (mean: 77.1%, SD: 3.1%) resulting in 18 538 questionnaires collected from 5 654 unique patients. Since the data were collected for all patients having received treatment during the last year, newly recruited patients were included in the study, making it an *open cohort*. This approach introduces correlations between some of the observations by design, and care must be taken when choosing the statistical methods for analysis.

2.3 Measures

The outcome variable, engagement in criminal activity, was defined as whether the patient had been arrested, put in custody, been charged, and/or convicted of a crime within the last 12 months prior to the completion of the questionnaire, either self-reported by the patient or known to the staff. Thirteen relevant covariates from the questionnaire were included in the analysis and further divided into three types of factors: demographical, psychosocial and drug use-related.

Demographical factors included age as a continuous measurement, gender, substitution medication and regional treatment centre. In addition, the number of times per week the patient was supervised when consuming the OMT medication was included. Type of substitution medication received by the patient was divided into two groups; methadone or buprenorphine, where buprenorphine indicated either Subutex or Suboxone. The regional treatment centre was included to adjust for any potential centre effect.

The psychosocial factors were living arrangement and occupation. The patients living arrangements were divided into four categories: no or temporary accommodation (shelters, hotels etc.), in an institution, a stable living arrangement (owned/rented apartment etc.) and other (living with friends/family, being in prison etc.). Occupation was categorized as having no occupation, having a full-time job or having a part time job/being a student.

The drug use-related factors were defined as illegal use of stimulants, cannabis, and non-prescribed use of opioids and benzodiazepines. In addition, alcohol use to the level of intoxication was included. Drug use-related variables were assessed by self-reporting and/or through urine testing and reported as one or more incidents of drug-use during the last 30 days.

2.4 Missing data

18 538 questionnaires were available for analysis of which 12 282 (66.3%) were complete. 3 091 (16.7%) of the questionnaires had only one missing value and 3 165 (17.1%) had two or more missing values. Both the outcome and covariates had missing values. The missing data had a non-monotone pattern and was assumed to be Missing At Random (MAR) (Graham, 2009; Schafer & Graham, 2002).

2.5 Statistical analyses

Descriptive statistics for each year were presented as counts and percentages. Generalized Estimation Equations (GEE) (Liang & Zeger, 1986) with the log link function for binary outcome data was used to estimate univariate, multivariate and a reduced model with adjusted odds ratios (aORs) and 95% confidence intervals (CIs) for the association between criminal activity and the included covariates. GEE is a population average model which accounts for the potential correlation of measures by noting that data are clustered within each patient (Hanley, Negassa, & Forrester, 2003). GEE models have been found to provide a useful approximation of the truth when assessing associations between different factors in epidemiology research (Hubbard et al., 2010). A final reduced model, including only covariates that contributed significantly to the model, was based on quasi-likelihood under the independence model criterion (QIC) (Cui, 2007).

To reduce the potential bias of missing data we used Multiple Imputation to pre-process data before applying GEE (2008). In this study we used Multivariate Imputation by Chained Equations (MICE)

(Buuren & Groothuis-Oudshoorn, 2011). MICE is a flexible multiple imputation tool for handling both missing response and covariate data under the Missing at Random (MAR) assumption. It has been shown that MICE in combination with GEE gives unbiased parameter estimates (Jolani & van Buuren, 2014). 10 imputations were performed and combined using Rubin's rule; estimated parameters from all complete data sets are pooled giving a measurement of variation within and between the imputed data sets.

All analysis were performed using R 3.1.2 (R, 2014). The GEE was fitted using the function `glmgee` from the package `geepack` (Halekoh, Højsgaard, & Yan, 2006). An exchangeable covariance matrix was used. Year was used in the `waves` argument and ID as cluster-component. MICE was employed using the function `mice` and the prediction matrix was automatically generated using the `quickpred` function in the R package `mice` (Buuren & Groothuis-Oudshoorn, 2011).

2.6 Ethics
The study was approved by the Regional Committees for Medical and Health Research Ethics. No individuals can be identified through the presented data.

3. Results

3.1 Patient characteristics

The study population consisted of 5 654 persons with an average of 4.11 (SD: 1.46) questionnaires per person in 18 538 questionnaires. Descriptive statistics and patient flow per year is displayed in Table 1. In 2005, 1 943 questionnaires were available for analysis; 1 436 (73.9%) of the same patients responded the following year. The number of respondents increased during the study period, and in 2010 a total of 3 941 questionnaires were collected. The percentage of patients responding for at least two consecutive years also increased; 80.6% of the patients responding in 2010 had also completed the questionnaire in 2009. 20.2% of the patients responded only once, between 15% and 20% responded 2, 3, 4 or 5 times and 9.7% of the patients responded all six years. The proportion of men was relatively stable during the study period, ranging from 68.9% to 70.9%, while the mean age increased from 39.9 (SD: 7.3) in 2005 to 41.9 (SD: 8.5) in 2010.

Table 1. Descriptive statistics per year of the n=18 538 questionnaires in the study period 2005-2010.

	2005	2006	2007	2008	2009	2010	**Total**
Number of responses	1943	2834	2944	3243	3633	3941	**18538**
Number of consecutive responses	-	1436	2087	2281	2633	2934	
Percentage of consecutive responses	-	73.9	73.6	77.5	81.1	80.6	
Percentage of men	69.2	68.9	69.7	70.1	70.0	70.9	**69.9**
Mean age (SD)	39.9 (7.3)	40.1 (7.4)	40.6 (7.6)	41.1 (7.9)	41.3 (8.1)	41.9 (8.5)	**41.0 (7.9)**

3.2 Factors associated with ongoing criminal activity

A total of 2 132 questionnaires (1 485 individuals) had a positive response to the question relating ongoing criminal activity and some individuals had more than one positive response: 312 individuals had two positive responses, 98 had three, 40 had four and 5 persons had participated in criminal activity in all five years. Results from the regression analysis are summarized in Table 2 and below.

3.2.1 Demographic variables

Older patients had less engagement in criminal activity (aOR: 0.96, CI: 0.95-0.97) while being male increased the risk by approximately 80% (aOR: 1.83, CI: 1.59-2.10). There was an increased risk of criminal engagement in the group of patients who received buprenorphine compared to the patients on methadone (aOR: 1.20, CI: 1.07-1.35) and supervised consumption of OMT medication was positively associated with engagement in criminal activity with an aOR of 1.15 (CI: 1.12-1.18) per extra day of supervised intake. There were also regional differences: patients belonging to regions other than Midt had a higher risk of ongoing criminal activity compared to patients in region Bergen. See Table 2.

Table 2. Results of univariate, multivariate and reduced Generalized Estimation Equations models of n=18 538 questionnaires in the study period 2005-2010.

Risk Factor	Univariate models OR (95% CI)		Multivariate model aOR (95% CI)		Reduced model aOR (95% CI)	
Demographic variables						
Age (continuous)	0.95	(0.94-0.96)	0.96	(0.95-0.96)	0.96	(0.95-0.97)
Gender: Female (ref)	-		-		-	
Male	1.89	(1.65-2.16)	1.84	(1.60-2.11)	1.83	(1.59-2.10)
OMT medication: Methadone (ref)	-		-		-	
Buprenorphine	1.24	(1.11-1.39)	1.20	(1.07-1.35)	1.20	(1.07-1.35)
Supervised intake: times per week	1.31	(1.28-1.34)	1.15	(1.12-1.18)	1.15	(1.12-1.18)
Centre: Bergen (ref)	-		-		-	
Buskerud	0.77	(0.56-1.06)	1.16	(0.84-1.60)	1.16	(0.84-1.60)
Midt	0.56	(0.43-0.73)	0.83	(0.64-1.09)	0.83	(0.64-1.09)
Oest	1.06	(0.89-1.26)	1.43	(1.19-1.72)	1.42	(1.19-1.70)
Telemark	1.46	(1.14-1.88)	1.51	(1.18-1.94)	1.51	(1.17-1.94)
Vestagder	1.57	(1.24-1.99)	1.83	(1.44-2.33)	1.83	(1.43-2.33)
Vestfold	1.19	(0.90-1.58)	1.34	(1.01-1.77)	1.34	(1.01-1.78)
Psychosocial variables						
Occupation: None (ref)	-		-		-	
Full time work	0.22	(0.16-0.29)	0.47	(0.34-0.64)	0.47	(0.34-0.64)
Part-time work/study	0.44	(0.38-0.52)	0.72	(0.59-0.88)	0.72	(0.59-0.88)
Living arrangement: No/temp (ref)	-		-		-	
Institution	0.62	(0.49-0.78)	0.81	(0.63-1.04)	0.81	(0.63-1.05)
Stable living	0.37	(0.31-0.45)	0.70	(0.57-0.87)	0.70	(0.57-0.87)
Other	1.15	(0.93-1.41)	1.63	(1.31-2.04)	1.64	(1.31-2.04)
Drug use-related variables						
Opioids: No (ref)	-		-		-	
Yes	1.78	(1.57-2.01)	0.97	(0.84-1.12)		
Cannabis: No (ref)	-		-		-	
Yes	1.91	(1.73-2.11)	0.92	(0.82-1.04)		
Benzodiazepines: No (ref)	-		-		-	
Yes	2.11	(1.91-2.33)	1.04	(0.90-1.20)		
Stimulants: No (ref)	-		-		-	
Yes	2.89	(2.57-3.24)	1.65	(1.45-1.89)	1.64	(1.44-1.87)
Alcohol: No (ref)	-		-		-	
Yes	1.39	(1.22-1.58)	1.05	(0.91-1.22)		
Drug use (last year): No use (ref)	-		-		-	
Some use	2.35	(2.04-2.72)	1.79	(1.51-2.11)	1.77	(1.51-2.09)
Regular use	5.31	(4.63-6.08)	3.05	(2.56-3.64)	3.00	(2.56-3.52)

OR: Odds Ratio

aOR: adjusted Odds Ratio

3.2.2 Psychosocial variables

Having a full-time job was negatively associated with ongoing criminal engagement (aOR: 0.47, CI: 0.34-0.64), while having a part-time job or study had an aOR of 0.72 (CI: 0.59-0.88). A stable housing arrangement was found to be associated with a reduced engagement in criminal activity by 30% (OR: 0.70, CI: 0.57-087) compared to patients with no or unstable living conditions. Being in an institution did not significantly influence the risk (aOR: 0.81, CI: 0.63-1.05), while having another type of living arrangement was positively associated with being engaged in criminal activity during the past 12 months (aOR: 1.64, CI: 1.31-2.04).

3.2.3 Drug use-related variables

Drug use was found to be a risk factor associated with engagement in criminal activity: compared to patients with no reported drug use during the last 12 months patients who used drugs occasionally had an aOR of 1.77 (CI: 1.51-2.09) and patients who used drugs regularly had an aOR of 3.00 (CI: 2.56-3.52). Using stimulants significantly increased the risk of engaging in criminal activity with an aOR of 1.64 (CI: 1.44-1.87).

4. Discussion

Nearly 26 % (n=1 485) of patients reported engagement in criminal activity during the past 12 months at least one year during the period of 2005-2010. We found several factors associated with criminal activity in the Norwegian OMT patient population: having a job, full-time or part-time, or being a student decreased the risk of criminal involvement, as did having a stable living situation. On the other hand, being male, younger, living in unstable conditions and illicit drug use on a regular basis increased the risk significantly.

While it is generally agreed that OMT reduces criminal activity, some patients continue criminal involvement while in treatment (Bukten et al., 2013; Bukten et al., 2012; Oliver et al., 2010). The amount of criminal engagement reported by the patients in our study is in accordance with results of previous self-reported studies of criminal activity in the OMT population (Teesson et al., 2006). However, it is important to consider that crime levels are often measured by different methods across studies, e.g. self-reported versus recorded crime, which consequently will affect the prevalence reported in each study. Our results indicate that regular use of illicit drugs during OMT, and especially illegal use of stimulants were risk factors for ongoing criminal engagement. This is in accordance with previous studies which have found associations between use of stimulants and criminal behaviour and that frequency of drug use was associated with increased levels of criminal behaviour (Skjærvø, Skurtveit, Clausen, & Bukten, 2016; Stewart, Gossop, Marsden, & Rolfe, 2000). A previous study of the Norwegian OMT population showed that approximately 90% of the stimulants use was amphetamine (Skjærvø et al., 2016).

The finding that having stable living conditions, having a job or being a student was associated with less criminal engagement while in treatment is highly important. Earlier studies have found that the level of social rehabilitation in OMT is associated with improved treatment outcomes, compared to the provision of methadone or buprenorphine alone (Kraft, Rothbard, Hadley, McLellan, & Asch, 1997; McLellan et al., 1993). This fact should not be forgotten in modern-day treatment programs, even though funding schemes are tightened. According to World Health Organization guidelines, pharmacological treatment of opioid dependence should be assisted by psychosocial interventions at the social level, including support with basic needs such as health-care, accommodation and employment (WHO, 2009). Our findings also support earlier studies reporting that employment and stable living conditions, education and employment is associated with being successful in substance use treatment (Huissoud, Rousson, & Dubois-Arber, 2012; Mutter, Ali, Smith, & Strashny, 2015).

In line with previous findings, we find more ongoing criminal activity in some treatment centres (Bukten et al., 2011a). There may be different reasons for this. The Norwegian OMT model is psychosocially oriented (Waal, 2007), however prior reports have found that the degree of

psychosocial rehabilitation differs between treatment centres (Gjersing et al., 2011). It is thus likely that continued criminal activity might be related to programme differences within the national OMT system.

Similar to previous findings, being younger and being male was associated with an increased risk of engagement in criminal behaviour during treatment (Bukten et al., 2012). Conversely, several previous studies have found no effect of gender on criminal activity during treatment (Oliver et al., 2010; Teesson et al., 2006).

4.1 Strengths and limitations

The questionnaires for this study were completed by staff at the regional OMT centres, meaning that both the outcome variable and potential risk factors were filled out by the same person. Most questionnaires were completed after clinical encounters with the patient and in collaboration with the patient, though not all.

Approximately 80% of the patients in any given year have questionnaires filled out as part of the annual surveys. However, a selection, the total response rate is high considered the patient group in question and the high number of questionnaires collected is a great benefit to the study. The study contains a selection of regional treatment centres covering around 85% of the national patient population and results can therefore not be generalized beyond these.

The outcome measurement, engagement in criminal behaviour during the last 12 months includes whether the patient has been arrested, put in custody, been charged and/or convicted of a crime within the last 12 months prior to the completion of the questionnaire, either self-reported by the patient or known to the staff. The measurement is broad and considers a variety of indicators of criminal involvement which is likely to reflect criminal engagement.

4.2 Clinical implications

As OMT provision is expected to be followed by reduced harms related to opioid use, reduced criminal activity during treatment may serve as a proxy for successfulness of treatment. Less engagement in crime while in treatment might contribute to extensive reductions in costs, both for society the victims of crime, as well as individual suffering.

Considering that patients using stimulants during treatment were more engaged in criminal activity, illustrates the importance of both identifying and providing adequate treatment for comorbid substance use disorders during opioid maintenance treatment. As OMT medication mainly reduces the craving for opioids, additional treatment approaches may be needed for patients with polysubstance use in general and stimulant use particularly.

Stable accommodation and participation in meaningful daily activity was found to be protective in terms of criminal activity. Together our findings point towards more social rehabilitation as a success factor for reducing the criminal burden among opioid users engaging in OMT.

Policy makers should be aware that successful outcomes of OMT depend on sufficient resources allowing for appropriate emphasis on psychosocial rehabilitation such as stable housing and participation in meaningful daily activity for patients. The distribution of OMT medications alone does not provide the full benefits as compared to what a combined medical and psychosocial treatment regime may accomplish. This is fully in line with the earliest descriptions of OMT as provided by Dole and Nyswander in 1965 (Dole & Nyswander, 1965).

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