Illicit Opioid Use, Treatment and Economic Costs, and Options for Cost Reduction: An Overview and Estimations

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Brief glossary of terms and how they relate to each other:

Cost-benefit analysis: A type of **economic analysis** that measures costs and benefits in monetary units and computes a net monetary gain/loss or a cost-benefit ratio. Benefits, i.e., health outcomes such as life years gained, have to be 'priced' and assigned a monetary value, usually by assessing individuals' willingness to pay for this outcome (or, to avoid a negative outcome). In research on illegal drugs, we often find partial studies, where cost savings (e.g., via reduced criminality) are compared to the costs of treatment.

Cost-effectiveness analysis: A type of **economic analysis** that compares interventions or programs having a common measurement of health outcome (measured in terms of 'natural units') in a situation where, for a given level of resources, the decision maker wishes to maximize the health benefits conferred to the population of concern. As an example, two substitution programs can be compared with respect to their effectiveness to reduce overdose mortality. The more cost-effective of the programs uses less financial resources per prevented overdose death.

Cost-utility analysis: A type of **economic analysis** that measures benefits in utility-weighted life-years (QALYs or DALYs), i.e. a virtual measure that combines quality and quantity of life and which computes a cost per utility-measure ratio for comparison between programs.

Direct costs (of illicit opioid use): All the goods, services and other resources that are consumed in the provision of services which are attributable to illicit opioid use, i.e. which would not be necessary, if there was no illicit opioid use. This includes medical costs (hospitalizations, emergency room visits, medication), costs for law enforcement (policing, courts, prisons), and other direct costs (e.g. for research and prevention).

Economic analysis: Analyses which involve the allocation of scarce resources among competing alternative uses and the distribution of the products from these uses among the members of the society. Three main types can be distinguished: **cost-effectiveness analysis, cost-utility analysis and cost-benefit analyses**.

Indirect costs (of illicit opioid use): Total sum of morbidity costs (goods and services not produced by the patient because of the drug-attributable illness and disability), mortality costs (goods and services the person could have produced had the drug-attributable illness not been incurred and the person not died prematurely), and lost productivity due to drug-related legal matters (e.g. stay in prison).

Economic benefits: Quantified monetary benefits of an intervention (e.g., treatment) based on standard methodology. Benefits may be expressed as **gross benefits** (i.e., expressing only the benefits of an intervention without its costs), and **net benefits** (i.e., the benefits after subtracting the costs of the intervention).

Opiate: A narcotic drug that contains **opium** or an opium derivative. Sometimes in popular language also used to include synthetic **narcotics**, but in this text we will use it only in the more restrictive scientific meaning as given above.

Narcotic: a drug that produces numbness or stupor; often taken for pleasure or to reduce pain; extensive use can lead to dependence or addiction.

Opioid: A synthetic narcotic that resembles the naturally occurring **opiates**, respectively any substance that binds to or otherwise affects the opiate receptors. We use the term in the wider definition to comprise both, naturally occurring and synthetic substances with the above described properties.

Opium: An addictive **narcotic** extracted from seed capsules of the opium poppy.

Introduction

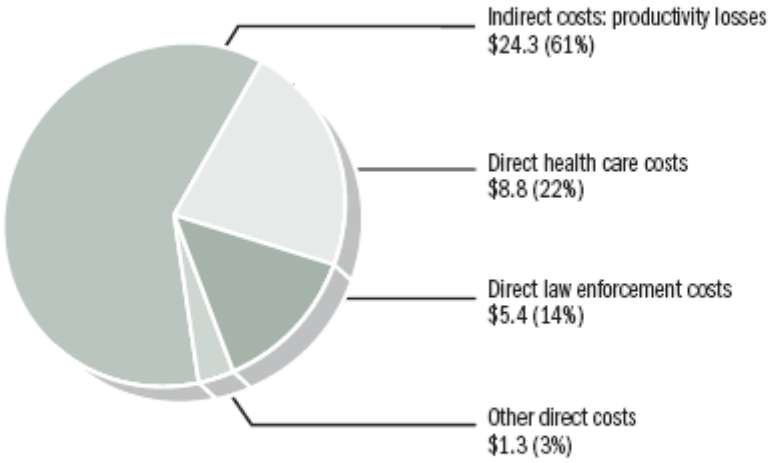
This brief summarizes key evidence with regards to the economic costs related to illicit – specifically, illicit opioid - substance use and presents an overview of the economic impact of different forms of therapeutic interventions aimed at illicit opioid (e.g., opioid maintenance treatment). In particular, the brief considers the specific role of costs of crime and law enforcement as a key driver of costs. The specific focus is on Canadian data where possible, and policy implications are discussed.

Costs of Substance Use

The overall social costs of substance abuse in Canada have recently been assessed to be $39.8billion[1] – or $1267 per capita - for 2002 (Rehm et al., 2006). While the majority of costs are related to licit substances, i.e. alcohol and tobacco, some 20% of these costs are related to illicit substance use (Rehm et al., 2006). One important observation is that the proportional cost share of crime and law enforcement expenditures is largest (66%) for the illicit substance category with respect to direct costs.

Figure 1

Figure 1: Costs attributable to substance abuse by cost category in Canada, 2002



Total cost: $39.8 billion

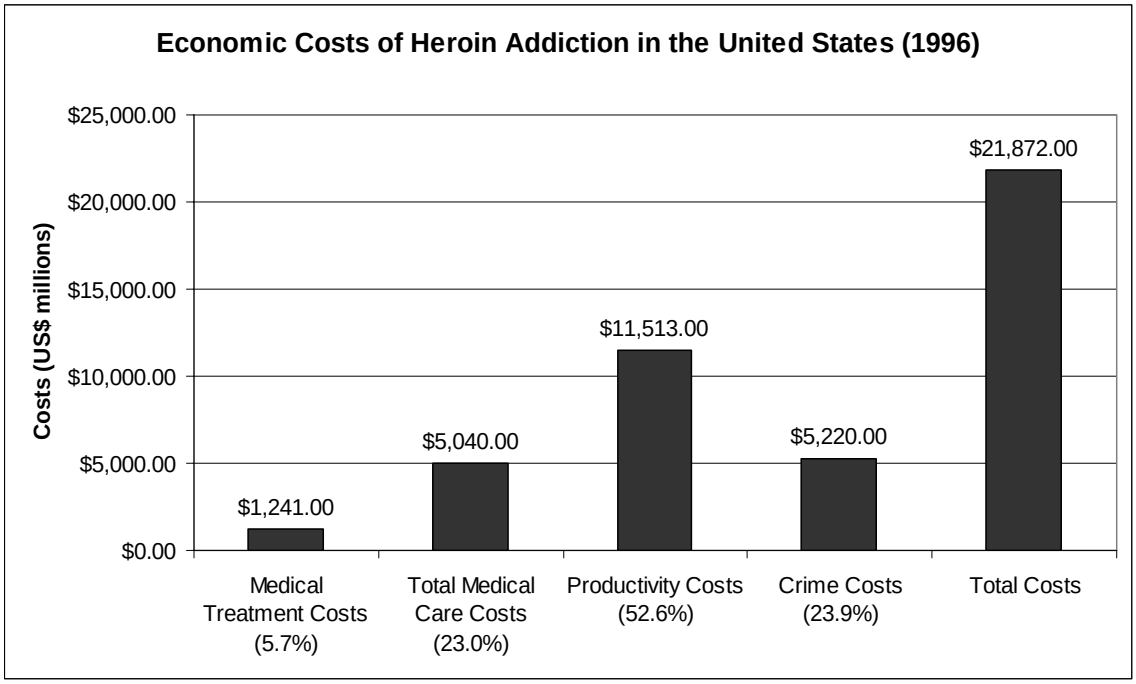
[1] All $ figures refer to Canadian dollars, unless otherwise indicated in the text

Source: Rehm, J., Balinaus, D., Brochu, S., et al. (2006). "The cost of substance abuse in Canada", Ottawa: CCSA.

Costs of Illicit Opioid Use

Few studies have attempted to assess the social costs of illicit opioid (e.g., heroin) abuse. A recent study from the U.S. (Mark et al., 2001) estimated that the "total economic cost of heroin addiction [in the U.S.] in 1996 was US$ 21.9 billion" (2001:196). This assessment was based on the prevalence range estimates of 600,000 to 1.1 million heroin addicts in the US for the time of study. Similar to the above cited economic cost study for Canada (Rehm et al., 2006), the major cost proportion categories of total costs are productivity losses (52.6%), followed by crime costs (23.9%) and medical/care costs (28.7%).

Figure 2

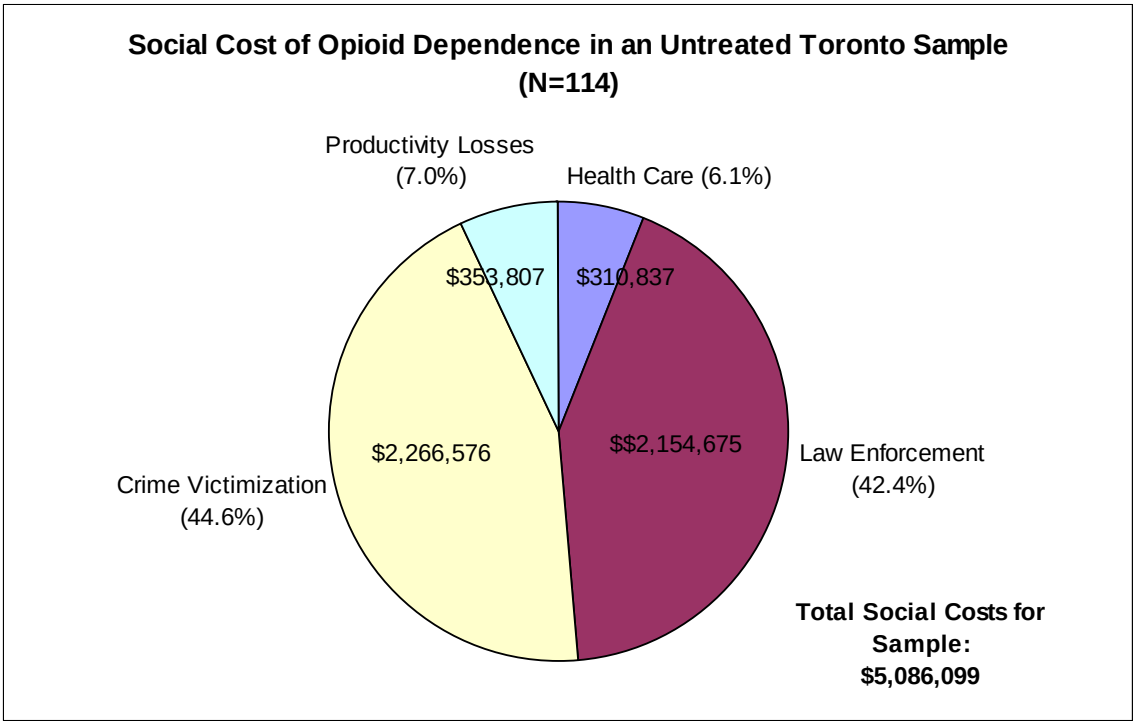


Source: Mark, T., Woody, G., Juday, T, et al. (2001). The economic costs of heroin addiction in the United States. *Drug and Alcohol Review*, *61*, 195-206

A different study – albeit on a smaller scale – was undertaken to assess the social costs of *untreated* opioid dependence in Canada (Wall et al., 2000). This study estimated the social costs caused by illicit opioid abuse and its consequences as empirically documented for a Toronto cohort of N=114 illicit opioid users outside of treatment at the time of study (1996 – 1997). The annual total social cost calculated for this sample was $5.086 million, or $45,000 per individual illicit opioid user (Wall et al., 2000). In terms of cost categories, this study found the proportional costs for crime victimization (44.6%) and law

enforcement (42.4%) to be the largest components, followed by productivity losses (7.0%) and health care (6.1%).

Figure 3



Source: Wall, R., Rehm, J., Fischer, B., et al. (2000). Social costs of untreated opioid dependence. *Journal of Urban Health*, *77*, 689-723.

On the basis of the Wall et al. study, hypothetical estimates of the cost burden of illicit opioid dependence for Canada have been suggestively outlined. Given an estimated illicit opioid user population of 60,000 – 90,000 in Canada for 1996 (Fischer & Rehm, 1997), and assuming this population to be entirely untreated, the estimated total costs – based on the Wall formula – would be in the range of $2.7billion – $4.1billion (See also Fischer, 2003). Of course, these estimates are only of hypothetical value, since a certain proportion of existing illicit opioid users are exposed to treatment, with a presumable reducing effect on behavior and subsequently costs.

Several earlier studies conducted in the U.S. to estimate the costs of heroin addiction in the late 1960s and 1970s also then already consistently found crime and criminal justice related costs to be the predominant cost driving factor in reference to this form of drug use (for an overview, see Fischer, 2003).

It is important to mention here that illicit opioid use in Canada - or in North America and Europe – is by far not limited to heroin abuse, yet (increasingly) includes the abuse of non-heroin opioids (i.e., prescription opioids, e.g., opioid analgesics; Fischer et al., 2006; Compton & Volkow, 2006). A considerable

extent of such prescription opioid abuse occurs in general populations yet is also increasingly prevalent in street drug user populations. For example, a recent pan-Canadian study has demonstrated that some form of prescription opioid – rather than heroin – were the most prevalent form of opioid used in the majority of the local study samples in five of the seven cities surveyed (Fischer et al., 2006). Cost estimates on prescription opioid abuse are available only from the U.S. In a very recent study, Birnbaum et al. (2006) estimated the total cost of prescription opioid abuse for 2001 to be US$8.6 billion; of this amount, 53% were workplace costs, 30.4% were healthcare costs, and 16.7% were criminal justice costs (Birnbaum et al., 2006). Given the documented recent substantial increases in prescription opioid abuse in the US (e.g., Compton & Volkow, 2006), it must be assumed that the corresponding cost burden has also substantially increased since 2001.

Reducing the Costs of Illicit Opioid Use

There are two main interventions for reducing the harms and costs of illicit opioid use – enforcement (i.e., deterrence) and treatment (i.e., rehabilitation). Several assessments have shown that treatment, rather than enforcement, overall is the by far more cost-effective approach to reducing the harmful consequences associated with illicit substance use (Tragler et al., 2001; Meara & Frank, 2005).

Methadone Maintenance Treatment (MMT)

The main and most widely accepted therapeutic intervention for illicit opioid dependence is that of opioid maintenance treatment (OMT). Opioid maintenance treatment has been provided in the form of methadone maintenance treatment (MMT) in North America and elsewhere since the 1960s, which is by far the most widely available and utilized form of OMT; over the past decade, several other opioid maintenance agents and regimes (e.g., heroin, morphine or buprenorphine maintenance) have been added to the spectrum of OMT.

The effectiveness of MMT has been examined and documented in several hundred studies over the past few decades. In light of the fact that MMT is commonly described as being “effective”, a key methodological issue and problem is that a large proportion of MMT studies are methodologically weak or flawed, and do not provide the basis for solid empirical conclusions based on the evidence they provide (Fischer et al., 2005; Mattick et al., 2003).

The two main – i.e., statistically significant - effects of MMT most rigorously evidenced by the highest standards of quality studies (i.e., Randomized Controlled Trials) are that MMT:

a) is more effective than non-pharmacological approaches in retaining patients in treatment, and

b) is effective in reducing illicit heroin use (see Mattick et al., 2003)

Both these effects are relevant from a cost perspective, since they are both demonstrated to be indirect mediators of behaviors linked to cost impact.

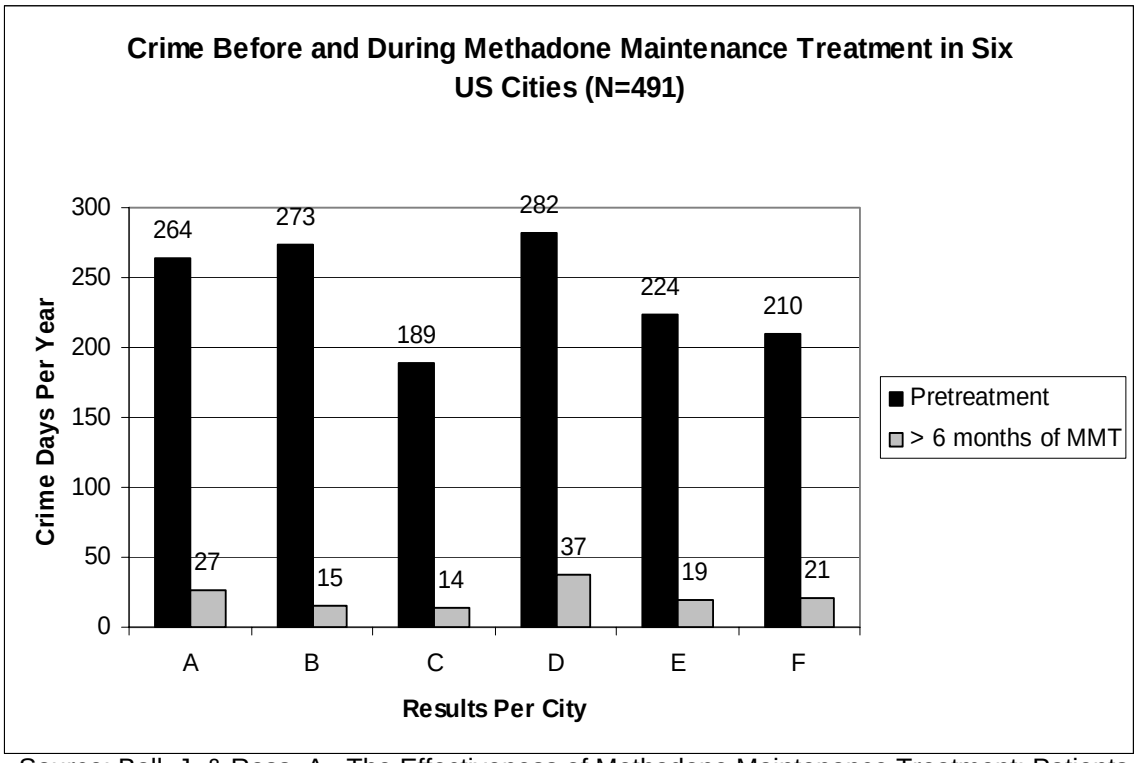
Further demonstrated effects of MMT include:

a) *Reduction of HIV transmission*: A recent comprehensive review of several dozen studies of MMT – comprising several thousand study subjects – found that MMT is effective in reducing risk behavior relevant for possible HIV transmission (e.g., needle sharing), and hence "reduces the likelihood that a [MMT patient] will become HIV positive" (Schilling et al., 2006; Sorensen & Copeland, 2000).

b) *Reduction of Criminal Activity:* While the above cited review of highest-quality studies of MMT (Mattick et al., 2003) did not find a significant crime reduction effect for MMT, other studies have demonstrated substantial crime reduction effects for individuals engaged in MMT. Several reviews have suggested that engagement in MMT may reduce criminal activity substantially, depending on how measured (e.g., whether measurement is based on arrests, official statistics, self-reported criminal acts, crime days, etc.; National Institute on Drug Abuse (NIDA), 1999). As landmark studies regarding the effects of MMT on crime, Ball & Ross (1991) observed a 79% reduction of the annual number of offenses between the year before admission to MMT and the more recent year in MMT in a sample of 617 patients. In the MMT programs examined by Anglin & McGlothlin (1981), the mean number of crime-days decreased from the range 96 – 131 to the range 24 – 70 from pre-admission to the period in treatment; similarly, the mean time of incarceration decreased from the range 28% – 39% to the range 13% - 22%. Finally, in terms of Canadian data, in a small follow-up cohort of Toronto opioid users originally outside of treatment, those who had engaged in MMT (n=29) in the period prior to follow-up were less likely to report illegal income generation compared to those who remained outside of MMT (n=40; Fischer et al., 1999).

c) *Mortality:* Contrary to common assumptions, the evidence of the effects of MMT on reducing mortality are actually mixed and inconclusive (Bertschy, 1995; Maddux & Desmond, 1992; Amato et al., 2005).

Figure 4



Source: Ball, J. & Ross, A., The Effectiveness of Methadone Maintenance Treatment: Patients, Programs, Services, and Outcome. New York: Springe-Verlag, 1991.

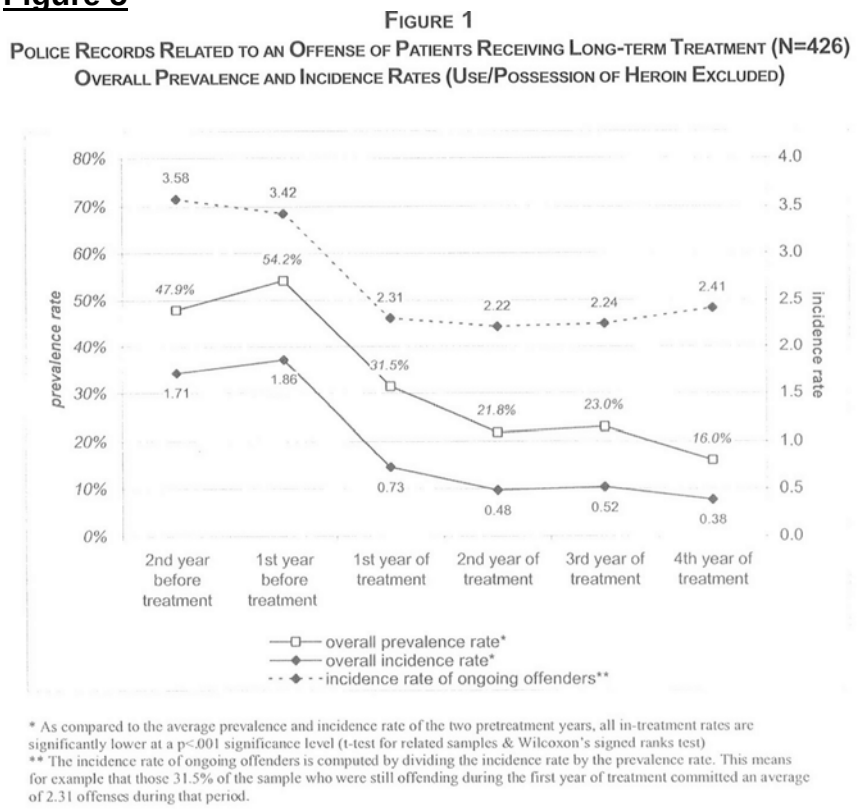
Opioid Maintenance Treatment (OMT) other than MMT

Buprenorphine: Given that several larger-scale studies and meta-analyses have suggested similar relative efficacy for buprenorphine treatment as documented for MMT on the key outcome indicators (see West et al., 2001; Barnett et al., 2006; Mattick et al., 2003; Harris et al., 2005), or that relevant studies involving buprenorphine did not systematically evaluate criminal activity (Amato et al., 2005), this particular treatment regime will not be further examined here.

Heroin-Assisted Treatment: Recently, several countries have experimentally assessed the feasibility and effectiveness of heroin-assisted treatment (HAT) for the treatment of chronic opiate addicts (see Fischer et al., 2002). The first of such studies was the Swiss PROVE cohort of N=1,019, a cohort of treatment refractory heroin addicts admitted to HAT between 1994 and 1996 (Uchtenhagen et al., 1999). A follow-up study of a sub-sample (N=237) of this cohort who remained in treatment for at least 18 months were assessed on various indicators, and demonstrated that (self-reported) illegal income generation prevalence decreased from 69% at admission to 17% at six-month, and 14% at 12-months follow-up, respectively (Rehm et al., 2001). A different angle of the same cohort – focusing on drug-related crime before and after admission to HAT among patients who stayed in treatment for at least 48 months (N=426) –

showed that both prevalence and incidence of criminal activity on the basis of police fell by more than 60% between pre-treatment and the fourth year of treatment (Ribeaud, 2004).

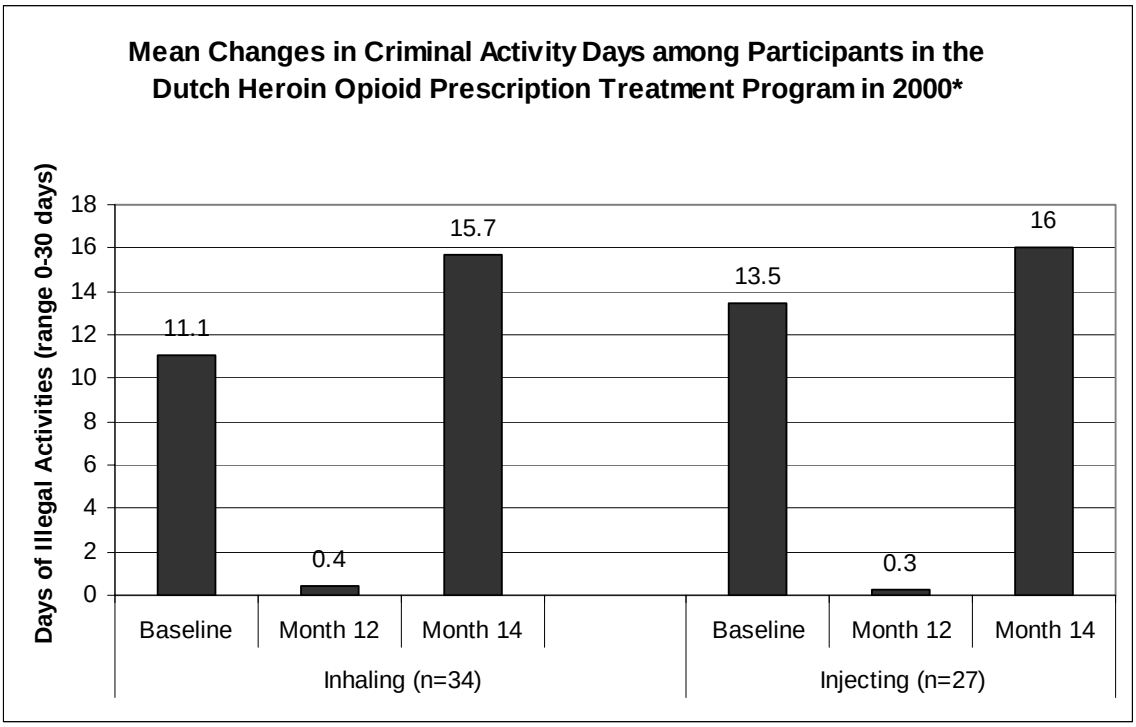
Figure 5



Source: Ribeaud, D. (2004). Long-term impacts of the Swiss heroin prescription trials on crime of treatment. *Journal of Drug Issues*, *34*, 163-194.

Evidently, the Swiss HAT study has been fundamentally criticized for the fact that it was a non-controlled observational study, and hence the validity of its findings is limited. Methodological progress has hence been offered by a series of controlled HAT studies (Ferri et al., 2006). In the small controlled HAT study (N=51) by Perneger et al. (1998), HAT patients were significantly less likely to be charged for any crimes than the controls during the treatment period. In the Dutch HAT trials (injected and non-injected co-prescribed heroin compared to MMT), crime indicators were measured only in aggregate form as part of a composite index of health, drug use and social measures. In both studies, the experimental conditions proved to be superior on the composite score outcomes compared to the controls (van den Brink et al., 2003). In the recently concluded German HAT trial, the experimental (heroin) group indicated a stronger reduction of criminal activities (i.e., illegal income generation) compared to the MMT controls (Naber, 2006).

Figure 6



Source: Van Den Brink, W., Hendriks, V., Blanken, P., et al. (2003). Medical prescription of heroin to treatment resistant heroin addicts: two randomized controlled trials. *British Medical Journal*, *327*, 1-6.

Economic assessments of OMT

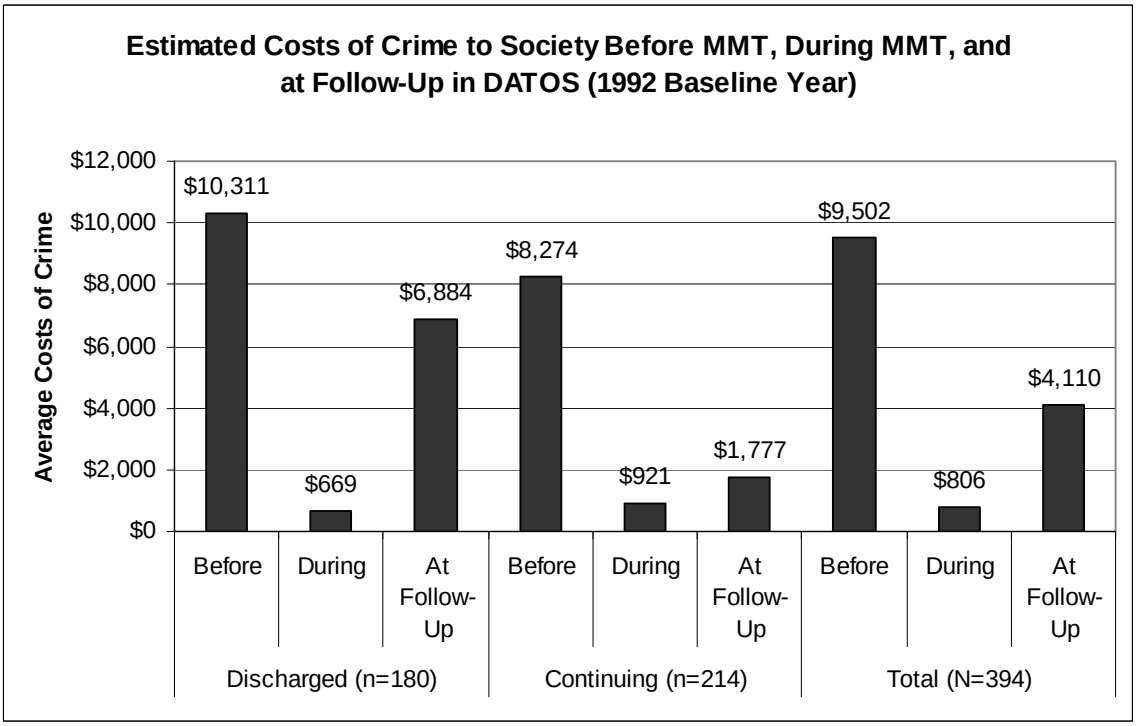
There are three key groups of economic evaluations of treatment interventions, namely a) *cost-benefit analyses (CBA)* and b) *cost-effectiveness analyses (CEA)* and *cost-utility analysis (CUA,* see glossary above for definitions*)*. CBA aims to compare the costs of a specific intervention (e.g., treatment) for a defined benefit (e.g., crime reduction) in monetary units. This is typically expressed by a cost-benefit ratio. CEA assesses the costs of achieving one additional ('incremental') unit of a desired and specified natural outcome. This is also true for CUA, but outcomes here are utility measures typically expressed through the measure of so-called 'Quality Adjusted Life Year' (QALY). For our purposes, however, CBA results are more relevant than either CEA or CUA results.

a) CBA

There are several studies from the US which have demonstrated the benefit-cost ratio of MMT in the range of 2:1 to 5:1, depending on the specific study perspective taken (Smioens et al., 2006; NIDA, 1999). A study focusing mainly on health care costs and benefits related to MMT documented a net average benefit of US$765 per month, or an overall benefit-cost ratio of 4.5:1 (Norlund et

al., 2004). Net benefits increased with length of stay in MMT. An economic evaluation of the Drug Abuse Outcome Studies (DATOS) detected a benefit-cost ratio of 3:1 for MMT. The net benefits – mainly savings (see Glossary) from reduced criminal activity versus treatment costs – amounted to US$5923 for subjects in treatment < one year, and to US$7168 for subjects in treatment for one year or more (Flynn et al., 2003).

Figure 7



Source: Flynn, P., Porto, J., Rounds-Bryant, J., et al. (2003). Costs and benefits of methadone treatment in DATOS - Part 1: Discharged versus continuing patients. *Journal of Maintenance in the Addictions*, *2*, 129-149.

The economic evaluation of a range of treatments (including MMT) under the British National Treatment Outcome Study found even much more dramatically positive benefit-cost relations, i.e. the benefits by far outweighed the costs. At 2-years following intake to treatment, additional health care costs of the equivalent of US$3,037,996 generated savings in crime costs of US$45,374,149, yielding a benefit-cost ratio of 15:1 (Simoens et al., 2006). The economic evaluation of the Swiss PROVE study also indicated a positive benefit-cost ratio of CHF (Swiss Francs) 95.50 vs. 44.84[2] per HAT subject/day, taking into accounts cost and savings indicators from social, health and crime domains (Frei et al., 2000). In other words, while HAT incurred CHF 44.84 of costs per patient and day (including treatment personnel, infrastructure and medications costs), it resulted

[2] CHF1.00 currently corresponds to $0.96

in gross benefits of CHF 95.50, and thus incurred net benefits of approximately CHF 50.00 per patient/day. However, the economic analysis of the multi-centre HAT/MMT study just completed in Germany found that while MMT (Euro 6,147 per patient/year) required substantially less costs than HAT (Euro 18,060) for the provision of treatment, only HAT resulted in economic benefits greater than its costs, or a positive net cost-benefit ratio (HAT: Euro 5,966 versus MMT: [minus 2,069]) (Schulenburg & Claes, 2006). Again, the driving force in this instance were costs and savings in the crime and criminal justice area, where MMT did not generate large enough improvement effects to outweigh its treatment costs.

Figure 8

Cost-Benefits by Sector of Swiss Heroin-Assisted Treatment (PROVE STUDY) 1996-1998, Per Subject/Day

Cost/Benefit Sector	CHF (Swiss Francs)	Percent (%)
Housing	2.41	2.52
Work	3.90	4.08
Legal Behaviour	72.08	75.48
Health	17.11	17.92
Gross Benefit	**95.50**	**100.00**
Net Benefit (minus cost)	*44.84*	*n/a*

Source: Frei A, Greiner RA, Mehnert A, et al. (2000): *Socioeconomic Evaluation of Heroin Maintenance Treatment*. In Gutzwiller F, Steffen T (Eds.): Cost-benefit Analysis of Heroin Maintenance Treatment. Karger Basel.

Important conclusions regarding CBA of different forms of OMT are that:

a) benefits have been shown to outweigh costs

b) that the emerging positive benefit-cost ratios are principally driven by the interventions' cost-reducing effects on crime and criminal justice expenditures (see Fischer, 2003; Frei et al., 2000). In other words, without the savings related to crime, the expenses for the treatment would be greater than the cost reductions incurred in other areas.

b) CEA/CUA

A more detailed discussion of CEA/CUA results will not be offered here, since these studies typically selectively focus on health-related outcomes (e.g., DALY). In summary, CEA/CUA studies examining opioid maintenance treatment suggest that defined units of health improvements are achieved through MMT at least as cost-effectively as documented impacts in other medical interventions

fields (e.g., cardiac care; Chisholm et al., 2006; Jamison et al., 2006; Dijkgraaf et al., 2005).

POLICY IMPLICATIONS & DISCUSSION

Illicit substance use is associated with considerable harms, most of which translate into social costs. For illicit substance – or opioid – use, the key cost driving factors are crime and law enforcement costs. Targeted interventions – e.g., treatment – have proven their ability to substantially reduce costs related to illicit opioid use. Moreover, evidence is available on the differential cost-effectiveness and cost-benefit scales of different treatment interventions available.

When aiming to concretely assess the costs of illicit opioid use; and the range in which these costs may be reduced by treatment interventions in a specific socio-geographic context – e.g., the City of Vancouver – two additional and fundamentally influential variables play a role:

a) A certain proportion of illicit opioid users are exposed to treatment at any given time, and these interventions can be presumed to reduce harmful behaviors, and subsequent costs. Concretely, of the 4,700 – 12,000 injection drug users (IDUs) estimated for the Vancouver area (Schechter & O'Shaughnessy, 2000; Buxton, 2005), some 2000 are estimated to be engaged in MMT at any time (although many of these engagements are short-term, and entail 'revolving door' treatment patterns and thus do not necessarily result in 'ideal' treatment outcomes (MMT estimates for Vancouver based on personal communications, J. Anderson, Dec 2006; furthermore (Anderson & Warren, 2004; Bell et al., 2006)).

b) The vast majority of people potentially eligible for treatment are poly-substance users (e.g., opioid and non-opioid users, e.g., speedballs), or primary users of non-opioid substances (e.g., cocaine, crack, etc.). The use of these substances, and their harmful consequences and costs, are not causally addressed by OMT (in fact, some counter-intentional effects may be observed). In other words, even if all users of illicit opioids were enrolled in OMT, the harm and cost consequences of their illicit substance use overall – e.g., crime, or costs overall – would not be eliminated in their entirety (and could not be unless the harms associated to their other substance can be effectively addressed).

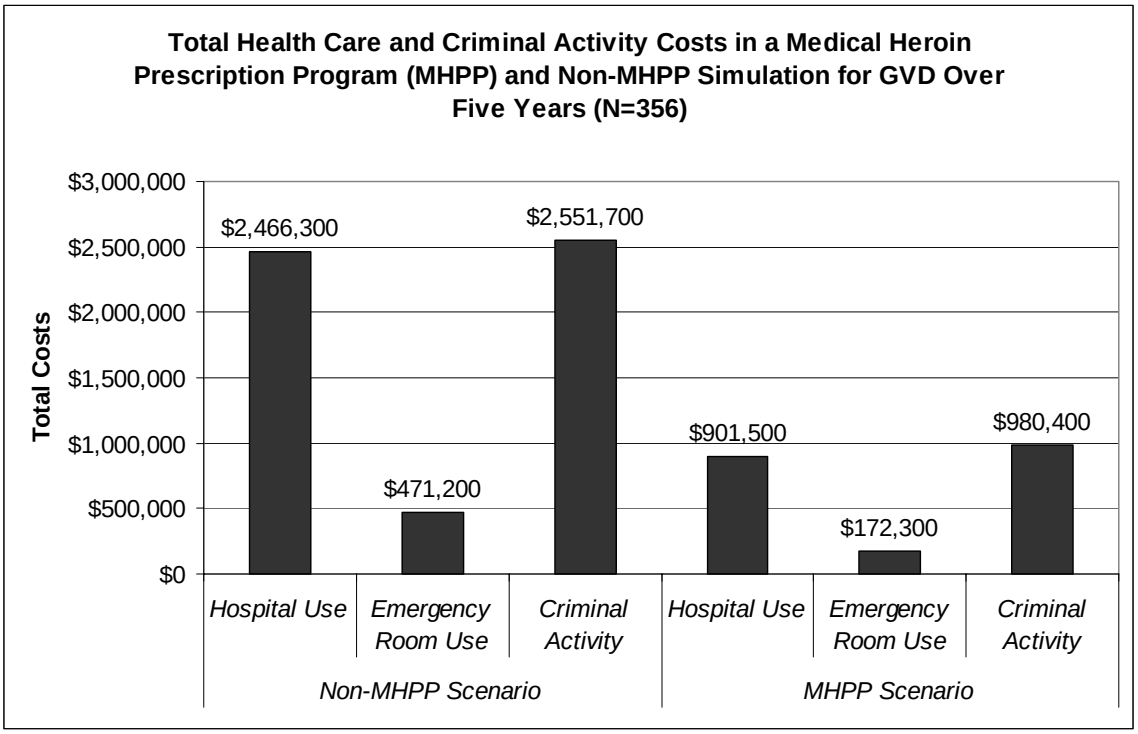
The bottom line is that through the targeted improvement of the available opioid treatment system in Vancouver (e.g., improving the offering of existing treatments, adding relevant new treatment options), the harmful consequences of illicit opioid use – specifically costs – could be reduced considerably. Specifically, based on a triangulation of available local estimates and data from other

systems, the following conclusions can be put forward on the basis of cautious yet informed estimations:

a) The enrolment in MMT may be raised by a range of 1000 – 4000 persons, if the MMT system is optimized in quantity and quality (i.e., attractiveness to potential patients). The complementary availability of buprenorphine may help facilitate this increase in treatment expansion, yet likely not add superior benefits beyond a similar expansion of MMT alone. Based on available cost-benefit data, the potential annual costs savings may be in the range of $10million - $40million.

b) For an estimated limited number of treatment-refractory heroin addicts (250 – 1000), it can be assumed that HAT could be feasible, effectively delivered and result in considerable savings. Based on a modeling exercised rooting in HAT effectiveness and cost-benefit data from Switzerland and a presumed sample of N=356 IDUs from the DTES eligible for HAT, there could be "potential savings of between [$7.0 million and $9.1 million] over a 5-year period for the Greater Vancouver Region" (Miller et al., 2004:261). Again, the by far greatest single cost-saving item emerging from these simulations occurred in the crime cost area.

Figure 9



Source: Miller, C., Schechter, M., Wood, E., et al. (2004). The potential health and economic impact of implementing a medically prescribed heroin program among Canadian infection drug users. *International Journal of Drug Policy*, *25*, 259-263.

c) For both projected possible cost-savings from increased or available MMT/HAT, it is important to point out the difference between calculated and realized cost-savings. For example, if MMT leads to less committed crime, the inferred cost savings for law enforcement materialize only when a reduction of expenditures in the criminal justice system (e.g., closure of correctional institutions or reduction of prosecutors or judges) is realized. This, in many instances, does not occur and rather these expenditures are displaced (e.g., the police officer preoccupied with less drug related crimes now is more available to deal with other crimes). At the same time, such displacement may result in the practical benefit that the criminal justice, health or other system components less preoccupied with drug-related occurrences are now more available for or more quickly able to deal with other demands (e.g., quicker police response times for burglaries or reduced wait times for paramedics). Secondly, it must be noted that potential cost savings occur on different levels. Basically, cost savings to health care would mainly benefit the provincial government level (as the main cost carrier of health care), while cost savings to law enforcement would benefit municipal and provincial levels (with the municipal level being a key cost carrier of policing, and the province paying mainly for criminal justice). A full understanding of the cost savings to each jurisdiction would require a more detailed analysis than is possible in this paper.

d) Given the particular epidemiological landscape of street drug use in Vancouver, and its high level of stimulant use, a large or predominant proportion of harms & costs are directly linked to this specific form of drug use, and their reduction requires measures effectively targeted at this specific problem. A few recent Canadian and other studies have shown that, for example, criminal activity or health problems are disproportionately prevalent in stimulant (co-)users (Fischer et al., 2006). The impact of conventional treatment approaches on stimulant dependence is highly limited (van den Brink, 2006), while research on the practical feasibility and potential overall effectiveness of stimulant maintenance treatment is in its infant stages (Grabowski et al., 2004). On these grounds, although speculations about potential cost/benefit dynamics in this arena remain hypothetical, they are still worth investigating.

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