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Is opioid substitution treatment beneficial if injecting behaviour continues?

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Abstract

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Background

Opioid substitution treatment (OST) is recognised as an effective treatment for opioid dependence. Still, a subgroup of OST users continues to inject drugs. This study examines health risks and criminal activity in a population of needle exchange programme (NEP) participants by comparing those identified as current OST users to i) those identified as former OST users and ii) those with no OST experience.

Methods

This was a semi-annual cross-sectional study conducted from 2002 to 2011. NEP participants were interviewed in Oslo, Norway (n=1,760); 341 were identified as current OST users, 356 as former OST users and 1,063 had no OST experience. The associations between OST status and health risk and criminal activity were assessed through univariate and multiple logistic regression analyses.

Results

Among NEP participants, those currently in OST had fewer non-fatal overdoses (OR=0.5 [95% CI 0.3, 0.9]) compared to former OST users and those never in OST. Additionally, they were less likely to have injected frequently (OR=0.4 [95% CI 0.3, 0.6]), to have used heroin daily or almost daily (OR=0.3 [95% CI 0.2, 0.4]), and to have committed theft (OR=0.6 [95% CI 0.4, 1.0]) and engaged in drug dealing (OR=0.7 [95% CI 0.5, 0.9]) in the past month. Overall, there was a high level of polysubstance use and no group differences on this measure.

Conclusions

NEP participants who are currently in OST have substantially reduced health risks and criminal activity than other NEP participants. The high level of polysubstance use nevertheless poses a public health challenge.

Key words: Opioid substitution treatment, drug user, injecting drug user, needle-exchange programmes, overdose, crime

1. INTRODUCTION

Some injecting drug users (IDU) in opioid substitution treatment (OST) inject while in treatment (Judson et al., 2010; Li et al., 2012), and consequently, continue to use needle exchange programmes (NEP) services (Gervasoni et al., 2012; Kerr et al., 2005). Continued drug use is cited as evidence of the failure of OST (Gyngell, 2011), and it is one of the reasons why the UK government, since 2010, has moved towards a drug strategy that emphasises rehabilitation with the aim of abstinence rather than OST (UK Government, 2010). This move has caused considerable debate around the benefits and cost effectiveness of OST (O'Hara, 2012). A rise in methadone-related deaths in Scotland in 2012 (National Statistics Scotland, 2012) has sparked the debate further (Christie, 2012; Spence, 2012).

OST has been found to benefit both IDUs and the general population by reducing health risks associated with injection drug use and criminal activity (Ball and Ross, 1991; MacArthur et al., 2012). There are documented effects on the reduction of morbidity and mortality risk also among those who continue to use drugs while in treatment (Gervasoni et al., 2012; Kerr et al., 2005; Kidorf et al., 2011; Millson et al., 2007). Many of these studies have recruited subjects that are willing and able to participate in specific interventions and follow-up evaluations (Kidorf et al., 2011; Van Ameijden et al., 1999). They may therefore not have included those who are unable to attend follow-up evaluations.

Thus, there is a need for a comparative assessment of health risks and criminal activity among OST users who continue to inject drugs. One question of substantial political interest is whether OST users who continue to inject drugs benefit sufficiently from treatment to defend the cost of treatment provision. This study examines health risks and criminal activity in a

population of NEP participants by comparing those identified as current OST users to i) those identified as former OST users and ii) those with no OST experience.

2. METHODS

2.1 A brief introduction to the Norwegian NEP and OST programme

Norway has approximately 5 million inhabitants and about 600,000 live in the capital, Oslo (Statistics Norway, 2012). The majority of heroin and amphetamine users inject and there is an estimated 8,700 to 12,300 IDUs (predominantly opioids), where approximately 3,000 of them live in the capital (Bretteville-Jensen and Amundsen, 2009). NEP was established in 1988, and it is part of the low threshold services provided by the city of Oslo. Annually, between 1.2 and 2 million syringes are distributed in Oslo (Norwegian Institute for Alcohol and Drug Research, 2012). The majority of needles and syringes are distributed from the only NEP facility in the city, but clean needles and syringes are also available from other low threshold services such as shelters, street clinics and the injection room. Over the study period, the mean annual number of individual visits to the NEP facility was 96,000.

OST became nationally available in Norway in 1998, as part of public health care services. In Norway, OST is only available through a public specialised health care programme (Waal, 2007). At the end of 2012, there were 6,640 OST users nationally (Waal et al., 2012).

Treatment initiation is the responsibility of a regional OST centre, but after the initial phase, a GP may act as the prescribing doctor under supervision by the centre (Gjersing et al., 2011).

Buprenorphine has been available since 2001, and in 2011 49% of OST patients were prescribed buprenorphine (Waal et al., 2012). The average dose was 103 mg for methadone and 18 mg for buprenorphine in 2011 (op.cit).

2.2 Design

Data was drawn from a semi-annual cross-sectional study conducted outdoors, outside the only NEP facility in the city centre of Oslo. The study has been conducted by The Norwegian

Institute for Alcohol and Drug Research since 1993 and interview sessions are held each year in March and September. The study operates independently from the NEP facility, but management and staff are familiar with the purpose of the study and they are notified in advance of which days data will be collected. Relevant variables were included into the study instrument from 2002, thus this study used data collected between 2002 and 2011.

2.3 Participants and recruitment

Participants collected injecting equipment from the NEP facility before they were approached. The inclusion criterion was to have injected at least once in the previous four weeks. However, since stimulant drug users who do not use heroin are not eligible for OST treatment, only those with heroin experience were included.

Researchers and trained research assistants from The Norwegian Institute for Alcohol and Drug Research recruit and interview participants during the facility's opening hours two or three weeknights within a month. The interview takes approximately 15 minutes to complete, and is conducted out of earshot from others. The respondents do not receive any monetary incentive for participation. Those who are too intoxicated are not approached. Among those who decline to participate, the most common reasons for refusal are that they do not have time or are experiencing withdrawal symptoms. No names or other personal information were collected. Those who were interviewed within the same month were excluded.

The study sample was divided into three groups based on their OST status at the time of the interview. The three groups were "OST users" who were currently in OST, "former OST users" who had been OST users in the past and "never OST users" who did not have any OST experience. Since 2002, there has been a steady increase in subjects who report that they are currently in OST or have been in the past.

2.4 Measures

The study instrument comprised detailed questions of participants' nationality, education, current living situation, sources of income (including illegal activities), type of substances used, number of injections and amount of drug used in the previous four weeks, and non-fatal overdose experiences in the previous four weeks. The questionnaire is described in more details elsewhere (Bretteville-Jensen and Skretting, 2010). Since 2002, respondents have been asked if they are currently in OST. If they are not currently in OST, they are asked if they have previously been in OST.

Non-fatal overdoses, having injected 100 times or more, daily or almost daily heroin use, and to have used more than one substance in the past month were chosen as outcome measures and indicators for health risks. In the total sample the mean number of injections was 99.8 in the past month, and thus this was set as the cut off for the variable "Injected 100 times or more". This variable reflected the total number of injections from heroin, amphetamine, cocaine, morphine and injections of all types of pills including benzodiazepines. Almost daily heroin use means to have used heroin four to six days a week. Theft and drug dealing committed in the past month were chosen as outcome measures and indicators for criminal activity.

2.5 Ethics

The information collected in this study is anonymous and non-identifiable (no names, date of birth, addresses, names of locations, occupation, etc. are collected). Since no personal information was collected, approval by the Norwegian ethics committee was not required.

2.6 Data analyses

Descriptive statistics and logistic regression analyses were completed using Stata version 12.1. In the univariate and multiple logistic regression analyses odds ratios (OR) with 95% confidence intervals (95% CI) were estimated and the differences between NEP users currently in OST and the two other groups (former and never OST users) were assessed.

In the multiple logistic regression analyses both former and never OST users were included as the reference group. The variables used in the multiple regression models were based upon known risk factors for overdoses, injection frequency, substance use and criminal activity available in the data. These variables were age, gender, length of injecting career, homelessness and shelter use (Bird and Robertson, 2007, Hickman et al., 2007, Loyd-Smith et al., 2008, Nordentoft et al., 2003; Ødegård et al., 2007). Length of injecting career is only known as a risk factor for overdoses (Ødegård et al., 2007), and it was therefore not used in the other multiple regression models. Furthermore, in all multiple regression models the time effect was adjusted for using one year dummy variables, and possible cohort effects were adjusted for using dummy variables for birth decades. In the tables for the multiple logistic regression models, the unadjusted estimates are also presented.

Logistic regression analysis requires observations to be independent. In this study, some subjects may have been interviewed more than once during the study period since all subjects were anonymous. It is also possible that an individual could be in more than one group as the divisions into groups were based on OST status at the time of interview. To address this potential bias, we combined a set of background variables to separate individuals from one interview session to another and deleted possible duplicates prior to running the models. The identifying variables were “gender”, “age”, “educational level”, “age at first injection”, “type of drug at first injection”, “how heroin was used the first time” and “age at first heroin

smoking”¹. From a total number of 1,827 interviews, 67 (4%) cases were removed in the preferred model. In case this procedure did not remove all duplicates, it can further be formally shown that given a relatively low ratio between the number of observations and the population size (which is the case here), estimation results will not be biased².

¹ Please see Appendix 1 for additional analyses using different combinations of variables.

² Please see Appendix 2 for more details.

3. RESULTS

3.1 Characteristics of the sample

In total, 1,760 individuals were interviewed outside the NEP facility between 2002 and 2011; 341 participants were identified as current OST users, 356 as former OST users and 1,063 had no OST experience. The NEP participants currently in OST were the same age as former OST users (37.3 years, SD 7.8 and 37.6 years, SD 8.8, respectively), but two years older than those never in OST (34.6 years, SD 9.1). Those currently in OST were approximately the same age as former OST users when they first injected (18.4 years, SD 5.5 vs. 18.9 years, SD 5.9), whereas they were two years younger than those never in OST (20.3 years, SD 6.8).

The majority (n=1,206) of the full sample were men and there were no gender differences across groups (Table 1). Similarly, two-thirds (n=1,148) had completed more than the mandatory years of education, which are the years children are expected by law to attend school. There were no group differences in educational attainment. Compared to the two other groups, fewer NEP participants currently in OST were homeless or shelter users at the time of the interview (OR=0.4 [95% CI 0.3, 0.5]).

3.2 Health risks

Table 1 shows that NEP participants currently in OST had less health risks compared to former OST users and those never in OST. Fewer (4%) reported non-fatal overdoses in the past month (OR=0.4 [95% CI 0.2, 0.8]). A significantly smaller proportion (27%) had injected 100 times or more in the past month compared to former OST users (56%) and those never in OST (46%) (OR=0.4 [95% CI 0.3, 0.5]). They had on average injected 66.1 times (SD 71.0) in the past month, compared to former OST users who had injected 120.2 times (SD 81.9) and those never in OST 103.7 times [SD 74.1]. Furthermore, fewer (39%) had injected heroin

daily or almost daily in the past month (OR=0.3 [95% CI 0.2, 0.3]), which was half the proportion of former OST users (82%) and also less than those who had never been in OST (67%).

Table 1 also shows that the vast majority of NEP participants in OST (97%) had used more than one substance in the previous month and there were no significant group differences (OR=0.8 [95% CI 0.4, 1.7]). All groups had on average used four different substances (SD 1.3) in the past month. A smaller proportion of those in OST (27%) had injected amphetamine daily or almost daily compared former OST users (32%) and those never in OST (34%) (OR=0.7 [95% CI 0.6, 1.0]). In this study, there were no differences in other substances used, except that a slightly higher proportion of those currently in OST (39%) had used cannabis daily or almost daily compared to 33% of former OST users and 31% of those never in OST (OR=1.4 [95% CI 1.1, 1.8]).

3.3 Crime

A significantly smaller proportion of NEP participants currently in OST had committed theft (7%) (OR=0.5 [95% CI 0.3, 0.8]), and engaged in drug dealing (29%) in the past month (OR=0.6 [95% CI 0.5, 0.8]) (Table1) compared to former OST users and those never in OST.

3.4 Multiple logistic regression analysis

Table 2 shows the unadjusted and adjusted ORs for the health risk indicators. The table shows that NEP participants currently in OST were 50% less likely to have experienced one or more non-fatal overdoses in the past month compared to the two other groups in unadjusted and adjusted analysis (OR=0.5 [95% CI 0.3,0.9]). Those currently in OST were also 60% less likely to have injected 100 times or more in the past month compared to the two other groups (OR=0.4 [95% CI 0.3,0.6]). Furthermore, those currently in OST were 70% less likely to have

used heroin daily or almost daily in the past month in adjusted analysis (OR=0.3 [95% CI 0.2, 0.4]). There were no significant differences between groups in regards to having used more than one substance in the past month (OR=1.0 [95% CI 0.4, 2.2]).

Table 3 shows the unadjusted and adjusted ORs for theft and drug dealing over the previous four weeks. NEP users currently in OST were 40% less likely to have used theft as an income source compared to the two other groups at a 10% significance level (OR=0.6 [0.4, 1.0]).

They were also 30% less likely to have used drug dealing as an income source compared to the two other groups, including adjustment for other factors (OR=0.7 [95% CI 0.5, 0.9]).

4. DISCUSSION

NEP participants who are currently in OST appear to have fewer health risks and impose less harm to the general population through criminal activity than former OST users and those never in OST. Those currently in OST reported fewer non-fatal overdoses, fewer injections, fewer daily or almost daily injections of heroin, and fewer had engaged in theft and drug dealing in the past month compared to the other NEP participants. The sustained high level of polysubstance use nevertheless poses a public health challenge.

Non-fatal overdoses increase the risk of medical complications such as peripheral neuropathy, chest infections and temporary paralysis of limbs (Darke and Hall, 2003a; Warner-Smith et al., 2002). Furthermore, it has been found that the majority of those who die from overdoses have previously experienced several non-fatal overdoses, and it is suggested that non-fatal overdoses may increase the risk for future overdoses (Darke et al., 2003b). Heroin injected in combination with other substances is one of the most common toxicological causes of overdoses (Kerr et al., 2007). In this study, almost all NEP participants who were currently in OST were polysubstance users, all had injected in the past month and 39% had injected heroin daily or almost daily. Despite the presence of these risk factors, fewer of those currently in OST reported non-fatal overdoses in the month leading up to the interview compared to the other NEP participants. This suggests that OST contributes to reduced health risks despite the high prevalence of risky drug use behaviours. Furthermore, OST was associated with less heroin use and this is likely another reason why fewer of those who were currently in OST reported non-fatal overdoses.

Injections are not only associated with risk of fatal and non-fatal overdoses, they are also associated with HIV, hepatitis, cutaneous injection-related infections and venous disease

(Lloyd-Smith et al., 2008; Pieper et al., 2009). Fewer injections are therefore associated with a major reduction in health risks. Many studies have found a negative association between OST and injection drug use (Camacho et al., 1997; Dolan et al., 2003; Kwiattkowski and Booth, 2001). This study contributes to the evidence showing that OST appears to reduce the health risks associated with injecting behaviour in NEP participants who are in OST.

The level of polysubstance use was, however, high in this study, and there were no differences between OST users and the two other groups. Two other studies also found high levels of polysubstance use among comparable populations of NEP participants (Gervasoni et al., 2012; Kerr et al., 2005). This suggests that OST is not optimal in reducing polysubstance use and that, despite fewer non-fatal overdoses, there is a need for specific interventions to reduce health risks further.

Harm to others caused by theft and drug dealing are important societal cost factors (Collins and Lapsley, 2008). Although drug dealing can have serious adverse consequences for the general community concerning issues such as increased drug availability, violence among market participants and societal costs for law enforcement, it is generally assumed to be less harmful than theft (McCollister et al., 2010). Theft often imposes substantial harms and costs to third-parties (García-Altés et al., 2002). OST has been found to reduce criminal activities in patients (Bukten et al., 2012). In the current study the negative association between OST and theft was no longer significant in the adjusted model, whereas the association between OST and drug dealing remained significant in the adjusted model. In a comparable study from Switzerland they also found a negative association between OST and illegal activities, but, as in this study, the findings were no longer significant after adjusting for other variables (Gervasoni et al., 2012). The lack of statistically significant results could be due to an insufficient number of subjects rather than a lack of real differences. On the other hand, it

could also indicate that NEP users who are currently in OST differ from OST users in general in that the association between OST and theft is weaker.

4.2 Strengths and limitations

The cross-sectional design limits casual inference. Furthermore, as with all studies that use self-reported data, possible weaknesses of this study include selection bias, recall bias, under- and over-reporting, and imprecise estimation of illegal activities. NEP participants may under-report their drug use due the social stigma attached to that behaviour and those currently in OST may further under-report because of their patient status. However, OST status is one of the final questions in the questionnaire, which may reduce this likelihood of under-reporting. Also, anonymous interviews increase the risk of repeated observations across interview sessions. However, this potential source of bias was reduced as possible duplicates were removed as described in details in the Methods section. Additionally, it is not likely that an individual has been interviewed more than once within the same interview session. This means that if an individual should appear in another year the OST status and outcome variable will only be related to the previous four weeks for the specific interview. Furthermore, it can be shown that when the sample size is small relative to the population size (like in the present case), repeated observations will not significantly influence the results.

The sample's gender and age distribution is similar to what is assumed for IDUs in Norway (Bretteville-Jensen and Amundsen, 2006), and the high number of needles and syringes distributed annually suggests that a large proportion of the city's IDUs are using the NEP facility in the city centre. People who inject drugs regularly are more likely to attend the NEP than those who inject less frequently, and consequently, the sample probably includes a higher proportion of the former population than the latter.

Importantly, it is likely that our data collection method allowed us to recruit IDUs who may not have been able to attend follow-up evaluations in long-term cohort studies. It is therefore possible that this study included a slightly different population than those usually assessed in cohort and treatment studies, and this enables a different view on the benefits of OST.

4.3 Conclusions

NEP participants who are currently in OST appear to have clear health benefits including fewer non-fatal overdoses, fewer injections and less heroin use. In addition those who are currently in OST appear to be associated with less criminal activity. Although those in OST had fewer non-fatal overdoses, the sustained high level of polysubstance use nevertheless poses a public health challenge as polysubstance use has been associated with an increased risk of overdoses (Kerr et al., 2007). It is therefore important that preventive and harm reduction strategies are developed in order to address this issue to reduce mortality and morbidity further in this population. Nevertheless, our findings suggest that there are large health benefits in providing OST also to those who continue to inject drugs while in treatment.

References

- Ball, J.C., Ross, A., 1991. The effectiveness of methadone maintenance treatment. Springer, New York.
- Bird, S.M., Robertson, J.R., 2011. Toxicology of Scotland's drugs-related deaths in 2000-2007: Presence of heroin, methadone, diazepam and alcohol by sex, age-group and era. *Addict Res Theory*. 19, 170-178.
- Bretteville-Jensen, A.L., Amundsen, E.J., 2006. Injecting drug use in Norway (In Norwegian). Norwegian Institute for Alcohol and Drug Research-Sirus, Oslo; Norway.
- Bretteville-Jensen, A.L., Amundsen, E.J., 2009. Heroin use og heroin seizures in Norway (In Norwegian). Norwegian Institute for Alcohol and Drug Research-Sirus, Oslo; Norway.
- Bretteville-Jensen, A., Skretting, A., 2010. Heroin smoking in Norway. *Nord. Stud. Alcohol Drugs*. 27, 5-18.
- Bukten, A., Skurtveit, S., Gossop, M., Waal, H., Stangeland, P., Havnes, I., Clausen, T., 2012. Engagement with opioid maintenance treatment and reductions in crime: a longitudinal national cohort study. *Addiction*. 107, 393-399.
- Camacho, L.M., Bartholomew, N.G., Joe, G.W., Simpson, D.D., 1997. Maintenance of HIV risk reduction among injection opioid users: a 12 month posttreatment follow-up. *Drug Alcohol Depend*. 47, 11-18.
- Christie, B., 2012. Methadone prescribing is to be reviewed in Scotland as user numbers continue to rise. *BMJ*. Accessed on 15.10.2012 <http://www.bmj.com/content/345/bmj.e6816>.
- Collins, D., Lapsley, H., 2008. The costs of tobacco, alcohol and illicit drug abuse to Australian society in 2004/05. Accessed on 03.03.2009 [http://www.health.gov.au/internet/drugstrategy/publishing.nsf/Content/34F55AF632F67B70CA2573F60005D42B/\\$File/mono64.pdf](http://www.health.gov.au/internet/drugstrategy/publishing.nsf/Content/34F55AF632F67B70CA2573F60005D42B/$File/mono64.pdf).
- Darke, S., Hall, W., 2003a. Heroin overdose: Research and evidence-based intervention. *J Urban Health*. 80, 189-200.
- Darke, S., Mattick, R.P., Degenhardt, L., 2003b. The ratio of non-fatal to fatal heroin overdose. *Addiction*. 98, 1169-1171.
- Dolan, K.A., Shearer, J., MacDonald, M., Mattick, R.P., Hall, W., Wodak, A.D., 2003. A randomised controlled trial of methadone maintenance treatment versus wait list control in an Australian prison system. *Drug Alcohol Depend*. 72, 59-65.
- García-Altés, A., Ollé, J.M., Antónanzas, F., Colom, J., 2002. The social cost of illegal drug consumption in Spain. *Addiction*. 97, 1145-1153.
- Gervasoni, J.P., Balthasar, H., Huissoud, T., Jeannin, A., Dubois-Arber, F., 2012. A high proportion of users of low-threshold facilities with needle exchange programmes in Switzerland are currently on methadone treatment: Implications for new approaches in harm reduction and care. *Int. J. Drug Policy*. 23, 33-36.

- Gjersing, L.W., H.; Røislien, R.; Gossop, M.; Clausen, T., 2011. Variations in treatment organisation, practices and outcomes within the Norwegian opioid maintenance treatment programme. *Norsk epidemiologi*. 21, 113-118.
- Gyngell, K., 2011. Breaking the habit. Why the state should stop dealing drugs and start doing rehab. Centre for policy studies, Surrey; UK.
- Hickman, M., Carrivick, S., Paterson, S., Hunt, N., Zador, D., Cusick, L., Henry, J., 2007. London audit of drug-related overdose deaths: characteristics and typology, and implications for prevention and monitoring. *Addiction*. 102, 317-323.
- Judson, G., Bird, R., O'Connor, P., Bevin, T., Loan, R., Schroder, M., McGrath, R., Weatherall, M., Moriarty, H., Robinson, G., 2010. Drug injecting in patients in New Zealand Methadone Maintenance Treatment programs: An anonymous survey. *Drug Alcohol Rev*. 29, 41-46.
- Kerr, T., Fairbairn, N., Tyndall, M., Marsh, D., Li, K., Montaner, J., Wood, E., 2007. Predictors of non-fatal overdose among a cohort of polysubstance-using injection drug users. *Drug Alcohol Depend*. 87, 39-45.
- Kerr, T., Marsh, D., Li, K., Montaner, J., Wood, E., 2005. Factors associated with methadone maintenance therapy use among a cohort of polysubstance using injection drug users in Vancouver. *Drug Alcohol Depend*. 80, 329-335.
- Kidorf, M., King, V.L., Pierce, J., Kolodner, K., Brooner, R.K., 2011. Benefits of concurrent syringe exchange and substance abuse treatment participation. *J Subst Abuse Treat*. 40, 265-271.
- Kwiatkowski, C.F., Booth, R.E., 2001. Methadone maintenance as HIV risk reduction with street-recruited injecting drug users. *J Acquir Immune Defic Syndr*. 26, 483-489.
- Li, L., Lin, C.Q., Wan, D., Zhang, L.L., Lai, W.H., 2012. Concurrent heroin use among methadone maintenance clients in China. *Addict Behav*. 37, 264-268.
- Lloyd-Smith, E., Wood, E., Zhang, R., Tyndall, M.W., Montaner, J.S.G., Kerr, T., 2008. Risk factors for developing a cutaneous injection-related infection among injection drug users: a cohort study. *BMC public health*. Accessed on 04.01.2009
<http://www.biomedcentral.com/1471-2458/8/405>.
- MacArthur, G.J., Minozzi, S., Martin, N., Vickerman, P., Deren, S., Bruneau, J., Degenhardt, L., Hickman, M., 2012. Opiate substitution treatment and HIV transmission in people who inject drugs: systematic review and meta-analysis. *BMJ*. Accessed on 10.10.2012
<http://www.bmj.com/content/345/bmj.e5945>.
- McCollister, K.E., French, M.T., Fang, H., 2010. The cost of crime to society: New crime-specific estimates for policy and program evaluation. *Drug Alcohol Depend*. 108, 98-109.
- Millson, P., Challacombe, L., Villeneuve, P.J., Strike, C.J., Fischer, B., Myers, T., Shore, R., Hopkins, S., 2007. Reduction in Injection-Related HIV Risk After 6 Months in a Low-Threshold Methadone Treatment Program. *AIDS Educ Prev*. 19, 124-136.

National Statistics Scotland, 2012. Drug-related deaths in Scotland in 2011. Accessed on 03.10.2012 <http://www.gro-scotland.gov.uk/statistics/theme/vital-events/deaths/drug-related/2011/index.html>.

Nordentoft, M and Wandall-Holm, N., 2004. 10 year follow up study of mortality among users of hostels for homeless people in Copenhagen. *BMJ*. 327, 81-83.

Norwegian Institute for Alcohol and Drug Research-Sirus, 2012. The drug situation in Norway. Oslo; Norway.

O'Hara, M., 2012. Charities unite in opposition to government drugs policy. *The Guardian*. Accessed on 20.08.2012 <http://www.guardian.co.uk/society/2012/apr/24/charities-unite-against-changes-drugs-policy>.

Pieper, B., Templin, T.N., Kirsner, R.S., Birk, T.J., 2009. Impact of injection drug use on distribution and severity of chronic venous disorders. *Wound Repair Regen*. 17, 485-491.

Spence, D., 2012. Methadone is no panacea. *BMJ*. Accessed on 01.09.2012 <http://www.bmj.com/content/345/bmj.e5670>.

Statistics Norway, 2012. Population. Accessed on 01.12.2012 http://www.ssb.no/english/subjects/02/befolkning_en/.

UK Government, 2010. Reducing demand, restricting supply, building recovery: Supporting people to live a drug free life. Accessed on 1.10.2012 <http://www.homeoffice.gov.uk/publications/alcohol-drugs/drugs/drug-strategy/drug-strategy-2010>.

Van Ameijden, E.J.C., Langendam, M.W., Coutinho, R.A., 1999. Dose-effect relationship between overdose mortality and prescribed methadone dosage in low-threshold maintenance programs. *Addict Behav*. 24, 559-563.

Waal, H., 2007. Merits and problems in high-threshold methadone maintenance treatment. Evaluation of medication-assisted rehabilitation in Norway 1998-2004. *Eur Addict Res*. 13, 66-73.

Waal, H.C., T; Håseth, A; Lillevold, P.H., 2012. The 2011 annual assessment of the Norwegian OMT programme (In Norwegian). Norwegian Centre for Addiction Research, Oslo, Norway.

Warner-Smith, M., Darke, S., Day, C., 2002. Morbidity associated with non-fatal heroin overdose. *Addiction*. 97, 963-967.

Ødegård, E., Amundsen, E.J., Kielland, K.B., 2007. Fatal overdoses and deaths by other causes in a cohort of Norwegian drug abusers-a competing risk approach. *Drug Alcohol Depend*. 89, 176-182.