

Patterns of acquisitive crime during methadone maintenance treatment among patients eligible for heroin assisted treatment

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Abstract

Objective: To determine the patterns of acquisitive crime during methadone maintenance treatment among chronic, treatment-resistant heroin users eligible for heroin assisted treatment in the Netherlands.

Methods: We retrospectively assessed the type and number of illegal activities during 1 month of standard methadone maintenance treatment in 51 patients prior to the start of heroin assisted treatment. Data were collected using a semi-structured interview focussed on crime with special emphasis on property crime. Volume analyses consisted of frequencies and descriptives of mean numbers of offences per day and per type.

Results: In a Dutch population of problematic drug users eligible for and prior to commencing heroin assisted treatment, 70% reported criminal activities and 50% reported acquisitive crimes. Offending took place on 20.5 days per month with on average 3.1 offences a day. Acquisitive crime consisted mainly of shoplifting (mean 12.8 days, 2.2 times/day) and theft of bicycles (mean 5.8 days, 2.4 times/day); theft from a vehicle and burglaries were committed less frequently. The majority of these patients (63%) reported to have started offending in order to acquire illicit drugs and alcohol.

Conclusion: During methadone maintenance treatment, 50% of criminally active, problematic heroin users eligible for heroin assisted treatment reported acquisitive crime. Shoplifting, thefts and/or other property crimes were committed on average two to three times on a crime day. This study discusses that the detail provided by self-reported crime data can improve cost estimates in economic evaluations of heroin assisted treatment. © 2006 Elsevier Ireland Ltd. All rights reserved.

Keywords: Methadone maintenance treatment; Heroin dependence; Crime; Netherlands

1. Introduction

Methadone maintenance treatment (MMT) is considered the reference treatment for chronic heroin addiction (van den Brink and van Ree, 2003). However, a substantial part of patients in MMT fails to respond favourably to this treatment. For these chronic, treatment-resistant patients, new interventions have been developed including the supervised prescription of heroin also referred to as heroin assisted treatment (HAT; e.g. Rehm et al., 2001; van den Brink et al., 2003). However, HAT is much more expensive than MMT. Recently, a cost utility analysis from a societal perspective was performed comparing MMT and HAT

in a chronic, treatment-resistant population of heroin addicts using data from two randomized controlled trials (Dijkgraaf et al., 2005). For the economic evaluation the costs and health benefits of treatment were assessed in the two RCTs ($n = 430$). In this paper, we describe the rationale, approach and results of a complementary study in 51 patients on crimes committed by chronic, treatment-resistant heroin addicts eligible for HAT.

1.1. Rationale

A causal link between drug use and crime is hard to establish, but a high correlation between the two clearly exists (Bennett, 1998; Hall, 1996; Jofre-Bonet and Sindelar, 2001). However, with subjects being on the edge of two scientific disciplines, medicine and law, two major shortcomings emerge from the

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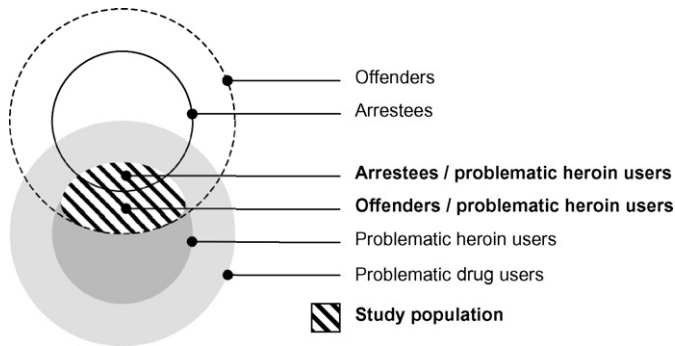


Fig. 1. Offenders, arrestees and problematic drug use. The study population consists of offending problematic heroin users, whether known as arrestee or not.

literature which hamper the economic evaluation of medical treatments for drug abuse. One shortcoming relates to the level of detail of assessed criminal behaviour, the other to the target group under study.

First, when criminal behaviour is measured in clinical trials on addiction, items in the assessment are often restricted to arrests, charges, or days with criminal activities. For instance, Ball et al. (1983) did extensive research among 354 heroin addicts in Baltimore, USA and reported a mean number of 255 crime days per year. Theft was the most frequent type of crime with 125 days per year. Similarly, van den Brink et al. (2003) reported fewer arrests and less days of crime among patients in HAT compared to patients in MMT. Measuring crime days, whether or not specified by type of crime, may include registered and unregistered crime, but these studies lack detail concerning the number of crimes committed on a day and the costs that are involved in these crimes. Many other studies only investigated convictions or arrests by drug users, but these units of criminal activity leave out all unregistered crime with associated costs (Bell et al., 1992; Gjeruldsen et al., 2004; Gossop et al., 2005; Lind et al., 2004; Rothbard et al., 1999; Sheerin et al., 2004).

Second, even when those details are available, e.g. to guide governmental policies towards effective reductions of both crime and drug use, these data generally concern the type and frequency of those drug addicts who were arrested (DeAngelis et al., 1976; Holloway et al., 2004; Meijer et al., 2003). Samples of mainly drug using arrestees or arrested drugs users at police stations, however, cannot reveal the unknown number of all offences committed, nor can it be used to estimate the prevalence of criminal behaviour within a group of problematic drug users. Fig. 1 shows the distinct populations: problematic heroin users among arrestees and offenders among heroin users.

In economic evaluations of addiction care with potentially societal savings resulting from reduced crime rates following successful treatment, both of these shortcomings should be addressed. The level of detail should be sufficient for calculating the cost savings accompanying the reduction in law enforcement and victim damage following registered and unregistered crime. At the same time, observations of reduced crime rates should be representative for the population eligible for the treatment under study, whether or not they run the risk of becoming arrested or charged.

The Dutch trials on the effectiveness and safety of supervised HAT (van den Brink et al., 2003) provided insufficient data for the performance of an adequate cost-effectiveness analysis without making fallible assumptions concerning specific crime behaviours of the target population. To overcome these shortcomings a complementary study was conducted in order to obtain detailed information regarding criminal behaviours of a patient population very similar to the ones studied in the randomized controlled trials. Emphasis was put on acquisitive crime, because the vast majority of the offences committed by drug users in the Netherlands are property crimes (74%, $n = 453,342$; Meijer et al., 2003).

2. Methods

2.1. Design and population

The study design was a retrospective assessment of the type and frequency of criminal activities during MMT prior to the start of HAT. Study participants were chronic, treatment-resistant heroin addicts, eligible for and actually receiving heroin on medical prescription in combination with oral methadone.

Participants had to be highly comparable to the initial population of the randomized controlled trials conducted between 1998 and 2001 in order for these data to be applied in the economic evaluation of the original trials. In spring 2003, 141 new patients were accepted for HAT in the Netherlands. Eligibility criteria were the same as in the original heroin trials. Inclusion criteria were a heroin dependency of at least 5 years (DSM-IV), unsuccessfully treated in MMT as evidenced in poor physical and/or mental and/or social health, registered in a MMT and with regular contact during the previous 6 months, at least 25 years old and daily or nearly daily use of illegal heroin. Severe medical, psychiatric or psychosocial problems that could interfere with the conduct of the study were some of the exclusion criteria. Treatment setting, interviews and clinical protocols were identical as well (for all eligibility criteria and further details see: Central Committee on the Treatment of Heroin Addicts, 2002). In addition to the selection criteria of the trials, participants were eligible for the present study if they had committed at least one acquisitive crime in the month prior to the first or baseline screening for acceptance in the HAT.

During the 6 months of MMT prior to the start of HAT, the patients bear the costs of heroin use with possibly acquisitive crime as a source of income. One month during this pre-HAT MMT period is the scope of the interview of the current study. Since the study took place in spring 2004, interviewing the initial trial population (inclusion period 1998–2001) would require interviewees to recall activities of 3–6 years ago. The new, comparable group enrolled in 2003 enabled us to shorten this recall period to 1 year.

2.2. Assessment

Theoretically, the best method to collect data on acquisitive crimes with related societal costs of victim damage and law enforcement would be by direct observation. Obviously, this is an impractical strategy in the real world. The second best option would be a structured interview approach by trained interviewers. During the trials, the European Addiction Severity Index (EuropASI; Kokkevi and Hartgers, 1995) was used. It is a validated and widely used, semi-structured interview method addressing social and crime related issues such as number of charges, number of days of incarceration and days with acquisitive crime. To collect specific data on property crimes and to make estimates of revenues and victim damage, we developed a more detailed semi-structured interview, complementary to the EuropASI. Criminal activities were categorized in violent offences, property crimes, drug law violations, traffic offences, disorderly conduct and so on. An overview of offences questioned during the interview is given in Table 1. Property crime questions contained open questions about the kind of items stolen most frequently and the participant was asked to indicate the mean market values of these items when sold. A distinction was made between 'average' days with acquisitive crime and so-called peak days to learn about the range and maximum number of crimes on a single day and about

Table 1
Offences questioned during interview

Code	Type of offence	Notes
M05	Possession or sale of illicit drugs	
M06	Property crime	See M13–M24
M07	Violence	Including violent robbery, arson (aggravated) assault, rape, criminal homicide, manslaughter
M08	Public drunkenness and disorderly conduct	Including vagrancy (begging, loitering), vandalism and failure to pay fares on public transportation
M09	Prostitution and commercialized vice	
M10	Driving while intoxicated (DWI) or driving under the influence (DUI)	
M11	Other offences of road traffic and vehicle laws	Including reckless driving, speeding, joyriding, driving without a licence, hit-and-run
M12	Other (open question)	For example criminal negligence of minor children, reckless endangerment of family/children, embezzlement, sex offences, illegal possession of weapons
Property crimes		
M13	Shoplifting	Without damage, otherwise M20
M14	Theft of bicycle	
M15	Theft of scooter or moped	
M16	Theft of vehicle	
M17	Theft from private vehicle	
M18	Theft from company vehicle	For example buses, (commercial) vans, trucks
M19	Burglary in a dwelling	Trespassing with or without damage
M20	Burglary on commercial premises	Trespassing with or without damage
M21	Pickpocketing	
M22	Robbery, mugging	
M23	Forgery and counterfeiting/fraud	For example false (identity) documents, non-payment of mail orders, selling identity documents/bank cards
M24	Selling stolen goods	

possible patterns (e.g. many offences once a week versus daily shoplifting). All questions about offences had the time frame of 30 days during MMT, before the participant was recruited for HAT.

The study was approved by the Dutch 'Central Committee on Research involving Human Subjects' (CCMO). All participants provided written informed consent. Anonymity was guaranteed and treatment unit personnel had no access to the interview data. Data were gathered in February and March 2004. Interviewees received a fee of €10 as compensation for their time.

2.3. Statistical analysis

Based on the required precision of the descriptives needed for the cost utility analysis, we estimated that a minimum of 34 respondents was necessary to estimate the number of offences (by type) on a day with acquisitive crime reliably. With a finite population of 100 and an expected range of 1–9 offences on 1 day with a standard deviation of 1.59 (normally distributed), there is an 80% probability of estimating the number of offences with a 95% confidence interval of one offence. To allow for possible dropout and outliers, we aimed at including 50 respondents. Volume analysis consisted of frequencies and descriptives of mean numbers of offences per day and by type.

3. Results

3.1. Participants

Fig. 2 shows the inclusion flow of participants. Of all 141 eligible patients for HAT, 99 (70%) reported criminal activities. Seventy-one (50%) met the additional inclusion criterion on acquisitive crime. The cooperating treatment units invited eligible participants ($n = 65$) for this one-time interview at the

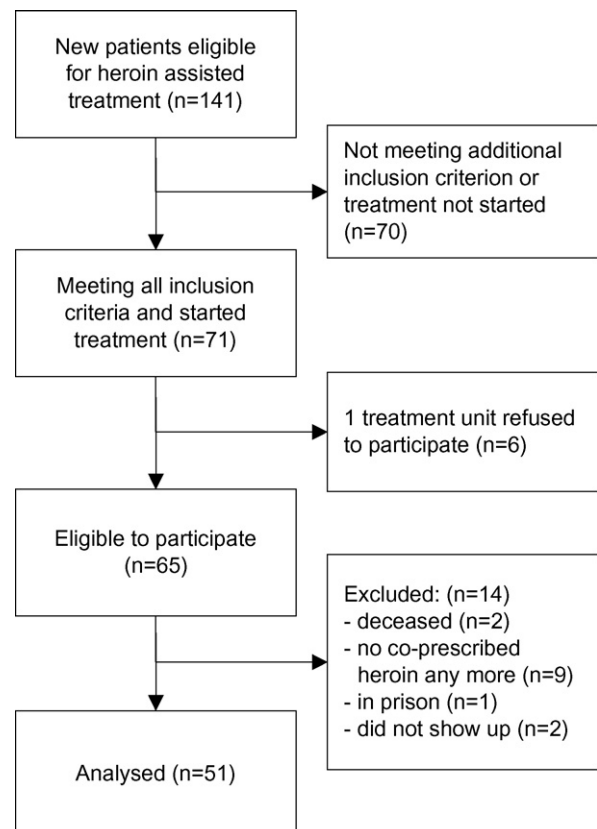


Fig. 2. Flowchart of participant inclusion.

Table 2
Socio-demographics and substance use characteristics at baseline

Variable	New group ^a , 2003–2004 (<i>n</i> = 51)	Initial group ^a , 1998–2001 (<i>n</i> = 204)
Male (%)	94.1	87.7
Age (mean) ^b	40.3 (6.2)	38.3 (5.6)
Dutch/European ethnicity (%)	88.2	84.3
Usual employment status, past 2 months (%)		
Working regularly	9.8	18.1
Other	90.2	81.9
Major source of income, past month (%)		
Work	7.8	7.8
Other	92.2	92.2
Injecting heroin (%)	37.3	43.6
Years of regular use (mean)		
Heroin ^b	18.9 (6.6)	15.9 (5.9)
Methadone ^b	15.5 (6.4)	12.3 (6.2)
Cocaine ^c : 96.1% (49/51) and 91.2% (186/204)	12.1 (7.2)	10.0 (6.0)
Poly drug use ^b	19.6 (5.9)	17.0 (6.6)
Alcohol (≥ 5 units/day) ^c : 76.5% (39/51) and 61.3% (125/204)	10.2 (8.4)	10.0 (8.0)

^a The values in the parentheses denote S.D.

^b Differences between groups (chi-square or Mann–Whitney *U*-test, $p < 0.05$).

^c Percentages of new and initial group respectively that uses substance.

treatment unit. Twelve participants were excluded and 51 of the remaining 53 patients were interviewed; two participants did not show up at the day of the interview. At every site (five cities) between 7 and 17 participants were enrolled: Rotterdam 17, Amsterdam 9, Utrecht 9, Groningen 9 and The Hague 7. They had been enrolled in the HAT for between 11 and 13 months (mean 11.5) before the interviews took place in February and March 2004.

The study sample should be representative for participants in the initial trials of medically co-prescribed heroin to chronic, treatment-resistant addicts, who were actively involved in acquisitive crime in the month(s) preceding the trials. The demographics and substance use characteristics of both samples are shown in Table 2. Taken into account that the current study took place 3–5 years after the inclusion of patients in the original trials, the two samples look very similar in terms of both demographic and substance abuse characteristics.

3.2. Criminal activities

Before questioning the patients about the various specific types of crime, subjects were asked how often they committed offences on average in a month during MMT prior to receiving HAT. Subjects reported a monthly average of 20.5 days with offences (median = 25) and an average frequency of 3.1 offences on a criminal day (median = 2). Apart from property crimes, the following types of offences (mean number of days per month; S.D.) were reported: possession or sale of illicit drugs (13.2; 13.9), violence (0.22; 1.1), drunkenness (6.4; 11.5) and all other types of crime (see Table 1) on (less than) 3 days on average per month.

Overall, the target group of heroin dependent drug users with acquisitive crime committed property crimes on a median of 12 days and a median frequency of two times on such days.

After this general question, different types of property crimes were investigated (see Table 3). Of all participants interviewed, nobody reported having committed robberies or having stolen scooters during MMT. One participant reported pickpocketing every once in a while (three times a month). Shoplifting was by far the most frequently reported type of acquisitive crime with a mean of 12.8 days per month. On a 'usual' day of shoplifting, participants would steal goods from two shops or supermarkets, but on some occasions the number of thefts on a single day could amount to 4 (median), or even 10 ($n = 3$). Other property crimes included theft of a vehicle (mean 0.6 days/month), theft from a vehicle (mean 1.2 days/month) or from a company vehicle (mean 1.0 days/month), and burglary either in a dwelling (mean 3.3 days/month) or on commercial premises (mean 1.4 days/month).

Of all participants interviewed, two denied having committed any acquisitive crimes during MMT, while during baseline assessment they admitted having committed acquisitive crimes in the last 30 days.

Table 4 shows the prevalence of specific property categories in shoplifting and other thefts and the stolen items that were sold. Shoplifting is the most prevalent property crime with 71% (36/51). Shoplifters most frequently stole clothing or shoes (39%). Food (meat and coffee), non-food such as washing-powder, and electrical devices/tools are also common targets of shoplifters.

In case of burglary, electrical devices (e.g. car radios, cameras) from private cars and tools from company vehicles are the items stolen most frequently (81%). Burglars would often take audio equipment, money or wallets, household items and jewelry from a dwelling. Burglary on commercial premises is frequently aimed at laptops and (electrical) tools. Sometimes other goods of value are taken, such as metal pipes from construction sites.

Selling stolen goods is a major source of income to buy illicit drugs. Participants were asked to report up to three items (or

Table 3
Offences per type of crime

Type of crime	Days (<i>n</i> = 51)		Frequency		
	Mean (S.D.)	Median (IQR)	Mean (S.D.)	Median (IQR)	<i>n</i>
Against commercial and public sector					
Shoplifting	12.8 (11.6)	10 (25)	2.17 (1.2)	2 (2)	36
Burglary on commercial premises	1.4 (5.2)	0 (0)	1.1 (0.3)	1 (0)	10
Fraud/forgery/counterfeiting	0.2 (0.7)	0 (0)	1		4
Theft from company vehicle	1.0 (4.4)	0 (0)	1.3 (0.8)	1 (1)	6
Against individuals					
Theft of vehicle	0.6 (4.2)	0 (0)	–	–	2
Theft from vehicle	1.2 (4.7)	0 (0)	1.6 (1.1)	1 (1)	10
Theft of bicycle	5.8 (11.1)	0 (3)	2.4 (2.2)	0 (2)	19
Theft of scooter	0 (–)	0 (0)	–	–	–
Burglary in a dwelling	3.3 (9.1)	0 (0)	1.4 (0.5)	1 (1)	7
Pickpocketing	0.1 (0.4)	0 (0)	–	–	1
Robbery	0 (–)	0 (0)	–	–	–
Selling stolen property (fencing)	12.6 (11.9)	8 (25)	2.3 (2.1)	2 (2)	38

categories) which they sold and to indicate what they got in return: money, drugs or something else. Only one participant had occasionally received drugs in return for goods, but generally, stolen goods were sold for money. Electrical devices/tools were sold by 39% to a middleman for €20–300. Many others (34%) sold expensive clothes and shoes for €10–250, depending on the number and price of the items. In case of shoplifting, six participants (from three different cities) always got one third of the original item market value. Burglars often sold goods like compact discs, audio equipment, jewelry and other household items with revenues ranging from €2 for a CD to €450 for an antique. Not everything was sold to a middleman, e.g. bicycles were often sold for €10–35 to passers-by.

3.3. Patterns of property crime

Concerning crime patterns, 36% of the respondents always committed the same type of property crime, 47% committed two types of property crime and 18% committed three or more different types of crime. The combination shoplifting and theft of

bicycles (*n* = 15) was most frequently seen, followed by shoplifting and theft from a vehicle (*n* = 10).

Further analyses were done to explore differences between subgroups. Splitting the study sample by median age or median number of days with criminal acts did not reveal differences in the number of days and frequency of specific types of property crime.

3.4. Reasons for offending

Table 5 shows the reasons for the start of criminal offending and the relationship with heroin use. The main reason to start offending was to acquire money for drugs and alcohol (63%, *n* = 32). In the category ‘other’, interviewees said that the start of criminal behaviour was for luxury reasons and mainly consisted of stealing luxury goods. None of the participants mentioned ‘debt payment’ as the reason of the first criminal activities. More than half (30/51) had already committed offences before (regular) heroin use and almost everyone (48/51) said offending was an important source of income.

Table 4
Theft of property and selling stolen goods, prevalence and revenue in 2004 euros

Property category	Shoplifting (<i>n</i> = 36)		Other ^a (<i>n</i> = 21)		Selling goods (<i>n</i> = 38)		€ Range ^b (<i>n</i>)
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Clothing/shoes	14	39	1	5	13	34	10–250 (14)
Food	12	33	1	5	8	21	1–35 (8)
Non-food	12	33	–	–	8	21	2–40 (8)
Electrical devices/tools	10	28	17	81	15	39	20–300 (16)
Household items	6	17	8	31	12	32	2–450 (12)
Liquor/cigarettes	4	11	1	5	3	8	10–35 (3)
Other	7	19	4	19	5	13	15–200 (5)
Bicycles					4	11	10–35 (4)
Wallets			9	43			

^a From categories: theft from vehicle, theft from company vehicle, burglary in a dwelling, burglary on commercial premises.

^b Based on number of times the item was reported (maximum three items per interviewee); range is stated because it was not always clear if the amount received was per item, per lot or per lot of different items.

Table 5
Start of illegal behaviour and drug use

Item	<i>n</i>	%
Main reason of onset offending		
Money for drugs/alcohol	32	62.7
Money for living	6	11.8
Do not know	1	2.0
Other	12	23.5
Offending before heroin use		
Yes	30	58.8
No	21	41.2
Offences (general) during month		
	Days (<i>n</i> = 51), mean: 20.5 (S.D. 10.5), median: 25 (IQR 18)	Frequency (<i>n</i> = 48), mean: 3.1 (S.D. 3.9), median: 2 (IQR 2)

4. Discussion

4.1. Summary of the results

In a Dutch population of chronic, treatment-resistant heroin users eligible for HAT, about half reported having committed acquisitive crimes mainly in order to buy illicit drugs during their methadone maintenance treatment. These crimes were committed every other day on average, with a mean of three property crimes on such day. Shoplifting, particularly supermarket theft, was the most frequently reported acquisitive crime. Theft of bicycles and burglary were frequent crimes as well. Meat, coffee and other products from a supermarket were often sold for small amounts of money, while household items, clothing and especially electrical devices were sold for substantial sums.

4.2. Comparisons

The differences in age and years of drug use between the study sample and the participants in the original trials coincide with the differential start of the inclusion periods. Because they are similar for all other baseline parameters, the groups are considered to stem from the same source population of chronic, treatment-resistant heroin dependent methadone maintenance patients. Applying the additional inclusion criterion, we found 71 participants with acquisitive crimes out of the total number of 141 potentially eligible patients (50%). Based on convictions rather than offences, others found similar percentages of criminally active drug populations (e.g. Bell et al., 1992; Hall et al., 1993; Lind et al., 2004). In an Australian study among 86 methadone-maintained opiate addicts, 52% reported offending during the past month on 11.8 days on average with mostly property offences (Patterson et al., 2000).

4.3. Sources of bias

We selected patients who at first screening or at baseline reported having committed at least one acquisitive crime in the past 30 days. Selecting patients based on two consecutive assessments instead of just one assessment helps to prevent bias

towards patients who commit acquisitive crime on a continuous or daily basis.

In case of drug users, doubts are often raised about the reliability and validity of self-report data. Self-report data on *illicit drug use* can be checked with urinalysis and self-report *arrest* data can be checked with police registers (e.g. Hall et al., 1993). Such diagnostic checks from the two related Dutch trials showed that self-reported data were found to be valid (e.g. self-reported versus registered charges had an overall agreement of 90%, Central Committee on the Treatment of Heroin Addicts, 2002). Because the present study sample is highly comparable with the group of criminally active subjects from the original trials, we expect that the self-reported data in this paper are equally reliable.

Perhaps more troublesome is the potentially presence of unintended recall bias, given the time lag between the interview and the MMT period of about 1 year. Such recall bias may have been limited by asking interviewees for crime-related details such as the types of items stolen and the related revenue.

Apart from possible recall bias, reporting frequencies and types of crime to an interviewer can be prone to error. Possible underreporting could have played a role when participants still feared the consequences for their treatment or when participants trivialized their criminal activity in order to give a more socially desirable response. Overreporting could have biased the results due to a changed self-image of their current condition (heroin treatment with hardly any crime at all), resulting in an exaggeration of the number of crime days and/or frequencies of crime in the past to emphasize the contrast between 'now' and 'then'. However, interview circumstances were free of negative consequences such that interviewees had no fear of sanctions. This will certainly have enhanced the reliability of the self-reported data about criminal behaviours (Darke, 1998; Maddux and Desmond, 1975).

4.4. Application of results

The results on the number of acquisitive crimes on crime days reported in this paper are but one necessary component to quantify the societal costs associated with co-prescribed heroin. Another essential component is the unit costing of these crimes. The unit costs are reported in the cost utility analysis mentioned earlier. Overall, the total societal costs of law enforcement and of victim damage resulting from property crimes were estimated at approximately €13,000 and €35,000, respectively, per patient per year receiving MMT (Dijkgraaf et al., 2005). The latter costs of victim damage are not to be mixed with the revenues of crime received by drug users from a middleman or a passer-by. Revenues as stated in Table 4 typically are much lower than the average costs associated with victim damage.

During the structured interview, we asked general questions about the number of days with property crime during 1 month and the number of acquisitive crimes on such days. Later on during the interview, we asked the same questions for each type of acquisitive crime. The latter (more specific) approach revealed a higher number of days with acquisitive crimes than the first (general) approach. Subsequently, the mean number of acquisitive

crimes per crime day, allowing for different types of acquisitive crime on the same day, rose from 2.1 to 3.4. Assuming that the specific approach is more reliable than the general approach, one should probably use the latter estimate in economic evaluations (Dijkgraaf et al., 2005).

It should be explicitly noted that the presented results cannot be generalized unconditionally to the total population of heroin dependent drug users. This is a group of mostly male addicts over 40 years old with a mean of 19 years of problematic drug use and an unsuccessful MMT history.

4.5. Concluding remarks

Criminal activity among chronic, treatment-resistant heroin users eligible for HAT consists mainly of acquisitive crime by means of shoplifting with virtually no violent acts. The study revealed the magnitude and diversity of acquisitive crime, thus providing a sound basis for estimates of societal costs related with illicit drug use during methadone maintenance treatment.

If criminality is part of an economic evaluation among heroin dependent users, it is highly likely that self-report data of sufficient detail are needed to quantify the economic impact of crime, including unregistered crime, in terms of the costs of law enforcement and of damage to victims. For accurate estimates of crime volume, it is recommended that multiple questions about types and frequencies of crime be included instead of one general question about criminal behaviour or a single question about arrests.

In view of the existing lack of detailed knowledge on crime of specific drug (ab)users in relation to the magnitude of (cost) benefits by crime reduction following treatment, further research should focus on detailed drug related crime in terms of volume and costs, and methods to incorporate these data in health economic research.

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