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ORIGINAL ARTICLE

Explaining the Effectiveness of Heroin-assisted Treatment on Crime Reductions

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Abstract This study examines the relationship between heroin-assisted treatment versus methadone maintenance and the criminal activity of 1,015 individuals participating in a German model project. The main objective is to investigate how these treatments contribute to a decline of criminal behavior. The analyses are based upon self-reported criminal offence and police data on alleged criminals. Logistic regression is employed to explain the variance in the 12-month prevalence 1 year after program admission. The results clearly show a decline of criminal offences among participants receiving maintenance treatment; this decline was significantly greater in the heroin group with respect to property crimes and drug offences. The multivariate analysis reveals that the effects are due to a decrease of illegal drug use and absence from the drug scene.

Keywords Crime · Heroin-assisted treatment · Methadone maintenance · Treatment effectiveness

The link between crime and drug addiction is well documented and is supported by a high suspect rate among drug addicts. Police crime statistics in Germany report for 2005 more than 100,000 suspects known to the police as users of hard drugs (heroin, cocaine, amphetamines, and amphetamine derivatives) (Bundeskriminalamt, Police Crime Statistics, 2005). Users of hard drugs commit 10–22% of all robberies, 11% of all burglaries in private homes, and 28% of all aggravated shopliftings. Empirical research repeatedly indicated a correlation between drug consumption and criminal activity (for an overview see MacCoun, Kilmer, & Reuter, 2003; Parker & Auerhahn, 1998; White & Gorman, 2000).

Methadone maintenance has become the most frequently used treatment approach for opiate dependence. Experience gained so far showed, however, that not all opiate dependents benefit from this treatment. A residual group of heavy users do not respond to methadone maintenance. They are often still dependent on the drug and involved in high-risk health and crime behaviors (Hser, Anglin, & Powers, 1993). For this reason, some European countries conducted model projects in recent years, where pure heroin is prescribed as a medication administered under medical supervision to the addicts. The health of drug dependents can thus be significantly improved by preventing the use of contaminated heroin, overdoses, infections, and abscesses from dirty syringes, etc.

The literature provides some evidence for the relationship between crime and heroin-assisted treatment. Heroin-assisted treatment has been the object of criminological research in Switzerland for a number of years (Killias, Aebi, Ribeaud, & Rabasa, 2002; for the primary medical study see Uchtenhagen, Dobler-Mikola, Steffen, Gutzwiller, Blättler, & Pfeifer, 1999). Prior to treatment, 50–60% of opiate dependents were registered by the police each year ($N = 428$); their number declined to 35% in the first treatment year and then stabilized at a low level. The same

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trend was revealed by self-reported data. However, the Swiss study did not use control groups and did not explore the effects of psychosocial support during treatment (for a discussion of the Swiss results see Reuter & MacCoun, 2002). In the Netherlands, dependents who received injectible heroin reported that the number of days they engaged in criminal activity had dropped from 12.9 to 2.9 (N = 76). In a methadone treatment group, the decline was significantly less (from 11.5 to 8.7) (N = 98) (van den Brink, Hendriks, Blanken, Huijsman, & van Ree, 2002). A supplemental study (N = 51) also showed effects in the number of arrests and convictions. However, the Dutch study relied only on self-reported crime data (Dijkgraaf, van der Zanden, de Borgie, Blanken, van Ree, & van den Brink, 2005). A small, randomized Spanish study by March, Oviedo-Joekes, Perea-Milla, and Carrasco (2006) compared heroin and methadone patients with respect to the number of days they engaged in criminal activities, in addition to several medical indicators. In the heroin group, the number of days declined from 11.5 to 0.6 (N = 27). In a methadone treatment group, the decline was significantly less (from 8.0 to 4.1) (N = 23).

A shortcoming of all the studies was that they generally described criminological changes but did not investigate psycho-criminological influencing factors. Therefore, they did not investigate the mechanisms of how treatment affects crime, and they do not provide an explanation as to what circumstances are responsible for the decline of delinquent behavior.

Different theories attempt to explain the correlation between drug use and crime (for an overview see Coid, 2002; Egg, 1999). They lead to different prognoses about the factors that mediate the effects of medical treatment on crime. According to the economic motivation model, criminal offences result from the need to obtain drugs (e.g. McGlothlin, Anglin, & Wilson, 1978; Nurco, Shaffer, Ball, & Kinlock, 1984; Nurco, 1998). A smaller group is assumed to be criminals first and foremost and that drug addiction is an accompanying phenomenon of a generally deviant lifestyle (e.g. Collins, Hubbard, & Rachal 1985; Collins & Messerschmidt, 1993; Khantzian, 1985). Other theories postulate common causes like environmental conditions, which influence both drug use and crime (e.g. Fagan, 1989; Hammersley, Forsyth, Morrison, & Davies, 1989; Sampson, Raudenbush, & Earls, 1997; Skogan, 1990). All three theories are supported by empirical results, at least for some settings and populations (for an overview see White & Gorman, 2000).

None of these influences is deterministic; there is a group of users of illegal drugs that does not turn criminal. Moreover, it is not likely that the different factors directly affect each other. Thus, there is only little support for the assumption that acute intoxication makes users aggressive and impulsive so that they tend to commit crimes in these moods. Also, the relationship between drug use and criminal behavior will vary across individuals, biographies, situations, and times (for example, because of different police strategies) (MacCoun et al., 2003; Parker & Auerhahn, 1998).

The different theories on the relationship between drug use and crime are related to different effects of medical treatment on the prevalence of criminal offences: If offences are due to the need to finance the addiction, medical treatment will lead to a decrease of criminal offences by reducing the need to buy drugs. If, on the other hand, drug addicts are criminals first and drug addiction is an accompanying phenomenon, medical treatment may change drug use but will not have much effect on criminal offences. If drug use and crime are influenced by third factors, medical treatment will reduce criminal offences to the extent that it changes these third factors. If, for instance, homelessness is such a third factor, effective treatment should include help in finding lodgings.

This paper investigates the relationship between heroin-assisted treatment and the criminal activity in 1,015 individuals. The study is based on a controlled, randomized design and includes both the year prior to treatment and the first year of treatment. The analyses are based upon self-reported criminal offences and police data on alleged criminals, thus counterbalancing the shortcomings of each data source: Research on the validity of self-reports indicates that socially unacceptable behavior is often underreported by 35–50% (e.g. driving while drunk), and correctly remembering details such as the amount of drugs consumed or the number and type of crimes committed more than 12 months ago has serious limitations (Harrell, 1985). However, since many crimes are not discovered by the police, police data tend to underestimate the actual number of crimes committed.

Logistic regression is used to explain the variance in the 12-month prevalence of all offences within the first year, with several control variables and mediators assumed to be linked to crime employed as explanatory variables. The primary questions addressed are the following: (a) Is heroin-assisted treatment associated with a decline of criminal offences compared to methadone? (b) Can changes in criminal offences be explained by specific treatment mediators such as drug use?

METHOD

Participants

The German model project on heroin prescription, conducted from 2002 to 2006, was designed as a randomized,

controlled medication trial supported by a parallel criminological study (for the clinical trial see Verthein, Degkwitz, & Haasen, 2007). Participants were 1,015 opiate dependent men and women between 22 and 61 years of age. They were recruited via harm reduction facilities (consumption rooms), drug counseling services, local health services, medical practitioners, and the regional press in seven German cities: Bonn, Cologne, Frankfurt, Hamburg, Hanover, Karlsruhe, and Munich. The inclusion criteria were as follows: at least 5 years of opiate dependence, poor physical health (at least 13 symptoms on the OTI Health Symptoms Scale (Darke, Ward, Zador, & Swift, 1991)) or current mental symptoms (Global Severity Index GSI of SCL-90-R (Derogatis, 1983, German version: Franke, 1995) of at least 60 points), no participation in substance abuse therapy within the last 6 months, *or* a negative course of maintenance treatment due to continued heroin or cocaine use. Exclusion criteria included serious physical disease that would involve risks for the participant (e.g. known epilepsy or acute bronchial asthma), pregnancy or breastfeeding, custody or imprisonment at the time of registration, or a high likelihood of imprisonment within the next 3 months.

After screening for inclusion and exclusion criteria, baseline data were collected. Subsequently, participants were randomly assigned to the heroin or the methadone treatment program and started study treatment. The study design provided two forms of psychosocial support (psychoeducation/drug counseling and case management/motivational interviewing) to which the participants of both treatment groups were randomly assigned as well (Haasen et al., 2007).

The average age of participants was 36 (SD = 6.7 years). Some 98% were not in regular employment, and 23% reported illegal sources of income. Thirty-five percent reported having been in outpatient rehabilitation, 85% had undergone in-patient rehab, and 89% had experience with maintenance treatment. Seventy-nine percent reported offences committed in the year before treatment, 26% had been imprisoned in the year before treatment. Thirty-four percent were early-onset delinquents, i.e. they had committed at least one of the crimes covered in the interview before the age of 14. Sixty-four percent of the participants had frequently experienced minor physical violence or rarely to frequently heavy physical violence by their parents (frequency*/severity index of the Conflict Tactics Scale (CTS), Straus, 1990, see Sect. "Measures"). The variable "self-confidence" is a standardized factor integrating several scores on personality scales (see below under "measures"). The group's composite scores of the European Addiction Severity Index (ASI: McLellan, Luborsky, & O'Brien, 1980; McGahan, Parente, Parente, & McLellan, 1986; EuropASI: Kokkevi & Hartgers, 1995) at baseline indicated high levels of drug problems (composite score = .53), as well as problems in other areas. Due to the random assignment to the heroin and the methadone group, no significant differences between groups were evident at baseline. Table 1 provides a description of the study participants.

Table 1 Patient characteristics ($N = 1{,}015$)

	Heroin	Methadone	Total
Sociodemographic characteristics			
Gender, number of males (%)	80.0	79.8	79.9
Age (years)	36.2	36.6	36.4
German citizenship (%)	90.8	92.5	91.6
Completed apprenticeship or vocational training (%)	45.5	43.7	44.6
Main source of income legal (%)	5.0	3.8	4.4
Main source of income illegal (%)	22.2	23.6	22.9
Work in the last 30 days, number of days	2.1	1.7	1.9
Criminal biography			
Prior offenses (%)	78.8	79.1	79.0
Prior prison sentence (%)	24.4	27.3	25.9
Early-onset delinquency (%)	32.4	34.8	33.6
Personality characteristics			
Violence in childhood (%)	61.6	66.3	63.9
Self-confidence	0.04	−0.04	0.00
Treatment history			
OIT health scale (0–50)	18.6	19.1	18.9
GSI score, SCL-90-R (*T* value)	68.9	69.7	69.3
Outpatient rehab: lifetime (%)	31.4	34.6	33.0
In-patient rehab: lifetime (%)	85.0	85.3	85.2
Substitution treatment: lifetime (%)	88.1	89.9	89.0
Severity index (ASI composite scores)			
Medical	0.42	0.42	0.42
Employment	0.92	0.92	0.93
Alcohol	0.12	0.12	0.12
Family/social	0.27	0.28	0.27
Psychiatric	0.23	0.24	0.24
Drug	0.52	0.53	0.52
Legal	0.42	0.40	0.41

ASI composite scores range from 0 to 1, with higher scores indicating higher severity (McGahan et al., 1986)

* $p < .05$

Treatment Program

In the model project, heroin was "government-provided" for the sole use within this project: It was dispensed in specially equipped outpatient drug treatment units. Methadone maintenance treatment was provided in existing outpatient clinics. The study treatment program for the heroin group comprised three daily doses of heroin applied

intravenously, medical examinations performed by qualified medical staff, and regular psychosocial support. The methadone group received a once daily oral dose of methadone, and medical examinations and psychosocial support on the same regular basis as in the heroin group. The mean daily dose in the heroin group was $M = 442$ mg of diacetylmorphine with an additional $M = 8$ mg of methadone (mean daily dose over all heroin treatment days). In the methadone group the mean daily dose was $M = 99$ mg of methadone.

Psychosocial support consisted either in case management or in psychoeducation and was administered to both treatment groups. Case management was provided by a drug counselor, who established contact with the patients and maintained this contact throughout the entire treatment period. It involved personal contact at least once a week. Psychosocial treatment, including psychoeducation, consisted of group therapy with 12 standardized sessions over a period of 3 months (see Kuhn et al., 2007).

Some 31% of the methadone patients did not take part in the study treatment at all, perhaps out of disappointment for not receiving any diamorphine. However, since retention rates in both groups dropped evenly after treatment initiation, treatment loyalty was similar. Taking the initial drop-out of methadone patients into account, the 12-month retention rate was 40.0% in the methadone group but 67.2% in the heroin group (Kaplan–Meier survival analysis: Log-Rank = 94.4, DF = 1, $p < 0.001$). The average number of treatment days was $M = 290$ (SD = 124) days in the heroin group and $M = 195$ (SD = 158) days in the methadone group.

Measures

Self-reported Data

The self-reported data were collected using a standardized interview: once prior to randomization and once after an average of 12 months of treatment.

EuropASI The EuropASI (Kokkevi & Hartgers, 1995; McLellan et al., 1980) is a standardized data collection instrument used throughout Europe for the identification of treatment needs of drug addicts. It delivers comprehensive sociodemographic data along with clinical information on the severity of existing problems in seven different categories: physical condition, work and income, drug and alcohol use including cost of using drugs, legal situation, family and social relationships, personal background, and psychological condition. Lifetime and 30-day time windows are used. For each problem area, one or two summarized composite scores are calculated (McGahan et al., 1986).

The EuropASI was modified and supplemented for the study. The following describes the supplementary sections of the questionnaire and the scales applied to the special criminological study.

Crime Lifetime prevalence and 12-month incidence data were collected for 17 offences. Participants were also asked at what age they first committed an offence. The offences were grouped into four crime categories: (1) drug offences: prescription theft, theft of drugs and medication, prescription forgery, pharmacy break-ins, cannabis/medication dealing, heroin/cocaine/LSD/Ecstacy/amphetamines dealing, and bringing drugs into the country; (2) violent crime: bodily harm, bodily harm involving a weapon and robbery of private individuals; (3) property crime and damage to property: shoplifting, theft, breaking into private homes, car break-ins, institutional robbery (e.g. banks), damage to property; (4) fraud (with a broad spectrum of examples cited). For offences involving individual victims (e.g. bodily harm and theft), it was noted that 'all types of cases' should be included: "a stranger, a friend, an acquaintance, a man or woman from the drug scene, e.g. other drug addicts, customers seeking the services of prostitutes." This allowed inclusion of offences committed within the drug scene which would otherwise go unrecorded because they are not reported and the police do not investigate crime within the scene (Kreuzer, Römer-Klees, & Schneider, 1991). Lifetime prevalence, 12-month incidence, and age data were also collected for the time spent in prison (imprisonment or custody).

Victimization Previous studies showed that drug addicts are both perpetrators and victims, at least when they frequent the drug scene, which is shaped by illegality (see also Kreuzer et al., 1991). Hence, experience with victimization is a possible indicator of someone being part of the drug scene. Eight offences were listed related to the individual's experienced victimization: theft, fraud and deception, robbery/extortion, being threatened with a weapon, bodily harm, bodily harm with use of a weapon, rape/sexual harassment, and defrauding prostitutes by refusing to pay the agreed fee.

Exposure to Violence in Childhood Exposure to intrafamily violence during childhood was registered using the violence subscale of the Straus CTS (Straus, 1990). CTS is one of the most widely used data collection tools in research on domestic violence. Its validity and reliability have been tested and confirmed in a wide range of studies (see Straus, 1990). The violence subscale comprises ten items relating to parental behavior such as 'my parents spanked me' and a four-option answer scale ranging from 'never' to 'often.' For this study, the age limit for 'childhood' was set at 10 years old.

Coping Mechanisms To record the coping mechanisms, a scale developed by Brandtstädter and Renner (1990) was used which is based on a two-process model developed by Brandtstädter and team (Brandtstädter & Greve, 1992;

Brandtstädter, Wentura, & Greve, 1993). The model distinguishes two coping styles. In an assimilative coping style, pro-active efforts are made to solve problems without changing goals, standards, or focus (subscale "tenacity/assimilation," 15 items). In an accommodative coping style, reassessment of adaptive preference formation and cognitive restructuring are used to resolve the perceived burdens (subscale "flexibility/accommodation," 15 items).

Self-esteem Rosenberg's (1965) self-esteem scale (ten items) was used to document respondents' self-esteem. The scale has long been established internationally and has been tried and tested for German-speaking countries (Ferring & Filipp, 1996; Rosenberg, Schooler, & Schorenbach, 1989).

Self-control This was recorded using the delayed rewards questionnaire (Utz, 1979). Blass (1983) modified the original scale and reduced the number of items from 20 to 12. Four items selected from the modified scale serve as indicators of the ability to delay a reward. Moreover, Gottfredson and Hirschi's self-control scale was used. In evaluating the self-control scale, a shortened version of the scale by Grasmick, Tittle, Bursik, and Arneklev (1993) was used, which was evaluated satisfactorily on dimensionality, reliability, and validity by Herbers (2002). It comprised the subscales risk-seeking/impulsiveness (six items), temperament (four items), and self-centeredness (four items).

Social support Sommer and Fydrich's (1989) "Fragebogen zur sozialen Unterstützung" (F-SOZU) (Social Support Questionnaire) has become the most commonly used tool in recording perceived support in the German-speaking world. The summarized form containing 22 items (SOZU-K-22) was used for the present study.

Since the flexibility, tenacity, self-esteem, and social support variables were highly correlated, they were combined by factor analysis into a single self-awareness factor (principle component analysis, eigenvalue criterion, explained variance 51.3%). Factor values were saved as a new variable "self-confidence" using the regression method, and this variable was subsequently used in the multivariate analysis.

Police Data on Alleged Criminals

Police data on alleged criminals were collected from the Landeskriminalaemter (state criminal police offices) of the federal states participating in the project. All offences committed during the model project, including date and type of crime, were extracted from the police data bases. Police data on alleged criminals could be gained for 81.3% ($N = 825$) of the entire initial sample, since, due to data protection, participation in this part of the study was optional. Heroin treated group and methadone treated group did not differ on permission to use their police data (81.4 vs. 81.2%).

The police data subsample was comparable to the total sample with respect to sociodemographic characteristics, treatment history, and extent of illegal drug use (see Löbmann, Koellisch, & Kreuzer, 2008). Only the rate of convictions (93.5%) was lower than in the main sample (95.9%; CI 95%: 94.0–97.0%) which might indicate a minor selection effect in aid of a lower degree of criminal behavior of the participants. From the police data on alleged criminals, 12-month prevalence and incidence at T_{-1} and T_{12} were calculated for drug offences, violent crime, property crime/damage to property, and fraud. However, these four crime categories did not exactly correspond to the categories built for the self-report data, because, due to economic reasons, the questionnaire could not cover all the offences registered by the police.

RESULTS

Pre–post-crime Analysis

The following is a comparison of the 12-month prevalence in both treatment groups for the year prior to treatment and the first treatment year. The figures are based on an intention-to-treat analysis (ITT-analysis): calculations were performed for all individuals who were randomly assigned to a treatment group. If a patient dropped out of the treatment program, the baseline value was used to estimate the offences during the treatment year. It is therefore assumed that drop-outs will continue offending at their baseline rate. All calculations were repeated separately for the group of patients completing the treatment (per-protocol analysis, $N = 546$).

Table 2 compares 12-month prevalence and incidence in the pre–post-period in the heroin and in the methadone group for four crime categories (ITT-analysis). Both the heroin and the methadone group showed improvement—the heroin group even more than the methadone group. The percentage of individuals who had committed at least one of the listed offences in the respective year dropped from 79 to 63% in the methadone group and from 79 to 45% in the heroin group. McNemar tests of change revealed significant differences between the pre- and the post-period for both groups (heroin $\chi^2 = 129.36$, $p < .000$; methadone $\chi^2 = 42.95$, $p < .000$). The average number of offences also declined in the heroin group, from $M = 76.7$ to $M = 26.8$; this drop was greater than the drop in the methadone group, where it declined from $M = 79.7$ to $M = 49.9$. The statistical analysis showed a main effect of treatment ($F = 9.83$, $p = .002$) and of time ($F = 179.40$, $p < .000$), and an interaction between the two factors ($F = 11.53$, $p = .001$). With respect to Cohen's d, effect size was "small" to "medium."

Table 2 Self-reported criminal activity pre- and post-program admission

Type of offense		Heroin prescription $N = 515$		Methadone substitution $N = 500$		Effect size
		T_{-1}	T_{12}	T_{-1}	T_{12}	
Drug offenses	%[b,c,d]	66.34	33.20	65.66	47.70	*NNT* = 6.90
	M[e,f,g]	58.30	20.46	62.59	37.61	D = 0.31
	SD	73.23	47.27	77.05	62.99	
Violent crime	%[c,d]	17.93	10.31	19.96	14.03	*NNT* = 26.91
	M[f]	1.04	0.50	1.17	0.48	D = 0.01
	SD	6.32	4.42	6.18	1.81	
Property crime/ damage to property	%[b,c,d]	40.43	23.15	44.67	36.27	*NNT* = 7.60
	M[e,f,g]	14.20	4.87	13.55	10.48	D = 0.22
	SD	35.68	21.04	31.50	29.66	
Fraud	%[c,d]	20.68	7.39	24.07	10.53	*NNT* = 31.92
	M[f]	3.23	0.96	2.55	1.28	D = 0.03
	SD	13.58	8.12	11.69	9.22	
Totals	%[b,c,d]	78.79	45.44	79.12	62.73	*NNT* = 5.78
	M[e,f,g]	76.66	26.76	79.74	49.95	D = 0.33
	SD	90.57	60.08	93.74	78.68	

%, 12-month prevalence (percentage of participants committing crimes during a 12-month period); M, 12-month incidence (mean number of crimes per participant per year); SD, standard deviation of incidence

Tests of prevalences: [a] Significance of difference between groups at T_{-1}; [b] Significance of difference between groups at T_{12}; [c] Significance of difference between T_{-1} and T_{12} in the heroin group; [d] Significance of difference between T_{-1} and T_{12} in the methadone group

Tests of incidences: [e] Main effect group, [f] Main effect time, [g] Interaction

Level of significance $p < .05$

NNT, Number needed to treat

The results of the per-protocol analysis indicated the same trend and were even more marked: 12-month prevalence dropped from 79 to 59% in the methadone group and from 76 to 38% in the heroin group. The average number of offences dropped from $M = 74.1$ to $M = 14.9$ in the heroin group and from $M = 82.3$ to $M = 37.0$ in the methadone group.

Individual offences were compared by calculating effect sizes as Numbers Needed to Treat (NTT) for 12-month prevalence and as Cohen's d for 12-month incidence. NTT stands for the mean number of patients needed to be treated to prevent one negative incident. It is calculated here as the inverse of the absolute risk reduction, the inverse of the difference between 12-month prevalence of offences at T_{12} in the methadone and in the heroin group. There are no conventions about the meaning of different sizes of NTT values, rather NTT values should be compared only within the same study. However, smaller NTT values denote a larger treatment effect.

Table 2 shows that NTT values of drug offences and property crime are much lower than NTT values of violent crimes and fraud: While heroin treatment leads to abstinence from drug offences in every sixth to seventh additional patient (compared to the methadone group) and to abstinence from property crime in every seventh to eighth additional patient, the advantage regarding violent crimes (NTT = 26.9) and fraud (NTT = 31.9) is only small. Thus, individual offences follow two different patterns as regards prevalence trends. In one set of offences, crime decreased in both treatment groups, and the decrease was equally pronounced in both groups. This held true for violent offences and fraud. In another set of offences, crime decreased in both treatment groups, but the decrease was more pronounced in the heroin group. This held true for drug offences and property crime.

The superiority of the heroin-assisted treatment group with respect to reduced drug offences and property crime was validated by the analysis of police data on alleged criminals (see Table 3). For violent crimes and fraud there was no remarkable difference between groups. Overall, the percentage of individuals who had been registered by police for at least one of the listed offences in the previous year dropped from 53.5 to 41.3% in the heroin group (Mc-Nemar-test: $\chi^2 = 16.80$, $p < .000$), whereas no significant change occurred in the methadone group (pre = 50.7%, post = 51.5%) (Mc-Nemar-test: $\chi^2 = .028$, $p < .866$). Effects on the police data on alleged criminals occurred mainly in the prevalence rates; the incidence rates showed only very small changes. The smaller effect compared with the self-reported data is due to a low rate of

Table 3 Police-recorded criminal activity pre- and post-program admission

Type of offense		Heroin prescription $N = 419$		Methadone substitution $N = 406$		Effect size
		T_{-1}	T_{12}	T_{-1}	T_{12}	
Drug offenses	%[b,c,d]	38.66	29.12	35.22	36.21	NTT = 14.10
	M[e,f,g]	0.83	0.64	0.81	0.80	$D = 0.10$
	SD	1.63	1.49	1.60	1.62	
Violent crime	%[c,d]	8.59	6.68	7.64	8.62	NTT = 51.60
	M[f]	0.12	0.10	0.10	0.12	$D = 0.04$
	SD	0.42	0.44	0.40	0.45	
Property crime/ damage to property	%[b,c,d]	31.98	22.91	28.57	30.79	NTT = 12.70
	M[e,f,g]	0.76	0.71	0.83	1.03	$D = 0.12$
	SD	1.71	2.56	3.01	2.65	
Fraud	%[c,d]	5.25	4.30	5.91	6.16	NTT = 53.71
	M[f]	0.08	0.05	0.10	0.10	$D = 0.12$
	SD	0.47	0.27	0.52	0.51	
Totals	%[b,c,d]	53.46	41.29	50.74	51.48	NTT = 9.81
	M[e,f,g]	1.79	1.51	1.84	2.06	$D = 0.16$
	SD	2.77	3.39	4.02	3.70	

%, 12-month prevalence (percentage of participants committing crimes during a 12-month period), M = 12-month incidence (mean number of crimes per participant per year), SD, standard deviation of incidence

Tests of prevalences: [a] Sig. difference between groups at T_{-1}, [b] Sig. difference between groups at T_{12}, [c] Sig. difference between T_{-1} and T_{12} in the heroin group, [d] Sig. difference between T_{-1} and T_{12} in the methadone group

Tests of incidences: [e] Main effect group, [f] Main effect time, [g] Interaction

Level of significance $p < .05$

detection making police data less sensitive to changes: Individuals, who were delinquent before treatment but not detected, might have stopped committing crimes due to treatment. However, in the police statistics, they will be treated as non-delinquents in the pre-period as well as in the post-period. Thus, positive changes attributable to treatment will be masked (see, Löbmann et al., 2008).

Explanatory Analysis of Crime During Treatment Period

For a better understanding of the determinants of crime during heroin treatment, a multivariate logistic regression model was employed. The dependent variable was the prevalence of all offences during the 1-year post-admission period. In order to reduce influence of social desirability police data and self-reported data were combined into a single dependent variable assigning a "1" whenever he or she was identified as having committed a crime in at least one of the two data sources and a "0" if he or she had not committed an offence in either data source. Prevalence was chosen over incidence because of two reasons: First, self-reported incidence data turned out to be less reliable than prevalence data (see Köllisch & Löbmann, 2008) which is probably due to the fact that remembering details such as the number of crimes committed during the past 12 months has serious limitations especially for long-term opiate users whose cognitive abilities may be somewhat deteriorated. Second, police detection rate is only very low which leads to a large underestimation of incidence rates in this data source. It is more likely that police will detect a criminal committing several offences at least once rather than that police will detect every offence of his.

The model variables explaining crime was based on the hypothesis that decline in the prevalence of criminal offences following admission to the heroin prescription program would be related to (a) treatment variables: heroin versus methadone, retention rate (b) mediator variables (among others, general stabilization of living circumstances and decreasing drug and alcohol consumption); (c) control variables (gender, age, extent of drug and alcohol use before treatment, violence in childhood, self-confidence); and (d) criminal history (prior offences, prior prison sentence, early-onset delinquency).

Technically, the analysis of control and criminal history variables was performed prior to the mediator analysis in a separate logistic regression. This two-stage approach was chosen to filter out irrelevant control variables. It also ensured an appropriate number of variables to match the sample size (see Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996). The outcome is stable compared with a one-off logistic regression for all variables (both by the

inclusion method and the backward conditional method). It should be noted that a number of variables had to be removed during the analysis process due to multicollinearity: extent of drug use, extent of alcohol use, low resistance to delayed rewards. Retention rate was kept in the analysis although it correlated highly with treatment group in order to adjust for selection bias.

Thus, an explorative logistic regression with stepwise elimination of non-significant predictors was performed with the treatment, control, and criminal history variables. The type of treatment (heroin versus methadone) showed a substantial relationship with crime in the first year of treatment ($B = .340$; OR = 1.405; $p = .000$). Additionally, a high retention rate contributed to less delinquency at T_{12} ($B = -.259$; OR = 772; $p = .001$). The other factors refer to criminal biography—early-onset delinquency ($B = .172$; OR = 1.188; $p = .023$), 12-month prevalence of all offences in the year prior to treatment ($B = .458$; OR = 1.581; $p = .000$) and 12-month prevalence of arrests in the year prior to treatment ($B = .166$; OR = 1.188; $p = .032$).

Table 4 describes the mediators and displays their mean values in both groups at T_{-1} and T_{12} as well as the effect sizes for the differences between treatment groups at T_{12}. There are two mediators dealing with use of psychoactive substances (drug use and alcohol use), and three mediators measuring different aspects of involvement in the drug scene: drug use of family and friends, time spent in drug scene, and victimization. According to Kreuzer et al. (1991), drug addicts who frequent the drug scene often take on a dual role as perpetrators and victims. Therefore, victimization may also be an indicator of involvement with the drug scene. Finally, three mediators measure living circumstances: relationship, economic, and living situation.

Although there seems to be some improvement in both groups regarding the extent of drug use, drug use of family and friends, time spent in drug scene, victimization, and economic situation, the improvement in the heroin group is considerably greater regarding drug use ($D = .63$), and somewhat better regarding time spent in drug scene ($D = .23$) and victimization (NNT = 11.8). For the multivariate analysis difference values were calculated from the T_{-1} and T_{12} variables and used as predictors in logistic regression (see below).

Mediators correlate with each other only with values below $R = .100$, which is good for the statistical analysis as multicollinearity seems to be low. Low correlations also mean that the mediators seem to measure different dimensions of the potential constructs: Alcohol and drug use (use of psychoactive substances) did not correlate substantially, neither did drug use of family and friends, time spent in drug scene, and victimization. An exception

Table 4 Descriptive statistics of potential mediating variables in both groups at T_{-1} and T_{12}

Variable	Definitions		Heroin		Methadone		Total		
			T_{-1}	T_{12}	T_{-1}	T_{12}	T_{-1}	T_{12}	D
Drug use	ASI composite score	*M*	0.38	0.16	0.39	0.24	0.38	0.20	0.64
		SD	0.10	0.12	0.10	0.13	0.10	0.13	
Alcohol use	ASI composite score	*M*	0.12	0.10	0.12	0.13	0.12	0.11	0.15
		SD	0.18	0.18	0.19	0.21	0.19	0.19	
Drug use of family and friends	Five-point scale[a], min = 0, max = 5	*M*	1.26	1.11	1.26	1.19	1.26	1.15	0.06
		SD	1.37	1.33	1.31	1.30	1.34	1.31	
Time spent in drug scene	Number of days spent in scene[b]	*M*	18.9	5.97	19.1	8.43	19.0	7.17	0.23
		SD	11.7	9.80	11.7	11.2	11.7	10.60	
Victimization	12-month prevalence for all victimization	%	77.4	54.9	73.2	63.3	75.3	59.0	[c]
Relationship situation	Four-point scale[d], min = 1, max = 4	*M*	1.93	1.97	1.89	1.91	1.91	1.94	-
		SD	1.24	1.28	1.23	1.24	1.24	1.26	0.05
Economic situation	ASI composite score	*M*	0.91	0.87	0.92	0.86	0.92	0.85	-
		SD	0.23	0.22	0.21	0.29	0.23	0.30	0.04
Living situation	Fixed place	%	76.6	87.3	76.7	86.1	76.7	86.6	[e]

[a] Scale comprising five dichotomous variables on drug/alcohol misuse of family and friends, partner consumes drugs yes/no, cohabitee consumes drugs yes/no, majority of people participants spend free time with consume drugs yes/no, majority of trustworthy persons consume drugs yes/no (Cronbach's alpha = .720)

[b] Reference over 30 days

[c] NNT = 11.8

[d] Living alone to permanently cohabiting

[e] NNT = 69.7

was the relationship between decrease of time spent in drug scene and decrease of drug use ($R = .262$). In comparison with the other correlations, this one seemed to be more substantial, which is explained by the fact that time spent in drug scene may partly be spent buying drugs for own use.

Next, a mediator analysis following the steps of Baron and Kenny (1986) was performed. First, the correlation between type of treatment as independent variable and 12-month prevalence of all offences at T_{12} (combined from police-data and self-reported-data, see above) as dependent variable was verified in a logistic regression analysis using only these two variables ($B = .359$, $p = .000$). Next, multiple regression analyses with the mediators as outcome variables and the type of treatment as independent variable were performed to check for the correlations between the initial variable and the potential mediators. Regression analysis had to be used here because outcome variables were not dichotomous. A significant relationship with type of treatment was observed for decrease of illegal drug use (standardized $B = -.231$, $T = -6.544$, $p = .000$), decrease of alcohol use (standardized $B = -.116$, $T = -3.216$, $p = .001$), decrease of time spent in drug scene last 30 days (standardized $B = -.088$, $T = -2.436$, $p = .015$), and decrease of victimization (standardized $B = -.108$, $T = -2.980$, $p = .003$), but not for decrease of drug use of family and friends, improved relationship situation, improved living situation, and improved economic situation which were therefore dropped from the analysis. Finally, the relationship between the mediators and the dependent variable was checked. To this goal, type of treatment as independent variable, the significant control, and criminal history variables together with all remaining mediator variables were incorporated by the inclusion method into a final logistic regression. The results of the mediator analysis are shown in Table 5.

Among the mediator variables, decrease of victimization experienced by the subject ($B = -.270$; $p = .001$ and decrease of illegal drug use ($B = -.220$; $p = .011$) showed a significant negative relationship with prevalence of criminal offences. As treatment group is still significant, but has a smaller beta value than when used as a single predictor, both factors can be said to partially mediate the treatment effect on crime prevalence. Meanwhile decrease of time spent in drug scene and decrease of alcohol use turned out not to mediate the relationship between kind of treatment and crime in the multivariate model.

As the univariate results showed no difference between heroin-assisted treatment and methadone treatment for violent crime and fraud but only for drug offences and property crime, separate analyses were conducted only for the latter two types of crime. The results for drug offences were basically the same as in the overall analysis (decrease of victimization: $B = -.249$; OR = .780; $p = .004$; decrease of illegal drug use: $B = -.223$; OR = .800; $p = .051$). The analysis of property crime revealed time spent in drug scene as an additionally important factor ($B = -.185$; OR = .831; $p = .039$): Opiate addicts spending less time in the drug scene were less likely to commit acquisitive crime. Decrease of victimization ($B = -.162$; OR = .850; $p = .056$) and decrease of illegal drug use ($B = -.168$; OR = .854; $p = .060$) just missed significance in this model and contributed less to the explanation of crime than in the overall analysis.

Table 5 Logistic regression using inclusion method for mediators (N = 862) on 12-month prevalence for all offences (variable combining police and self-reported data)

Variables	B	p	OR
Mediators			
Decrease of illegal drug use	−.220	.011	.802
Decrease of alcohol use	.068	.554	1.071
Decrease of time spent in drug scene last 30 days	.048	.581	1.050
Decrease of victimization	−.270	.001	.764
Treatment, control, and criminal history variables			
Type of treatment (methadone)	.232	.007	1.261
Retention rate	−.282	.001	.755
12-month prevalence for all offences at baseline	.499	.000	1.647
12-month prevalence for arrests at baseline	.196	.020	1.216
Early-onset delinquency	.153	.061	1.165

Nagelkerkes $R^2 = 0.180$; Hosmer-Lemeshow-test: $\chi^2 = 5.726$, $p = .678$

Another analysis was conducted to further explore the role of involvement in the drug scene: a comparison of patients who did not spend-time on the drug scene (defined as zero days in drug scene during last month) and patients still involved in the drug scene (defined at 1 or more days in drug scene during last month) found marked differences regarding the use of psychoactive substances and other indicators of involvement in the drug scene (Table 6): patients who avoided the drug scene consumed considerably less drugs ($D = .80$) and were much less victimized (NNT = 4.20). Small differences were also found for alcohol use ($D = .32$) and drug use of family and friends ($D = .27$).

DISCUSSION

This study dealt with a major social issue: the chronic high rate of criminal offending of heroin addicts. It investigated the effects of a new kind of outpatient therapy, the heroin-assisted treatment for severely dependent opiate users. The results showed a clear crime-reducing effect of this kind of treatment. With regard to drug offences and property crime

Table 6 Descriptive statistics of potential mediating variables for patients withdrawn from the drug scene versus patients still involved in drug scene at T_{12}

Variable	Definitions		Involved $N = 418$	Not involved $N = 499$	Effect sizes
Drug use	ASI composite score	*M*	.25	.15	$D = .80$
		SD	.13	.12	
Alcohol use	ASI composite score	*M*	.14	.08	$D = .32$
		SD	.21	.16	
Drug use of family and friends	Five-point scale[a] (min = 0, max = 4)	*M*	1.31	.96	$D = .27$
		SD	1.37	1.23	
Victimization	12-month prevalence for all victimization	%	67.9	44.3	NNT = 4.20
Relationship situation	Four-point scale[b] (min = 1, max = 4)	*M*	1.97	1.90	$D = .06$
		SD	1.27	1.25	
Economic situation	ASI composite score	*M*	.88	.83	$D = .17$
		SD	.26	.34	
Living situation	Fixed place	%	82.3	91.2	NNT = − 10.45

[a] Scale comprising four dichotomous variables on drug/alcohol misuse of family and friends. partner consumes drugs yes/no, cohabitee consumes drugs yes/no, majority of people participants spend free time with consumes drugs yes/no, majority of trustworthy persons consume drugs yes/no (Cronbach's alpha = .720)

[b] Living alone to permanently cohabiting

the effect was even greater in the heroin group than in the methadone group. For violent crimes and fraud, self-reported data showed an equal decline in both groups. However, police data on alleged criminals only found a decrease in the heroin and not in the methadone group. This difference might be due to the limitations of either data source: social desirability and memory deficits on the self-report side, and low detection rate on the police side. Therefore, a conservative interpretation of the results would be that heroin maintenance reduces different types of crime but is superior to methadone maintenance only for drug offences and property offences.

One of the questions arising is whether these results can be generalized to other groups and cultures. We know of three recent studies investigating the effects of heroin-assisted treatment on crime in other countries: the Swiss study by Killias et al. (2002), the Dutch study by van den Brink et al. (2002; see also Dijkgraaf et al., 2005), and the Spanish study by March et al. (2006). They all found a considerable decline of crime related to heroin-assisted treatment. However, Switzerland and the Netherlands have a history of more liberal politics toward illegal drugs than Germany: for example, heroin-assisted treatment has now been conducted in Switzerland for several years and is widely supported by the Swiss population; in Germany, diamorphine is still not registered and was only licensed for the model project described in this study. In the Netherlands, the possession of small amounts of cannabis has not been prosecuted since 1976 and in Germany only since 1994. Moreover, there are differences between the populations. For example, the Netherlands have a history of colonization and hence many immigrants from Surinam and the Netherlands Antilles. These people inhale heroin ("chasing the dragon") rather than injecting it. The positive results of heroin prescription is also observed in heroin inhalers (see Uchtenhagen et al., 1999). In Spain, too, the heroin is predominantly inhaled; in Germany, the majority of heroin addicts inject the drug. Thus, the effects of this treatment do not seem to be limited to a specific country or culture. It is reasonable to expect similar success in other countries, e.g. Canada (where a model project is currently running, see Fischer et al. 2007) or the United States. One argument advanced against the feasibility of this treatment in the United States is that European societies are supposed to be fairly homogeneous and rule-abiding, where program operators can be trusted and even heroin addicts can be expected to follow rules, whereas American addicts would not be capable of meeting the demands imposed by a three times a day clinic attendance. It is true that Swiss addicts are less violent than their American counterparts (see Reuter & MacCoun, 2002), but German addicts have considerably higher rates of violent offences than Swiss addicts (Köllisch, 2007) and still benefit from heroin-assisted treatment.

Although heroin-assisted treatment was found to be the most effective maintenance treatment for opiate addicts, this kind of treatment is still politically controversial (Fischer et al. 2007; Rehm & Fischer 2008; McKeganey 2008). In Germany, the introduction of heroin-assisted treatment into the general health care system is still under discussion. The most powerful argument against heroin-assisted treatment brought in by politicians of the conservative party is the higher costs in comparison to methadone

treatment. The substance diacetylmorphine has not been approved so far (though there was a positive decision by the respective authority in August 2006). Currently, heroin-assisted treatment is delivered in seven cities that originally participated in the randomized trial. The treatment is regulated by the German narcotics act, which allows heroin-assisted treatment only as an exception under very restricted conditions. Only three cities plan to admit new patients. The inclusion criteria are similar to the study conditions. At present (spring 2008), about 275 patients are undergoing heroin-assisted treatment in Germany. In the Netherlands, diacetylmorphine was approved by the end of 2006 (after completing the randomized trial in 2003). Both kinds of substances, the inhalable and the injectable form, were registered for the treatment of opiate dependence.

With respect to the different theories explaining the correlation between drug use and crime, it might be asked what the multivariate results imply for the influencing effects of heroin prescription on crime. As drug offences are expected to decline with treatment, and violent crimes and fraud showed no differences between treatment groups we focus on the effects on property crime in this part of the discussion. The prevalence of all these crimes decreased during treatment with either methadone or heroin—with a greater decline of property crimes in the heroin group, mediated by a decline in drug use, victimization, and time spent in the drug scene. This is partly in support of the most popular theory that crime results from the need to obtain drugs. As heroin-assisted treatment leads to less illegal drug use, the need to obtain drugs and hence drug-related acquisitive crime is also less. Therefore, the theory that crime comes first and that drug addiction is an accompanying phenomenon is not supported; if it were the case, less drug use would not engender less criminal offences. Moreover, results on victimization and time spent in the drug scene point to the fact that avoidance of the drug scene may be another important mediator in reducing acquisitive crime. It reflects participants' efforts toward stabilization and reintegration to avoid exposing themselves to cues eliciting illegal behavior as they are present in the drug scene, for example, offers to buy illegal drugs or opportunities to deal with them.

Although no substantial effects on social integration indicators such as relationship, economic, and living situation were found, withdrawal from the drug scene may be the first step toward improvement in these areas. Effects might be found after a longer observation period regarding the effects of treatment. In fact, two-year follow-up data of the heroin group are already available and the preliminary analysis reveals that the relationship situation is a significant predictor of the prevalence of criminal offences at T_{24}.

Very few studies on heroin prescription or methadone maintenance aim at explaining the reduction of crime. To our knowledge, only two studies took other predictors than treatment into account to explain crime. Ribeaud (2005) investigated a sample of 302 Swiss heroin patients analyzing 12-month longitudinal data. He investigated potential parallel developments of individual decrease of criminal offences and social integration (legal income, employment, stable housing situation). He observed a substantial decrease of criminal offences but concluded that this decrease was not due to social integration but a mere effect of replacing illegal with legal heroin resulting in a reduction of acquisitive crime. In our study we also found no mediating effects of the relationship, economic, and living situation on crime.

Rothbard et al. (1999) attempted to explain the effects of methadone maintenance on crime. The arrest rate of 126 methadone patients was significantly predicted in a logistic regression by decrease of cocaine use, prior criminality, and retention rate. Decrease of illegal drug use and indicators of prior crime were found to be significant predictors in the present study, too. Retention rate correlated highly with the kind of treatment (heroin versus methadone) and was excluded from the final analysis due to issues of multicollinearity. In general, our results seem to fit quite well with those reported by Rothbard and colleagues.

This study is subject to certain limitations. One limitation is that effects were not tested against a no-treatment control group. On the other hand, methadone is known to reduce criminality that makes the study a conservative test—it may actually understate the benefits of heroin maintenance relative to addicts getting no treatment at all. Moreover, results gain even more importance when taking into account that a random assignment was used, multiple data resources were taken into account, and ITT compared to per-protocol analysis was employed.

Another limitation is that treatment could not be administered in a double-blind design. Rather, patients in the heroin group as well as in the methadone group knew which substance they were receiving. This in turn led to a larger drop-out rate for methadone patients being disappointed for not getting heroin. On the other hand, it is virtually impossible to comply with the requirements of a double-blind design in studies that compare the efficacy of diamorphine (heroin) and other maintenance substances (or even placebos) (Bammer, Dobler-Mikola, Fleming, Strang, & Uchtenhagen, 1999). Experienced users always recognize the study medication. Also the different durations of the pharmacological effects and the modes of administration of diamorphin and methadone could not be masked. Thus, the larger drop-out rate in the methadone treatment group had to be expected. The statistical analysis took care of this problem replacing missing outcome data with baseline data. Moreover, baseline data of drop-outs were compared to those of completers in separate analyses (cp. Verthein et al., 2007, p.

127). There were only very few demographic and substance abuse characteristics differing between those groups: Completers had a more stable social situation with respect to living and relationship situation. Drop-outs on the other hand had a higher cocaine use. No differences were found with respect to experience with other prior treatments. This held true for differences between drop-outs and completers in the methadone as well as in the heroin group.

Moreover, there were two confounds in the treatment assignment: First, the heroin treatment was administered in different clinics than the methadone treatment. Second, methadone was given in one daily dose but heroin was given in three daily doses. Administering the medication in different clinics was unfortunate but unavoidable considering the logistical, legal, and economic constraints required to run a heroin maintenance clinic. The frequency of daily visits could of course have an effect on the results in that patients with three visits get more care and are more likely to establish personal relationships with the employees. On the other hand, coming three times a day also requires greater effort and requires adjusting one's daily life to strict rules superimposed by others.

To conclude, the larger effects of heroin-assisted treatment on drug-related acquisitive crime are mediated mainly by a substantial decrease in illegal drug use. Additionally, the patients' efforts toward stabilization and reintegration are reflected by their withdrawal from the drug scene.

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REFERENCES

Bammer, G., Dobler-Mikola, A., Fleming, P. M., Strang, J., & Uchtenhagen, A. (1999) The heroin prescribing debate: Integrating science and politics. *Science, 284*, 1277–1278.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173–1182.

Blass, W. (1983). Stabilität und Spezifität des Belohungsaufschubs von Straftätern. [Stability and specificity of delay of rewards in offenders] In H.-J. Kerner, H. Kury, & K. Sessar (Hrsg.), *Deutsche Forschungen zur Kriminalitätsentstehung und Kriminalitätskontrolle [German research on development and control of crime]*, Bd. 6/1 (S. 640–680). Freiburg i. Br.: Max-Planck-Institut für ausländisches und internationales Strafrecht.

Brandtstädter, J., & Greve, W. (1992). Das Selbst im Alter: adaptive und protektive Mechanismen. [The aging self: Adaptive and protective mechanisms.] *Zeitschrift für Entwicklungspsychologie und Pädagogische Psychologie, 23*, 269–297.

Brandtstädter, J., Wentura, D., & Greve, W. (1993). Adaptive resources of the aging self: Outlines of an emergent perspective. *International Journal of Behavioral Development, 16*, 323–349.

Brandtstädter, J., & Renner, G. (1990). Tenacious goal pursuit and flexible goal adjustment: Explication and age-related analysis of assimilative and accommodative strategies of coping. *Psychology and Aging, 5*, 58–67.

Bundeskriminalamt (2005). Polizeiliche Kriminalstatistik 2005. Bundesrepublik Deutschland [Police Crime Statistics 2005. Federal republik of Germany]. Available at http://www.bka.de/pks/pks2005/index.html. Accessed 14 May 2008.

Coid, J. (2002). Opiates and criminal behaviour—a review of the literature. In J. Coid, A. Carvell, Kittler, A. Healey, & J. Henderson (Eds.), *Opiates, criminal behavior, and methadone treatment*. London: Home Office.

Collins, J. J., Hubbard, R. L., & Rachal, J. V. (1985). Expensive drugs use and illegal income: A test of explanatory hypotheses. *Criminology, 23*, 743–764.

Collins, J. J., & Messerschmidt, P. M. (1993). Epidemiology of alcohol-related violence. *Alcohol Health and Research World, 17*, 93–100.

Darke, S., Ward, J., Zador, D., & Swift, G. (1991). A scale for estimating the health status of opioid users. *British Journal of Addiction, 86*, 1317–1322.

Derogatis, L. R. (1983) *SCL-90-R: Administration, scoring and procedures. Manual II*. Towsen, MD: Clinical Psychometric Research.

Dijkgraaf, M. G., van der Zanden, B. P., de Borgie, C. A., Blanken, P., van Ree, J. M., & van den Brink, W. (2005). Cost utility analysis of co-prescribed heroin compared with methadone maintenance treatment in heroin addicts in two randomised trials. *British Medical Journal, 330*, 1297.

Egg, R. (Hrsg.) (1999). Drogenmißbrauch und Delinquenz. Kriminologische Perspektiven und praktische Konsequenzen. [Misuse of illegal drugs and delinquency. Criminological perspectives and practical consequences.] Berichte, Materialien, Arbeitspapiere aus der Kriminologischen Zentralstelle (Heft 15). Wiesbaden: Eigenverlag der Kriminologischen Zentralstelle.

Fagan, J. (1989). The social organization of drug use and drug dealing among urban gangs. *Criminology, 27*, 633–669.

Ferring, D., & Filipp, S.-H. (1996). Messung des Selbstwertgefühls: Befunde zu Reliabilität, Validität und Stabilität der Rosenberg-Skala. [Measurement of self-esteem. Results on reliability, validity, and stability of the Rosenberg-Scale] *Diagnostica, 42*, 284–292.

Franke, G. (1995). *SCL-90-R: Die Symptom-Checkliste von Derogatis—Deutsche Version: Manual. [The symptom-checklist by Derogatis—German version: Manual.]* Göttingen: Beltz Test.

Fischer, B., Oviedo-Joekes, E., Blanken, P., Haasen, C., Rehm, J., Schechter, M. T., et al. (2007). Heroin-assisted treatment (HAT) a decade later: a brief update on science and politics. *Journal of Urban Health, 84*, 552–562.

Grasmick, H. G., Tittle, C. R., Bursik, R. J., & Arneklev, B. J. (1993). Testing the core empirical implications of Gottfredson and Hirschi's General Theory of Crime. *Journal of Research in Crime and Delinquency, 30*(1), 5–29.

Haasen, C., Verthein, U., Degkwitz, P., Berger, J., Krausz, M., & Naber, D. (2007). Heroin-assisted treatment for opioid dependence: Randomised controlled trial. *British Journal of Psychiatry, 191*, 55–62.

Hammersley, R. H., Forsyth, A., Morrison, V., & Davies, J. B. (1989). The relationship between crime and opioid use. *British Journal of Addiction, 84*, 1029–1043.

Harrell, A. V. (1985). Validation of self-report: The research record. In B. A. Rouse & N. J. Kozel (Eds.), *Self-report methods of estimating drug use: Meeting current challenges to validity.* NIDA Research Monograph 57 (pp. 12–21).

Herbers, K. (2002). Das latente Konstrukt Selbstkontrolle in der „General Theory of Crime" Eine Analyse der Dimensionalität, Reliabilität und Validität der Selbstkontrollskala von Grasmick et al. (1993). [The latent construct self-control in the "General Theory of Crime". An analysis of the dimensionality, reliability,

and validity of the self-control scale by Grasmick et al.] Unveröffentlichte Diplomarbeit an der Universität Bremen, Studiengang Psychologie.

Hser, Y.-I., Anglin, M. D., & Powers, K. (1993). A 24 year follow-up of California narcotics addicts. *Archives of General Psychiatry, 50*, 577–584.

Khantzian, E. J. (1985). The self-medication hypothesis of addictive disorders: Focus on heroin and cocaine dependence. *American Journal of Psychiatry, 142*, 1259–1264.

Killias, M., Aebi, M. F., Ribeaud, D., & Rabasa, J. (2002). Schlussbericht zu den Auswirkungen der Verschreibung von Betäubungsmitteln auf die Delinquenz von Drogenabhängigen [Final report on the effects of prescription of narcotics on the deliquency of drug addicts] (3. Auflage mit Langzeitanalysen). Lausanne: Institut de police scientifique et de criminologie.

Köllisch, T. (2007). *Die heroingestützte Behandlung Opiatabhängiger—auch ein Erfolgsmodell zur Reduktion von Gewaltdelikten? [Heroin-assisted treatment—also a way for the reduction for violent offences?]* Paper presented at the 10th Scientific Meeting of the New Criminological Society (NKG) „Drugs-Addiction—Crime" in Innsbruck.

Köllisch, T., & Löbmann, R. (2008). Der Einfluss diamorphingestützter Behandlung auf die Delinquenz Opiatabhängiger [The influence of diamorphine-assisted treatment on the delinquency of opiat addicts]. *Monatsschrift für Kriminologie und Strafrechtsreform, 1*, 38–55.

Kokkevi, A., & Hartgers, C. (1995). EuropASI: European adaptation of a multidimensional assessment instrument for drug and alcohol dependence. *European Addiction Research, 1*, 208–210.

Kreuzer, A., Römer-Klees, R., & Schneider, H. (1991). *Beschaffungskriminalität Drogenabhängiger. [Acquisitive crime of drug addicts.]* Wiesbaden: BKA.

Kuhn, S., Schu, M., Vogt, I., Schmid, M., Simmedinger, R., Schlanstedt, G., et al. (2007) Die psychosoziale Behandlung im bundesdeutschen Modellprojekt zur heroingestützten Behandlung Opiatabhängiger [Psychosocial care in the German model project on heroin-maintenance therapy for opiate dependence.] *Sucht, 53*(5), 278–287.

Löbmann, R., Köllisch, T., & Kreuzer, A. (2008). Der Einfluss der Diamorphinbehandlung auf Kriminalität und Delinquenz Opiatabhängiger. [The influence of diamorphin treatment on criminality and delinquency of opiate addicts.] In: Bundesministerium für Gesundheit (BMG) (Hrsg.) *Das bundesdeutsche Modellprojekt zur heroingestützten Behandlung Opiatabhängiger. Band 2.* Baden-Baden: Nomos.

MacCoun, R., Kilmer, B., & Reuter, P. (2003). Research on drugs-crime linkages: The next generation. In National Institute of Justice (Ed.), *Toward a drugs and crime research agenda for the 21st century* (pp. 65–95). Washington, DC: National Institute of Justice.

March, J. C., Oviedo-Joekes, E., Perea-Milla, E., Carrasco, F., & the PEPSA team (2006). Controlled trial of prescribed heroin in the treatment of opioid addiction. *Journal of Substance Abuse Treatment, 31*, 203–211.

McGahan, P. L., Parente, J. A., Parente, R., & McLellan, A. T. (1986). *Addiction severity index. Composite scores manual.* Philadelphia, PA.

McGlothlin, W. H., Anglin, D., & Wilson, B. D. (1978). Narcotic addiction and crime. *Criminology, 16*, 293–316.

McKeganey, N. (2008). Should heroin be prescribed to heroin misusers? No. *British Medical Journal, 336*, 71.

McLellan, A. T., Luborsky, L., & O'Brien, C. P. (1980). An improved evaluation instrument for substance abuse patients. The addiction severity index. *Journal of Nervous and Mental Disease, 168*, 26–33.

Nurco, D. N. (1998). A long-term program of research on drug use and crime. *Substance Use and Misuse 33*, 1817–1837.

Nurco, D. N., Shaffer, J. C., Ball, J. C., & Kinlock, T. W. (1984). Trends in the commission of crime among narcotic addicts over successive periods of addiction. *American Journal of Drug and Alcohol Abuse, 10*, 481–489.

Parker, R., & Auerhahn, K. (1998). Alcohol, drugs, and violence. *Annual Review of Sociology, 24*, 291–311.

Peduzzi, P., Concato, J., Kemper, E., Holford, T. R., & Feinstein, A. R. (1996). A simulation of the number of events per variable in logistic regression analysis. *Journal of Climical Epidemiology, 99*, 1373–1379.

Rehm, J., & Fischer, B. (2008). Should heroin be prescribed to heroin misusers? Yes. *British Medical Journal, 336*, 70.

Reuter, P., & MacCoun, R. (2002). Heroin maintenance: Is a U. S. experiment needed? In D. Musto (Ed.), *One hundred years of heroin* (pp. 159–180). Westport, CT: Greenwood.

Ribeaud, D. (2005). Gibt es einen Delinquenzrückgang durch soziale Reintegration im Rahmen der schweizerischen Heroinverschreibungsversuche? [Is there a reduction of delinquency in the Swiss heroin trial because of social reintegration?]. *Sucht, 51*(2), 76–87.

Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.

Rosenberg, M., Schooler, C., & Schorenbach, C. (1989). Self-esteem and adolescent problems: Modeling reciprocal effects. *American Sociological Review, 54*, 1004–1018.

Rothbard, A., Alterman, A., Rutherford, M., Liu, F., Zelinski, S., & McKay, J. (1999). Revisiting the effectiveness of methadone treatment on crime reductions in the 1990s. *Journal of Substance Abuse Treatment, 16*(4), 329–335.

Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science, 277*, 918–924.

Skogan, W. G. (1990). *Disorder and decline: Crime and the spiral of decay in American neighborhoods*. Berkeley: University of California Press.

Sommer, G., & Fydrich, T. (1989). *Soziale Unterstützung. Diagnostik, Konzepte, F-SOZU. [Social support. Diagnosis, concepts, F-SOZU.]* Tübingen: Deutsche Gesellschaft für Verhaltenstherapie.

Strauss, M. A. (1990). Measuring intrafamily conflict and violence: The conflict tactics (CT9 scales). In M. A. Strauss & R. J. Gelles (Eds.), *Physical violence in American families* (pp. 29–47). New Brunswick: Transaction.

Uchtenhagen, A., Dobler-Mikola, A., Steffen, T., Gutzwiller, F., Blättler, R., & Pfeifer, S. (1999). *Prescription of narcotics for heroin addicts*. Basel: Karger.

Utz, H. E. (1979). *Empirische Untersuchungen zum Belohnungsaufschub. Ein Beitrag zur Konstruktvalididierung. [Empirical investigations on delay of reward. A contribution to construct validity.]* München: Minerva.

van den Brink, W., Hendriks, V. M., Blanken, P., Huijsman, I. A., & van Ree, J. M. (2002). *Medical co-prescription of heroin. Two randomized controlled trials.* Utrecht: Central Committee on the Treatment of Heroin Addicts. http://www.ccbh.nl.

Verthein, U., Degkwitz, P., & Haasen, C. (2007). Die Wirksamkeit der Diamorphinbehandlung im Vergleich zur Methadonsubstitution—Ergebnisse der 1. und 2. Studienphase. [The effectiveness of diamorphine treatment compared with methadone substitution—results of the 1 and 2. Study phase.] In: *Bundesministerium für Gesundheit (BMG) (Hrsg.) Das bundesdeutsche Modellprojekt zur heroingestützten Behandlung Opiatabhängiger. Band 1.* Baden-Baden: Nomos.

White, H. R., & Gorman, D. M. (2000). Dynamics of the drug-crime relationship. In *Crime and justice 2000, vol. 1: The nature of crime: Continuity and change* (pp. 151–218) (NCJ 182408). Washington, DC: U.S. Department of Justice, National Institute of Justice.