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TECHNICAL REPORT

Issues in estimating the economic cost of drug abuse in consuming nations

Report 3

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Prepared for the European Commission

RAND EUROPE

This study has been produced by the Trimbos Institute and RAND with the financial support of the Commission of the European Communities (contract JLS/2007/C4/005). The study does not necessarily reflect the opinions and views of the European Commission, nor is it bound by its conclusions.

Published 2009 by the RAND Corporation
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Preface

The European Commission contracted RAND Europe and the Trimbos Institute to analyse in detail the operation of the world market in illicit drugs and the policies aimed at curtailing it. This was in the context of the European Union's Strategy on Drugs 2005-2012 which calls for evidence-based policies and in turn responds to the EU Resolution adopted by the UN's Commission on Narcotic Drugs, calling for '… an objective, scientific, balanced and transparent assessment by Member States of the global progress achieved and of the difficulties encountered in meeting the goals and targets set by the General Assembly at its twentieth special session…'.

The resulting study provides a dispassionate overview of the true nature and extent of the problem today, and to assist policy makers at national and regional levels to deal with it. It was suggested that the drugs market be looked at as if it were licit, in order to get a clearer picture of the way that it works.

This document is the third of five reports published by RAND under this contract. It is accompanied by a main report which draws on the documents' findings to assess changes in global drug problems from 1998 to 2007 (Reuter and Trautmann 2009). This report looks specifically into the issues in estimating the economic cost of drug abuse in consuming nations. RAND Europe and the Trimbos Institute anticipate that it will be of interest to policy-makers from the European Commission, as well as other governmental bodies which are concerned with drug markets. It is also believed to be of value to NGOs and private organisations which are involved in one way or another in tackling the drugs market and its impacts.

RAND Europe is an independent not-for-profit policy research organisation that aims to improve policy and decision making in the public interest, through research and analysis. RAND Europe's clients include European governments, institutions, NGOs and firms with a need for rigorous, independent, multidisciplinary analysis. This report has been peer-reviewed in accordance with RAND's quality assurance standards.

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Summary

This report considers the current feasibility of constructing an estimate of the global cost of drug use. While national estimates exist for seven developed countries, most countries have yet to construct a comprehensive estimate. Furthermore, it is impossible to compare the existing national estimates because of differences in the construction, which may reflect varying political and social environments that influence the nature of use and its related harms.

This report lays out a conceptual framework for initiating the construction of country-specific estimates in a fashion that would facilitate cross-national comparisons. It demonstrates the difficulty in trying to implement this framework using existing data, as current data available in the various countries suffer from inconsistencies in definitions, coverage, and measurement. For example, in Australia a death caused by a car-accident involving a drugged driver would be included as a drug-related death; the EMCDDA definition only includes deaths in which drugs were the direct cause. Similarly, although it is clear what is meant conceptually by an injection drug user, the measurement of the total number of injection drug users within some countries is based on injection drug use among the treatment population and in other countries it is based on nationally representative surveys. The pitfalls and assumptions necessary to construct a comparable estimate using existing data, therefore, are quite significant.

We conclude that it is not possible at this time to develop a meaningful comparative estimate of the cost of drug use across countries. We believe, however, that steps could be taken to improve the consistency of measurement in many of the indicators in future years through coordinated international efforts, not unlike that currently being undertaken by the EMCDDA for the European Community.

Acknowledgements

The authors would like to thank the many people who contributed to this study.

We owe a large debt to the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) in Lisbon for the relevant input and support we received on many issues. The EMCDDA proved to be a particularly valuable source of information and expertise for our purposes. We want to express special thanks to Paul Griffiths, Brendan Hughes, Rosemary de Sousa and Frank Zobel who provided high quality information, data and advice throughout the project, as well as to their colleagues who contributed to specific sections in this report.

With regard to this report, we also would like to thank Greg Falconer and Philipp-Bastian Brutscher (RAND Europe) for their great assistance with the research into the economic cost.

Special thanks to the experts who made themselves available to review the draft report for their valuable input. The following experts gave input and precious suggestions for streamlining the final manuscript: Ruth Levitt (RAND), Wayne Hall (University of Queensland), Dick Hobbs (London School of Economics), Martin Bouchard (Simon Fraser University), William Rhodes (Abt Associates), Pierre Kopp (University of Paris-1), Michael Farrell (Institute of Psychiatry, London), Alison Ritter (University of New South Wales), Harold Pollack (University of Chicago) and Louisa Degenhardt (University of New South Wales). We also would like to thank Henri Bergeron (Institut d'Etudes Politiques de Paris), Constantijn van Oranje-Nassau (RAND Europe) and Esther Croes (Trimbos Institute) for their helpful comments.

Finally, many thanks to the people who gave precious support to get all things done: Toine Ketelaars (Trimbos Institute) for all the thorough literature searches, Yvonne Borghans and Danielle Branderhorst (Trimbos Institute) for their scrupulous text editing and for care and logistic support during the project, Pat O'Hare for again taking the job of copy editing (reports on drug problems and policy and on methodological challenges).

The authors are solely responsible for the views in this book.

CHAPTER 1 Introduction

While it is widely understood that the consumption of illegal substances imposes harms on the user as well as society at large, considerable debate exists regarding the nature of those harms, the actual burden they place on individuals and society, and the extent to which their existence and magnitude justify government action or are influenced by government policies. Some of the debate stems from philosophical differences with respect to the importance of personal liberties and the proper domain of government. However, a good portion of the debate also comes from observations made across various countries, where it is clear that fundamentally different approaches have been taken towards managing drug users and the harms they impose on others. Given these "natural experiments," there is a desire by scientists as well as policy makers to evaluate and compare the relative burden of illicit drug use across nations adopting different strategies in hopes that such a comparison would generate useful insights regarding successful approaches for balancing the harms from use and the harms from society's response to use. A careful cost-effectiveness analysis using information across countries would be the best way to obtain these insights. One of the first steps in conducting such an analysis involves the consistent assessment of the burden of drug use across countries.

Considerable work has been done in some developed countries to quantify the social cost of drug abuse (Rehm *et al.*, 2007; Collins & Lapsley, 2002, 2008; Godfrey *et al.*, 2002; ONDCP, 2002). Although these studies all employ the same end metric for valuing harm (currency), they use a variety of approaches that make it impossible to directly compare results. Political and social environments influence not only the types of harms considered in these calculations but also the relationship between drug use and the harm (e.g. harm reduction strategies influencing the relationship between injection drug use and the spread of HIV/AIDS). Methodological differences in the measurement of harms, the inclusion of intangible costs, and the time horizon in which harms are evaluated leads to further inconsistencies. In light of these differences, it becomes difficult to learn much from drawing comparisons across these studies even though they ultimately measure the problem using the same final outcome metric.

This report attempts to consider the feasibility of constructing a new estimate of the cost of drug abuse by focusing on a small subset of harm indicators that one might reasonably expect to be systematically and consistently measured across countries. It lays out the steps that were taken in an attempt to construct such an estimate for a select number of developed countries. While the report provides the components to estimate these costs for selected countries, the validity of the estimates for cross-country comparisons is highly

questionable and strongly discouraged. It became readily apparent while constructing these estimates that most of the data indicators were not truly consistent, particularly across countries. A given variable, even when defined in a consistent manner, is not measured the same way across countries. The pitfalls and assumptions necessary to construct a comparable estimate across countries are quite significant and described in detail throughout this report. We conclude that it is not possible at this time to develop a meaningful comparative estimate of the cost of drug use across countries or to aggregate these costs to the regional or global level.

The rest of this report is organised as follows. Chapter 2 compares the published national studies on the cost of drug abuse and highlights key differences in definitions, and measurement even when common methodological approaches are adopted. It demonstrates why simply aggregating existing studies to generate a global burden of the drug problem is problematic. Chapter 3 presents the conceptual framework for a simplified approach for considering the economic burden of drug abuse consistently across countries, identifying key cost components that *should* be obtainable in a consistent fashion across many countries. While national estimates of the cost of drug use generally include additional indicators of the cost of drug abuse, these indicators are unlikely to be collected systematically for all countries (as in the case of social welfare costs). Further, it is even less likely that consistent measures of unit cost estimates are available (as in the case of the value of lost time at work due to drug-related absenteeism). Therefore, the conceptual framework presented is necessarily less comprehensive than existing national estimates. Nonetheless, it captures many of the key cost drivers demonstrated in those national studies. In chapter 4, issues discovered in trying to implement even this simplified conceptual framework are discussed that led to a further narrowing of the number of countries and costs actually considered. In chapter 5, issues related to obtaining consistent estimates of the unit cost of the harms for just a relatively small number of developed countries are discussed. Finally, in chapter 6, after examining inconsistencies in the measurement of indicators and costs even for a subset of countries with relatively good data, it is determined that it is not yet possible to construct a comparable estimate of the cost of drug use in a manner that would enable cross-country comparisons in a systematic and scientifically consistent way. Such an effort requires the coordinated effort of countries interested and willing to engage in such an exercise, such as that being undertaken by the EMCDDA for the European Community, so that indicators and cost information is obtained in a fashion that would enable cross-country comparisons. The work of harmonizing indicators is a very difficult process, however, and one that takes time. More time is needed to expand the harmonization across more countries, including the U.S., Australia and Canada, before any serious attempt can be made.

CHAPTER 2 Review of national studies of the cost of drug abuse

Given the need of policy makers to better understand the importance of substance abuse vis-à-vis other societal issues, several Western nations have funded research examining the economic burden of alcohol, tobacco and illicit drugs within their own borders. From early studies it can be seen that political and social environments influence not only the types of harms considered but also the factors that influence these harms, including the availability of particular drugs, the likelihood that substances get used, and the probability that harm comes from either immediate or long term use of the substance. Thus, the concept of societal costs of drug use must be considered within the context of the country in which those harms are being considered. That being said, there are certain harms that can be uniformly observed across countries, such as development of dependence, the spread of HIV or hepatitis through needle sharing among injection drug users, and lost productivity associated with premature death. Similarly, there are in many cases common responses by countries, such as the delivery of treatment to those in need of it or the attempted suppression of supply through the incarceration of dealers and traffickers. Thus, there remain common elements that exist across countries that can be compared, but it requires consistency in the measurement of these indicators and in the unit costs applied to each.

The significant differences in indicators and costing strategies adopted in early national reports precluded comparisons of the drug problem across countries even when similar elements of the problem were being compared. In response, a series of symposia and workshops were held in Canada and the United States between 1994 and 2002 involving international experts engaged in these activities in various developed countries. From these meetings, international guidelines for estimating the cost of substance abuse (alcohol, tobacco and illicit drugs) were published by the World Health Organization (Single *et al.*, 2003) recommending a unified methodological approach across all studies.

Even with the development of these international guidelines, recent national studies of the economic burden of drug abuse remain disparate in important ways that preclude the direct comparison of their results. However, the guidelines were never intended to instruct authors on how to construct estimates for the purposes of international comparisons; instead they were offered as a way of harmonizing the general methodological approach. Table 1 provides a summary of key measurement issues related to the construction of recent national estimates from seven different countries (France, England and Wales,

Spain, the United States, Canada, and Australia).[1] As can be seen by the shading in Table 1, there are only two broadly consistent methodological elements across all seven studies, but these are important. First, all studies adopt a prevalence-based approach, which considers the current calendar year costs associated with individuals using drugs in that year, ignoring the future costs (or savings) associated with drug use as those current users age. The prevalence-based approach, therefore, assumes that the distribution of use and harms associated with use over the life course is stable and can be predicted from the distribution of users and harms observed among current users at different ages in the current calendar year. Second, all the studies consider costs imposed on society, not just the costs borne by users or the payer of health services.

[1] National estimates of the cost of illicit drug use in Switzerland, Luxembourg, and Finland were referenced in the general literature we reviewed, but we were unable to obtain copies of the original studies which would enable their inclusion in this analysis. We do not believe their omission, however, influences the main findings of this chapter, which are that systematic differences exist in the methods used to estimate these costs and hence direct comparisons of these estimates to generate a global burden of disease is not possible.

Table 1 Summary of General Measurement Issues in National Studies of the Economic Cost of Drug Abuse

	France	England & Wales	Spain	U.S.	Canada	Australia
Citation	Kopp & Fenoglio (2006)	HORS 249, Godfrey et al 2002	Garcia-Altes et al., 2002	ONDCP, 2004	Rehm et al., 2007	Monograph 49, Collins & Lapsley, 2002
Year	1997	2000	1997	2002	2002	1998-1999
Method	Prevalence-based	Prevalence-based	Prevalence-based	Prevalence-based	Prevalence-based	Prevalence-based
"Use"	Any use	Distinguishes recreational, regular and problematic use	Any use	Any use	Any use	Any use
Substances Considered	Alcohol, tobacco, and any illicit drug	Cocaine, crack, ecstasy, heroin, methadone, LSD, and magic mushrooms	Nonprescribed opioid; amphetamine and psychostimulants, cocaine, synthetic drugs, cannabis, hallucinogenic drugs and glues.	Any illicit drug	Alcohol, tobacco, cannabis alone, illicit drugs including cannabis	Cannabis, opiates, stimulants, hallucinogens, anabolic steroids
Perspective	Societal	Societal	Societal, but only public health	Societal	Societal only, no private costs	Social cost
Intangible costs?	Excluded	Partially included	Excluded	Excluded	Excluded	Included
Beneficial Effects?	Not included	Not included	Not included	Not included	Included	Included
Top-down or Bottom Up?	Bottom Up	Bottom Up	Bottom Up	Bottom Up	Top down	Bottom Up
Gender/Age specific?	No	Age specific	No	No	Yes	No
Monetary Unit	French Francs	British Pounds	Pesetas (PTA)	US Dollars	Canadian Dollars	Australian Dollars

However, even with respect to this dimension, the studies are not entirely consistent, as the notion of "societal" differs across studies. In particular, the Canadian study only includes costs imposed on others and does not consider the private costs (i.e. the costs borne only by the individual user) associated with drug abuse. In all the other studies, the term "societal" is used to refer to both the private and public costs associated with use. Another nuance is the breadth to which societal costs are examined. In the Spanish study, only the costs to the public health system are considered, whereas most of the other studies also consider the social costs impacting the criminal justice and welfare systems.

The similarities in methodological approaches across the studies end with these two dimensions. The aspects in which these studies differ are important for demonstrating why comparisons across countries are unwise when using information from existing national studies. As summarised in Table 1, there are important differences in either the definition of substance use (any use, abuse or regular use), the substances included (any illicit drug versus a set of particular drugs), the method to assess costs (bottom-up versus top-down, separately by gender and age group), and in the specific costs included (cost offsets from positive effects of use, inclusion of intangible costs).

In terms of the definition of use, most studies consider the costs of any use of the substance, but the Australian study examines only the cost of abuse, while the England and Wales study distinguishes costs associated with recreational (any) use, regular use, and problematic use. The distinction in type of use can have important implications for which costs or problems get included. For example, a recreational user in the United States and France can still be arrested for simple possession, which would be included in the total cost of drug use for these countries if any drug use was considered but would not be included if only problematic or dependent use was considered. Even more important is the fact that the substances considered across the studies are not the same. The focus on different substances across studies may reflect differences in the substance of abuse in these countries, the perceived harms of particular drugs, or the availability of data on particular substances abused. For example, in the case of the Godfrey *et al.*'s (2002) study of England and Wales, cannabis is not scheduled as a Class A drug, and hence is omitted from the study which focused exclusively on Class A drugs. However, cannabis remains the most widely used illicit substances in England (Reuter & Stevens, 2007). Comparing the total costs from Godfrey *et al.*'s (2002) study to that of Spain or Australia would be misleading given that different substances are represented and a key substance of abuse (cannabis) is missing by construction from the Godfrey *et al.* (2002) report.

Intangible costs refer to the emotional and physical burden placed on individuals because of drug-induced problems (addiction, premature mortality, or fear of crime and victimization). In some cases these intangible costs are borne by the drug user himself (when dealing with the emotional and physical burden of being addicted) and in some cases these costs are borne by others (those left behind when a drug user dies, those living in drug-infested neighbourhoods). Although widely recognised as a significant aspect of the total burden of drug abuse, only the most recent studies have attempted to quantify these losses (Godfrey *et al.*, 2002, 2004; Rehm *et al.*, 2007; Collins & Lapsley, 2002, 2008). The typical reason for their exclusion is the difficulty in placing a monetary value on these very personal measures of pain and suffering. There is substantial debate in the literature regarding how best to do this (see e.g., Hirth *et al.*, 2000; Viscusi & Aldy, 2003; Aldy &

Viscusi, 2008). Nonetheless, as indicated by those studies that have attempted to include them, they represent a considerable portion of the total burden of the disease. For example, Collins & Lapsley (2008), which updates their 2002 study mentioned in Table 1 and provides greater focus on drug-attributable crime, estimate that the intangible cost of all substance abuse represent 45% of the total economic cost in Australia (for 2004/2005).[2] Similarly, the extent to which the beneficial effects of substance use are considered when estimating the economic burden of these diseases is fairly mixed. Although the beneficial effects of moderate alcohol consumption is now widely recognised, the potential positive effects of cannabis for medicinal purposes are not generally considered in many cost of illness studies focused on illicit substances. Very few studies acknowledge the fact that most people initiate consumption of these substances because they seek the positive effects they offer (e.g. relaxation or pleasure).

The methods for assigning costs to specific indicators vary across studies as well. Although most of the recent national studies apply a bottom-up costing strategy, where specific health, treatment, crime, and productivity costs are given a unit cost estimate based on prevailing market rates, it has generally been more common in the previous literature to use a top-down approach for assigning costs. The top-down approach uses budget information from government authorities to construct a unit-cost estimate by diving the total budget for a given cost area (e.g. drug treatment) and dividing it by the number of patients served to get a cost per patient. The advantage of such an approach is that it directly considers the additional administrative and overhead costs associated with a variety of government activities. The disadvantage of that approach is that it is often extremely difficult in aggregate budgets to isolate costs that are strictly due to illicit drug use (versus alcohol use, tobacco use, or some other related problem).[3] Hence the unit cost estimates constructed from a top-down approach might not reflect the actual average cost for the drug users specifically. Moreover, if drug users require extra (fewer) resources than others pooled into that government budget, a top-down approach might underestimate (overestimate) the actual cost imposed by drug users. Related to these issues are differential costs due to gender and age. Assigning a value for premature mortality using the human capital approach (the approach most commonly employed in these studies) can be very different depending on the typical age and gender of the person who died from drug use (Viscusi & Aldy, 2003). Similarly the cost of treating a particular health problem could differ based on the age of the individual being treated (young versus old) or the timing of when it is detected (early identification of Hep C or HIV). Some studies apply gender and/or age-specific costing units for the outcomes considered in the study, while others apply simple averages for the population being served or evaluated. These sorts of differences can have important implications in terms of the total costs calculated for the same exact outcomes because drug-problems disproportionately affect certain segments of the population across countries (e.g. youth and young adults).

[2] When illicit drugs are examined by themselves, in absence of alcohol, the intangible costs represent a smaller but still sizable fraction of the total burden of illicit drugs (16%).

[3] Moreover, such an approach obtains the average cost of an event, not the marginal, which in most instances is actually lower than the average cost of the event (given that marginal cost does not consider the fixed costs associated with having an enforcement structure, health care structure, or whatever in place).

In addition to the general differences in methodological approaches described above, there are a number of relevant differences in the specific costs considered across the seven more recent national studies. Table 2 provides a brief overview of the key cost elements considered in the seven national studies previously discussed. To some extent the differences in indicators considered partially reflect availability of data, in some cases they represent an alternative conceptualization of the problem (e.g., productivity losses associated with long term disability due to drug use), and in other cases they represent differences in the social and political structures involved in responding to the drug problem (salaries and operating funds, employee assistance programs and health promotion). What is particularly salient here, however, is that differences exist even in categories that would otherwise seem similar. The specific example highlighted in this table is that of drug-related infectious diseases. Kopp & Fenoglio (2006) only consider the cost of drug-related AIDS, while Garcia-Altes *et al.* (2002) consider the cost of drug-related HIV infection as well as AIDS and Godfrey *et al.* (2002) consider the cost of HIV/AIDS, Hepatitis B and Hepatitis C. Given the different prevalence rates of each of these infectious diseases, not to mention their lifetime costs, very different cost amounts for "infectious diseases" could result based on alternative construction of the indicators included. The same could be said of the other categories broadly represented here, such as intentional injury, unintentional injury, and even premature mortality. In the case of premature mortality, the EMCDDA has developed a common definition that is uniformly applied in the Member States. According to the EMCDDA, drug-related deaths within the European Union refer to those deaths that are the direct result of drug consumption, such as overdose, poisoning, or drug-related suicides. But in the Australian studies, however, premature deaths due to drug use include deaths caused by drug- related diseases, such AIDS and Hepatitis C. So even within specific cost elements, considerable differences can exist in terms of the definition of behaviours being represented with a common label.

The fact that independent national studies differ along the dimensions just mentioned is in no way a statement that any particular study is better or worse in their construction of an estimate. Neither should these differences across studies diminish the significant contribution each study makes in terms of our general understanding of the drug problem within a particular nation's borders.

Instead, the differences are merely reflective of the fact that nations differ in their reasons to be concerned about drug problems, the harms caused by drug use, and the availability of data to measure those harms and their costs. Even when guided by the same methodological principles (Single *et al.*, 2003), important differences can still emerge that makes direct comparisons across nations difficult and unwise. If one is intending to take on the task of developing an estimate that can be directly compared to measures from other countries, then it is necessary to start from scratch and develop a common conceptualization of the problem that can be consistently measured and monetised in all the relevant countries. Then the very difficult work of harmonizing those indicators across cultures and societies would have to begin.

Table 2 Summary of Cost Elements Considered in Key National Studies of the Economic Cost of Drug Abuse

	France	England & Wales	Spain	U.S.	Canada	Australia
Citation	Kopp & Fenoglio (2006)	HORS 249, Godfrey et al 2002	Garcia-Altes et al., 2002	ONDCP, 2004	Rehm et al., 2007	Monograph 49, Collins & Lapsley, 2002
Health Indicators						
Drug Treatment	√		√	√	√	√
Drug Related Deaths	√	√			√	√
Overdoses	√	√	√	√		√
Infectious Disease	AIDS	HIV, Hep B & C	HIV/AIDS	HIV, Hep B & C	HIV, Hep B & C	AIDS, Hep B & C
Perinatal / Neonatal effects		√		√	√	√
Intentional Injuries	√		√		√	√
Unintentional Injuries	√	√	√	√	√	√
Mental health	√	√	√	Calculated separately, but not included in total estimate	√	drug psychoses only
Crime Indicators						
Policing drug-related crimes	√	√		√		√
Court cost for drug-related crimes	√	√	√	√	√	√
Corrections related to drug crimes	√	√	√	√		√
Productivity Losses						
LT disability					√	√
ST disability			√			√
Premature Mortality	√	√	√	√	√	√
Lost work time due to incarceration for drugs	√		√	√		√
Other Direct Costs						
Research Costs	√		√	√	√	
Prevention Costs	√		√	√	√	
Salaries & Operating funds	√			√	√	

Traffic accident damage	√			√	√	√
	France	**England & Wales**	**Spain**	**U.S.**	**Canada**	**Australia**
Citation	Kopp & Fenoglio (2006)	HORS 249, Godfrey et al 2002	Garcia-Altes et al., 2002	ONDCP, 2004	Rehm et al., 2007	Monograph 49, Collins & Lapsley, 2002
Losses associated with the workplace					√	
- EAP & health promotion					√	
- drug testing						
Administrative Costs for transfer payments			√			
- social welfare & other programs	√	√			√	
- workers compenation	√				√	

CHAPTER 3

A process for constructing a global estimate of the burden of illicit drug use

The complexities involved in constructing a comprehensive national estimate of the cost of drug use are significant and efforts to construct them are nontrivial. Each of the previous studies represents a substantial amount of effort with numerous incremental decisions that needed to be made in order to facilitate their construction. While many of the decisions are grounded in science, some are simply pragmatic and are a function of the environment in which they are being constructed (e.g., data only exist to measure certain aspects of the problem or behaviour; or no cost data exist for estimating the cost of particular outcomes so they are excluded). These sorts of complexities and details are important when trying to make comparisons of the relative burden of illicit drug use across countries from existing estimates. They also demonstrate why it is unwise to try to consider the global burden of the problem by simply aggregating results from different studies. There are just too many important caveats, assumptions, definitional inconsistencies, and costing differences for such an aggregation to be truly meaningful.

In this chapter, we lay the ground work for thinking about how to construct a global estimate of the burden of drug use that is mindful of the issues just discussed. It is important to realise that any estimate of the global burden of drug use must be far less comprehensive than national estimates in terms of cost elements considered. This is not because the omitted costs do not matter on a global scale. Rather, it is more a function of the fact that some costs cannot be consistently measured across all countries. This may be due to differences in social and political environments that give rise to particular costs, which vary across countries independent of drug use, or it may be due to inconsistency in the measurement of the problem or the unit cost of the outcome. The goal here is to describe an approach that focuses on a fairly narrow set of key elements that are almost universal across countries. When these elements are measured consistently across countries, they can be used as a means for comparing the relative burden of the drug problem across countries, at least with respect to these common core elements. Not all countries currently collect each of these elements, however, so it still is not possible to provide a full global estimate based even on this narrower conceptualization of the problem. The utility of such an approach can still be demonstrated for those countries providing information on these elements.

It is important to begin with a definition of drug use that can be meaningfully and consistently applied across the various countries and result in accurate measurement of the same behaviour. Although regular, dependent or problematic users are more likely to

impose harm on themselves and others compared to recreational users, it is far more difficult to obtain consistent indicators of dependent, heavy, or problematic drug use across all countries. Indeed, recent efforts by the EMCDDA to obtain consistent measures of problematic drug use in each of the European Member States resulted in only 15 out of 27 member states reporting a measure of problematic drug use in 2007 (EMCDDA, 2008b). Given the problem of inconsistent measurement, therefore, this report focuses on measuring harms for any recent use of an illicit drug, as indicated through past year prevalence. A major limitation of using this measure, of course, is that it is impossible to construct an estimate of the cost per dependent or problem user, as done by Godfrey *et al.* (2002) for England and Wales. Furthermore, by using a simple measure of prevalence of any drug use, it is not possible to decompose costs by substance used. These represent real limitations to bear in mind when examining the results presented from studies using the same prevalence-type measure.

The general approach is to identify the health, productivity, and crime indicators that can be consistently tracked across a large number of countries. The specific health indicators should focus on those that are clearly attributable to drug use (need for drug treatment, drug-related mortality, overdoses) and those for which significant attention has been given by the international community, particularly the World Health Organization and UNODC (e.g. HIV/AIDS, Hepatitis B and Hepatitis C). Although such an approach would not represent the full range of probable drug-attributable morbidity (e.g., drug-related driving deaths), it is clear from the national studies previously reviewed that there remains significant debate regarding the health harms that should be considered as well as the presumed attributable fraction of specific diseases (e.g. Collins & Lapsley, 2008; Popova *et al.*, 2007). Thus, by focusing on a small set of core indicators for which there is relatively good measurement consistently across countries and for which there is general agreement regarding the extent to which drugs contribute, it reduces the effort and focuses energy on indicators that are likely to be widely agreed upon trans-nationally.[4]

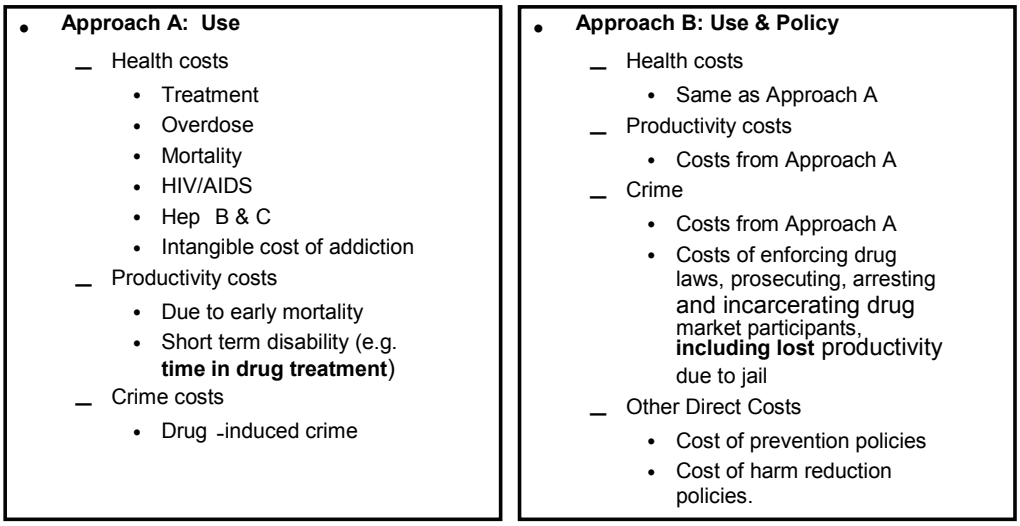
Figure 1 provides a basic conceptual framework for an approach that is mindful of the different social contexts and political responses that raise the cost of drug use when considering the burden of disease internationally. Two estimates of the economic cost of drug use should be constructed, rather than one. The first, which is referred to as Approach A, focuses more narrowly on costs that the scientific literature reasonably supports are incurred as a function of drug use itself. It largely reflects costs associated with drug treatment, poor health outcomes due to drug use, and lost productivity. It also includes the intangible health burden associated with drug addiction.[5] The second

[4] Of course, a major health area that is currently excluded from this framework is mental health. The literature examining the relationship between illicit drug use and particular mental health problems is still developing. As shown in Table 1.2, some national studies have included costs for specific mental health problems, but there is far from a consistent standard. Given the uncertainty regarding attributable fractions in the literature, the inconsistency in measurement of the problem in existing problems, and the lack of national data regarding the incidence of these problems for most countries, mental health costs are not being considered at this time.

[5] Recent work demonstrates that the intangible cost of living with addiction represents a substantial share of the total burden of the disease (Collins & Lapsley, 2008; Nicosia *et al.*, 2009). Other intangible costs also exist, such as family burden and the societal burden of living with diseases that are spread through drug use, but we

approach (labelled Approach B) adds to the first estimate the additional cost of society's response to the drug problem, in particular criminal justice costs, harm reduction and prevention policy responses. The reason for adding these costs in incrementally is so that the consumers of these numbers, in particular policy makers, can see the extent to which the economic burden is driven by consumption or society's response to that consumption.

Figure 1 Two Approaches for Estimating the Global Burden of Cost of Drug Use



Although drug treatment could clearly be considered a policy response rather than strictly a medical issue in many countries, we include drug treatment in Approach A rather than Approach B because it is unclear in many countries the extent to which drug treatment is a medical response (done because of a perceived medical need) rather than a policy response (done to change individual behaviour). Countries differ in terms of the fraction of drug treatment paid for by private payers versus public funders and the extent to which addiction is viewed as a health problem (and thus covered through regular health insurance) versus a behavioural or social problem. National statistics rarely differentiate treatment episodes in terms of who pays (private insurance, private charity/foundations or government). Indeed, even in Europe, the EMCDDA does not require member nations to report information regarding the fraction of all drug treatment paid for by the public sector. Given the inability to distinguish the extent to which drug treatment represents a policy response versus a medical response, it is included conceptually as part of Approach A.

Approach B provides an interesting point of comparison vis-à-vis estimates obtained using Approach A for both within-country assessments (in terms of the relative emphasis on responding to drug use versus the burden of that use itself) as well as across countries assessments (in terms of the relative magnitude of the costs of society's response versus the

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are not aware of any international efforts to systematically consider the quantification of these costs. However, in the case of the burden of disease, significant work has occurred internationally attempting to quantify the value of a lost quality of life or disability burden of addiction as well as other diseases (King *et al.*, 2005; Zaric *et al.*, 2000; Barnett & Hui, 2000; Hirth *et al.*, 2000).

cost associated with use).[6] Of course, no informed interpretation of these numbers can be made without additional information regarding the relative effectiveness of particular policies. Indeed, if a particular policy approach is truly effective, then it is possible that the cost of implementing it exceeds the cost of users who are undeterred by it in some cases. Thus, just because a policy approach is more expensive than consumption, per se, does not mean that the policy should not be pursued. Further, because it is impossible to know the extent to which treatment represents a medical response versus a policy response and treatment represents a major fraction of some country's total policy response, interpretations of these comparisons should only be made cautiously.

Figure 1 clearly represents a simplification of the drug problem and the costs associated with it. Several relevant and important aspects of drug-related harm captured in existing national studies are clearly omitted. The focus on these indicators, however, is due to the fact that they are the main cost elements considered consistently in previous national studies, as indicated by Table 2. They therefore represent the most plausible starting point for conducting a systematic assessment of costs for multiple countries.

[6] Note that if a policy has an effect, then the total cost estimated using Approach A would reflect the effect of the policy through lower estimates of consuming related harms. This does not make the suggested comparison uninteresting but demonstrates the need to be cautious interpreting results regarding the relative differences in cost of policy versus cost of consumption.

CHAPTER 4 Difficulties in constructing a global estimate: the need for further refinement

The viability and utility of the construct just developed is now considered through an attempt to generate our own prevalence-based, bottom-up estimate of the economic burden of drug use for a limited number of consuming nations. What becomes immediately apparent is that even using this simplified conceptualization of the burden of drug use, it is impossible to implement a consistent and comprehensive assessment of these few costs across most countries. Further reductions in both the number of countries considered and the elements actually included must be made due to the lack of systematic data collection efforts across most countries. These reductions are due to factors that could change in the future if data systems improve, so they are viewed as refinements made out of practical necessity rather than conceptual preference.

4.1 Limiting the number of countries considered

Originally this construct was to be broadly applied to a large set of developed and developing countries, but it quickly became evident that reliable data on even a small subset of drug-related harms is sorely lacking for most countries. This can be best illustrated by simply taking a closer look at a region of the world that has relatively good drug-related outcome measures, the 27 member states of the European Union. Unlike any other region, the EU has for the past several years dedicated significant resources to the compilation and standardization of measures of drug harm across its member states through a coordinated effort led by the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA). The task of harmonizing indicators across the member states has been a slow and difficult process because the member states started with very different data collection efforts in existence and it takes time to agree on a common definition and develop and harmonise processes for collecting data elements employing that common definition. Thus, the data reported to the EMCDDA today remains incomplete and highly variable in a few domains despite the significant progress that has been made. Table 3 summarises data on just a few health indicators reported in the 2007 National Focal Point (REITOX) reports and compiled by the EMCDDA in the 2008 Statistical Bulletin.[7] Although our goal was to obtain data for each health indicator across all EU member

[7] The data presented in Table 3 come from various tables presented in the EMCDDA's Statistical Bulletin for 2008 (EMCDDA, 2008b).

countries for the year 2006, several countries do not yet report annual updates for all of the health indicators we are hoping to use. So, what is included in Table 3 are estimates reported in the REITOX reports for either 2005 or 2006 (EMCDDA, 2008b). Data from previous years were not included although they are available in the EMCDDA data tables so that we could demonstrate the point that consistent estimates are not available across all indicators for a particular year. When data are not reported for either 2005 or 2006 in the EMCDDA Statistical Bulletin, the indicators are left blank in Table 3.

For some health indicators, there is fairly comprehensive reporting of health issues evidence of the success that EMCDDA has had in coordinating these data across countries. In particular data on new clients entering treatment, those receiving substitution therapy and drug-related deaths are fairly comprehensive in that estimates are provided by most Member States. However, even for these indicators, the EMCDDA provides extensive notes and cautions to users explaining that simple comparison of the levels of these indicators across all EU countries is still not possible due to some remaining differences in reporting, data methods, and definitions (which they are continually improving upon). Indeed, the EMCDDA writes in the methods section for drug-related deaths the following:

"National statistics are improving in most countries and their definitions are becoming the same, or with small differences, to the common EMCDDA definition (called "Selection B" for the General Mortality Registration and "Selection D" for the Special Registries). A few countries still include cases due to psychoactive medicines or non-overdose deaths, generally as a limited proportion of the total. In addition, there are still differences between countries in procedures of recording cases, and in the frequency of post-mortem investigation (including autopsy rates). In some countries information exchange between General Mortality Registries and Special Registries (forensic or police) is insufficient or lacking, which compromise the quality of information. However considerable progress has been obtained during the last years in quality and reliability of information on many Member States. Direct comparisons between countries in the number or rates of drug-related deaths should be made with caution; but if methods are maintained consistently within a country, the trends observed can give valuable insight and interpreted together with other drug indicators." (EMCDDA, 2008b).

Then there are indicators for which there is less consistent reporting even within the EU. In particular relatively few countries are able to provide national estimates of injection drug users even though this number provides the basis for measuring problem drug use, as defined by the EMCDDA. Indeed, as indicated by the second column under "Injection Drug Users" there are several countries who do not even report estimates of the fraction of clients entering treatment who inject drugs. Given the uncertainty regarding the actual number of injection drug users within each country, it seems difficult to understand how countries such as Poland can report the total number of problem drug users (final column). The EMCDDA requests that all member states provide information on the number of problem drug users, which they define as "injection drug use or long duration/regular use of opioids, cocaine and/or amphetamines. This definition specifically includes regular or long-term use of prescribed opioids such as methadone, but neither includes their rare nor irregular use, nor the use of ecstasy or cannabis. Existing estimates of problem drug use are often limited to opioids and polydrug use" (EMCDDA, 2007a). While, Poland does report information on individuals receiving substitution therapy, this

number (1,221 individuals) alone provides little understanding to someone not intimately familiar with the data collection efforts inside of Poland of how the 52,000 problem drug users were determined. Similarly, it is not clear how Italy can report having 304,539 problem drug users, but only 97,434 clients receiving substitution therapy and again no national estimates of IDU use. The low correlation among these three variables (problem drug use, injection drug use and substitution therapy clients) that, by definition of problem drug user should be highly correlated, is perplexing and raises questions regarding the variability of methods each country employed to generate these results to even a casual user of these data.

Table 3 European Indicators of Drug Related Health Problems for 2006 (or 2005 if 2006 data not available)

	Drug Treatment				Injection Drug Users			Problem Drug Users		
	New Clients Entering Drug Treatment	Clients Receiving Substitution Therapy	Drug Related Deaths	Mean Age	National Data	Entering Tx	Tested for HIV/AIDS	PDU	Upper Bound	Lower Bound
Belgium		12,300	123	34.2			494			
Bulgaria	1,328	1,100	29	28.8		926	1,216			
Czech Republic	8,164	3,700	42	32.1	29,000	4,939	2,134	31,800	35,700	28,600
Denmark	5,426	6,289	207	42		157	188	26,979	28,568	25,390
Germany	62,046	64,500	1296	35	94,250	5,026	1,326	179,500	195,000	164,000
Estonia		602	68	25.6	13,886		449			
Ireland	5,280	9,428	112	33.6		607	64	14,452	15,819	13,405
Greece	4,847	3,950	173		9,729	1,755	1,468	20,146	22,252	18,285
Spain		83,469	665				8,185	254,808	275,789	233,827
France	37,494	97,468	295	47.9		1,762	817			
Italy	47,823	97,434	517	35.2		13,677	67,300	304,539	314,520	234,803
Cyprus	528		7	28.3	604	144	96	692	909	548
Latvia		164	17	25.7			1,285	1,944	2,917	1,521
Lithuania	5,574	381	62	29.7		5,173	1,455			
Luxembourg	379	1,044	19	32.5		249	456	2,875	3,948	1,801
Hungary	15,480	853	25	30.2	3,941	960	369	24,204	29,075	19,333
Malta	758	671	7	28.6		338	175	1,727	1,874	1,625
Netherlands	9,623	13,450	112	39.2		87	452	32,418	39,118	25,718
Austria	5,603	8,120	197	29		1,025	556	29,597	31,431	27,763
Poland		1,221	290	42			1,258	52,000	71,000	33,000
Portugal		22,922	216	33			6,740	53,082	58,980	47,184
Romania	1,350	570	21	21.3		945	138			
Slovenia			44	33.2			350			
Slovakia	1,927		20	35.5	18,841	647	1,036	18,393	32,182	13,565
Finland	2,487	1,000	138	38.3		870	3,770	16,600	19,100	14,500
Sweden	6,962	2,739	135	36.8		1,246	561	25,745		
United Kingdom	128,446	146500	1979	37.7	156,398	23,634	4,389	403,547	423,907	395,378

The fact that the EU has not completely harmonised all of their harm indicators already is not by any means surprising or an indication that the current efforts are futile. Instead, it is indicative of the fact that this is a very difficult task and when done with great care and consideration, as being done by the EMCDDA, takes time. Furthermore, the attention that the EMCDDA is giving to the consistent collection of these data within its Member States raises general awareness of how different even similarly-named indicators can be across countries and how cautious one must be in simply drawing comparisons. The inconsistencies in data indicators across countries outside the EU are certainly far greater than that within the EU because of the coordination that has been undertaken in the EU.

Given the difficulties in interpreting numbers reported from different countries demonstrated by the EMCDDA, it was decided that the current effort would be greatly improved by focusing on a narrow set of countries for which the data are believed to be of reasonably high quality and information regarding their collection was readily available. Specifically, we attempt to construct consistent indicators of harm from existing data sources for the United States, Canada, Australia, the UK, Spain, France, Italy, Germany and the Netherlands. These countries are selected for because (a) they each represent a major consuming country, (b) the European countries selected are the largest consuming countries of the original 15 EU nations and hence represent important markets, and (c) these countries are believed to have the most reliable data in light of significant national efforts to collect meaningful data within each of them.

4.2 A further reduction in the cost elements considered

Some of the cost elements included as part of the conceptual framework in Figure 1 cannot be assessed even for a narrow set of countries with relatively rich data. In particular, there is no systematic reporting of reliable and consistent estimates across countries on the non-mortality based lost productivity (e.g. absenteeism) and drug-induced crime. Significant conceptual differences exist across countries regarding what should be included in these costs and how to measure them (Godfrey *et al.*, 2002; ONDCP, 2004; Rehm *et al.*, 2007; Collins & Lapsley, 2008). Many of these inconsistencies stem from scientific literatures that are far less conclusive regarding the extent to which drug use causally influences each of these outcomes. The findings from the literature are sensitive to which drugs are being considered, the age of the individuals involved, as well as the environment.

4.2.1 The literature on the association between drug use an non-fatal productivity losses

Substance use is believed to diminish productivity and lead to poor labour market outcomes for several reasons. First, it may delay initiation into the work force, thereby reducing experience and human capital accumulation associated with on-the-job training (Johnson & Herring, 1989). Second, it may decrease the probability of being employed which, again, may interfere with human capital accumulation (Gill & Michaels, 1992; Register & Williams, 1992). Third, it may increase absenteeism which directly influences the productivity of not only the drug user, but also those individuals who work with him (French *et al.*, 1998; Zarkin *et al.*, 1992). Finally, substance abuse may reduce an individual's productivity at the job, which should translate directly into lower wages if wages are indeed a good indicator of marginal productivity (Hoyt, 1992).

Empirical studies that analyze the direct effect of substance use and abuse on earnings, which is presumed to be the strongest indicator of an individual's productivity, have generated very mixed findings, however. Even after accounting for the endogeneity of substance use, earnings of substance users are found to be higher by some researchers (Kaestner, 1991; 1994a; Gill and Michaels, 1992; Register & Williams, 1992; French & Zarkin, 1995), lower by others (Burgess & Propper, 1998; Hoyt, 1992), and either statistically insignificant or not determinable by others (Kaestner, 1994b; Zarkin *et al.*, 1998). The lack of a robust finding has led many economists to focus on other measures of productivity, such as the probability of being employed or unemployed (Bray *et al.*, 1997; Register and Williams, 1992; Kandel & Davies, 1990) or absenteeism (French *et al.*, 1998). Here, too, the evidence is mixed. Given the uncertainty regarding a causal association, some researchers have attempted to capture the time spent away from work dealing with drug-related problems, such as treatment (Collins & Lapsley, 2002; ONDCP 2004; Rehm *et al.*, 2007). But research remains inconsistent across countries in the consideration and treatment of these costs.

It is clear that the relationship between substance use / abuse and labour market outcomes is dynamic and can be potentially influenced by the relationship between early substance use and human capital production. The potential for reverse causality, however, is also real. Just as substance use and abuse can lead to job separations and other poor labour market outcomes, job separations may lead to increased substance use and abuse. In light of the potential for feedback loops, it is important to use appropriate statistical methods that can isolate the true nature of the relationship. Much research in this area remains to be done examining associations within countries before aggregate level measures of lost productivity due to substance use can be reasonably constructed.

4.2.2 The literature on drugs and crime

Findings from surveys of prison populations over the past five years for European Member countries and the U.S. show that, compared to the general population, drug users are overrepresented in the prison population (EMCDDA, 2006; National Institute of Justice, 2000). Information pertaining to lifetime use rates among prison populations, however, provide no real information as to whether the individuals' drug use caused the crime to occur (with the exception of those crimes which are by definition caused by use or sale of a drug). The mere fact that a person uses an illicit substance does not mean that it was that substance that caused the individual to engage in crime in the first place (i.e. causal attribution). Moreover, a positive drug test does at the time of arrest does not necessarily imply that the individual was under the influence at the time the crime was committed. It merely implies there is a strong positive association between drug use and crime, which may be driven by a true causal mechanism (for some crimes and some drugs) or by some other factor (observable or unobservable) that is correlated with both the decision to engage in crime and the decision to use drugs.

When considering the economic burden of drug use, one wants to capture all those resources that are lost because of the use of drugs – not because the same people who use drugs also engage in criminal behaviour. Thus it is necessary to include only those criminal costs that are clearly attributable to drug use. The scientific literature most often refers to three categories of drug related crime based on Goldstein's tripartite model:

psychopharmacological, economic compulsive and systemic crime (Goldstein, 1985). Psychopharmacological crime refers to crime committed by individuals under the influence of an illegal substance. In other words, the chemical properties of the drug alter the individual's thinking, perceptions or mood and induces the individual to engage in the crime. Crimes that typically fall into this category include assaults and sexual offenses. Economic compulsive crime refers to crimes committed by drug users who are in need of income to fund their drug habit. These crimes generally include broad property crimes (theft, larceny, burglary, identity theft, motor vehicle theft), robbery, prostitution, and possibly drug selling that might generate income for the individual engaging in the crime. The third category of crime, systemic crime, refers to crime generated by efforts to maintain a black market or territory by illegal participants in the black market. Typical crimes included in this category are homicide, manslaughter, aggravated assault, and money laundering. A fourth category of drug-related crime is slowly gaining in recognition, victimization (MacCoun *et al.*, 2003).

While much has been written on each of these types of crimes and recent estimates of the cost of drug abuse attempt to consider their impact (e.g., Collins & Lapsley, 2008), the scientific evidence providing definitive proof of a causal association between drug use and particular crimes is rare in population data. Evidence from treatment populations appears to be far more convincing of a strong association (Zarkin *et al.*, 2005; McCollister *et al.*, 2003; Aos *et al.*, 2001), but that evidence has yet to be broadly construed as evidence of a causal relationship.

Without any clear guidance regarding what types of crime can and should be considered drug-related, independent investigators construct their own estimates of these relationships based on information they have available to them. Given the significant differences in data availability, this translates into estimates that are not naturally comparable across countries. For example, as part of their National Focal Point reporting, several EU countries report the extent to which either police agencies or the reporting agency attribute specific crimes to drugs. Other countries, including the U.S., use information on the number of arrestees or prisoners who report being under the influence of drugs or in need of drugs at the time of their crime as a way of estimating the number of drug-induced crimes. Both measures have limitations in that they both only represent crimes that generate an arrest and hence underestimate the extent to which these activities actually happen. However, they are not exactly comparable as the police reports reflect the police's interpretation of weather a crime was conducted to get drugs, whereas the arrestee or prison population data give information based on the perpetrator's own self-report.

4.3 Examination of a few indicators for countries with good data collection systems

Table 4 presents a small set of indicators that might be used to construct an estimate of cost using the framework described above for a few countries that are generally believed to have good data available. However, careful examination of each of the indicators presented here raises doubts as to whether even such a simple comparison is truly meaningful. In this section we discuss issues regarding the comparability of the actual indicators that might be

considered. In the next section we discuss the difficulties in trying to cost some of these measures.

4.3.1 Drug treatment

In the first column of Table 4 information on the number of clients receiving substitution therapy is reported circa 2006.[8] While data are generally available for many developed countries on the number of new treatment admissions and those receiving substitution therapies (as indicated in Table 3), countries do not consistently report information regarding the fraction of treatment episodes that take place in particular treatment settings or under specific therapies within those settings. That makes it extremely difficult to know how to compare treatment as well as the cost of the treatment, as costs are intrinsically tied to the type of treatment received (and for some countries, where it is given). Although substitution therapy is not the only form of drug treatment used across countries, and for some countries it is not even the most common form of drug treatment, it is a somewhat more standardised form of treatment that can be generally understood across countries and reported in such a way as to reflect a similar construct. There remains considerable variability in the types of substitution therapies that are available within countries, so direct comparisons across countries in any particular type of substitution therapy (e.g., methadone maintenance, buprenorphine, or prescription heroin) would not do adequate justice for demonstrating the extent to which substitution therapies are used in general. However, summary measures of the number of people receiving any type of substitution therapy should provide some measure of the availability of treatment generally.

Table 4 Primary Indicators for Establishing Cost of Drug Use

Country	Clients Receiving Substitution Therapy	IDU	HIV Cases Among IDU	Hep C	Hep B	Problem Drug User	Drug Related Deaths	Drug Related Offenses
Germany	64,500	94,250	4,995	70,688	49,953	179,500	1,296	243,706
Spain	83,469	83,972	31,070	55,589	18,894	254,808	665	235,422
France	97,468	122,000	19,520	67,100			295	101,110
Italy	97,434	67,300	8,143	5,857	26,584	329,691	517	68,370
Netherlands	13,450	3,115	296	1,730	1,096		112	20,704
United Kingdom	146,500	156,398	3,597	66,469	31,827	409,643	1,979	124,932
United States	97,400	546,257	65,551	294,979	87,401	2,384,000	2,612	1,889,810
Australia	38,659	321,100	4,817	195,871	57,798	637,546	458	78,533
Canada		284,263	37,523	186,761	73,908	474,327	1,041	85,953

[8] Information for European countries comes from the EMCDDA Statistical Bulletin (2008), Table HSR-3 ("Estimated number of clients in methadone treatment and of clients receiving any opioids substitution", Column 4 "All substitution clients, 2006"). Information for the United States comes from the 2006 Treatment Episode Data Set (TEDS). Information for Australia comes from the 2007 National Opioid Pharmacotherapy Statistics Annual Data Statistics, which reports numbers for 2006. Information on the number of individuals receiving substitution therapies in Canada is not available.

4.3.2 Injection drug use

In order to estimate the number of individuals impacted by HIV/AIDS, Hepatitis C and Hepatitis B due to illicit drugs in specific countries one must first have a good estimate of the number of injection drug users, as most countries only report rates of infection for these diseases among injection drug users. As shown earlier in Table 3, very few European countries provide national estimates of the number of IDUs. In fact, only 9 of the 27 member states of the European Union provide national estimates of the number of injection drug users for 2005/2006.[9] But in order to obtain national estimates of these infectious diseases of interest, one must start with national estimates of IDU rates, so attempts are typically taken to fill in the holes for non-reporting countries.

A common strategy used by researchers when current data are not available is to look for previous national estimates of the same indicator. Indeed, the EMCDDA reports in Table PDU-102 of the 2008 Statistical Bulletin all the individual studies that have been conducted providing national estimates of the population of injection drug users in Member States. Careful examination of this information shows that earlier national estimates for many of the non-reporting countries are available. For example, there is an estimate for Italy from 1996, Spain from 1998, France from 1999 and the Netherlands from 2001. These national estimates are inserted into Table 4 for these countries and are used for developing estimates of HIV/AIDS, Hep B and Hep C. However, some of these national estimates are more than 5 years old, and considerable changes in the number of injection drug use may have occurred in these countries. Thus, relying on such old estimates for generating good estimates of the incidence of these diseases for 2005/2006 would not be recommended.

While it is possible to construct current estimates for non-European countries, the methods for doing so necessarily differ across countries which should immediately raise concerns regarding their comparability. For the United States, a national estimate of injection drug users can be constructed by combining information from the 2006 National Survey on Drug Use or Health (NSDUH) on the number of dependent users (cocaine, heroin and stimulant) with information on the fraction of dependent individuals entering treatment who are likely to inject their drug of choice (TEDS, 2006). Such an estimate, while feasible, is hardly ideal as the household population is known to under represent or completely miss relevant populations who engage in use of harder substances, and hence injection drug use, and the Treatment Episode Data Set (TEDS) data only capture individuals in treatment. However, no national estimate of injection drug use for all drugs is available for the U.S., and so any construction would necessarily rely on inadequate data. For Australia, the 2004 Australian Household Survey inquires about injection drug use more generally in the survey. Approximately 1.9% of the population report ever injecting drugs in their lifetime, thus this estimate can be multiplied by the fraction of the Australian population that is 15 years of age or older to generate an estimate of national IDU.[10] For Canada, a similar approach to that of Australia may be used, as the 2004

[9] For these 9 member states, comparisons in the prevalence of drug-related HIV/AIDS rates can be reasonably done.

[10] Precise information on the 2006 Australian population by age could not be accessed, so we used the readily available 2007 estimates for generating our total population estimate. According to official records, the total

Canadian Addiction Survey includes a question regarding lifetime injection drug use within the survey (1.1% of the respondents report yes). Again, given this is a nationally representative household survey capturing individuals age 15 years and older, this estimate of injection drug rate can be multiplied by the population of Canada. Approaches for Canada and Australia, while possible, again are likely to underestimate the true number of injection drug users due to the fact that household surveys miss these often marginalised populations.

The true consistency and reasonableness of these IDU estimates for various countries is something that needs to be seriously considered. Although it is possible to obtain estimates for most countries, as indicated by the fact that we were able to "fill in" the IDU column in Table 4, some estimates are highly dated and others are based on general household surveys which are likely to significantly under-represent the very population we are trying to capture with this indicator. A simple examination of the values for particular countries raises serious questions. While the United States clearly comes out as the country with the highest number of IDU's, this translates to only 18.2 per 10,000 people, far lower than the UK, Australia and even Canada and much closer to per capita rates from Spain and France. Given the substantially different injection culture in Spain, France and the United States, comparability in the number of IDUs per capita seems a bit implausible. And the rate for Canada, which is a country neighbouring the United States and suffering from many of the same drugs of abuse, seems implausibly high when compared to the U.S. Thus, it seems unlikely that indicators constructed in this disparate manner truly do a good job representing the real variability in injection drug use that is likely to exist across countries (2005/2006). Such an observation is important because these estimates of the number of injection drug users form the basis for estimating the rates of drug-related HIV/AIDS, Hep C and Hep B, as is discussed next.

4.3.3 HIV/AIDS

HIV prevalence rates among injection drug users are consistently tracked by most developed countries in an effort to monitor the global AIDS crisis. For example, the EMCDDA reports in their Statistical Bulletin each year the percent of a sample of injection drug users who test positive for HIV.[11] The samples used to generate these estimates are in some cases nationally representative (e.g. Germany, Spain and Italy) and in other cases they are based on sub-national populations (France, the Netherlands and the UK). And again, in many cases estimates are not available for the most recent year, so earlier studies from previous years are employed (e.g. the Netherlands and France).

Similar estimates are available from national health statistics agencies for the other Western countries considered here. Information on the fraction of IDU-related new HIV cases in the U.S. comes from the U.S. Centres for Disease Control (CDC)[12], which is then

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Australian population grew by only 317,200, so we should not have introduced to large of an error using this method.

[11] Prevalence rates of HIV infection among IDU are reported for all EU countries in Table INF-1, which represents the primary source of our numbers.

[12] U.S. Centers for Disease Control (CDC). Available: www.cdc.gov/Features/dsWorldAidsDay/, accessed December 2008.

multiplied by the estimated number of injection drug users in the United States to get at the number of IDU-related HIV cases. Information on drug related HIV outcomes in Australia come from Australian Institute of Health and Welfare NCHECR annual surveillance report of IDU users participating in a needle and syringe exchange programs. Table 4.2.1 (2006) shows that the percent of IDU users testing positive with the HIV antibody across all 8 locations is 1.5%. Again, prevalence estimates of IDU-related HIV are then multiplied by the total number of IDU users estimated for Australia. Data on IDU-related HIV for Canada come from the 2006 report on I-TRACK: Enhanced Surveillance of Risk Behaviours among Injection Drug users in Canada Phase I Report (Public Health Agency of Canada, 2006). As in Australia, this surveillance system monitors known IDUs who participate in needle and syringe exchange programs throughout Canada. Thus, the method from which prevalence rates of HIV/AIDS among IDU users varies considerably across countries as do the population based from which they are drawn.[13]

HIV incidence rates among injection drug users from various national health departments are multiplied by the number of injection drug users reported in the second column of Table 4 to generate the number of drug-related HIV/AIDS cases for each country, as shown in Column 3 of Table 4. Estimates of the number of drug-related HIV cases reported in the Netherlands and the UK seem implausibly low, especially when compared to the other developed countries. In the case of the Netherlands, the low HIV number is driven by the fact that we have a small number of IDU users on which to get this total. In the case of the UK, it is actually that the estimated rate of HIV/AIDS among IDU users (range of 0.6 – 4.0, so midpoint is used) is significantly smaller than that of other European countries. This could be due to measurement error, as the UK estimate is drawn from sub-national studies. These examples demonstrate again why one should be cautious drawing comparisons from these numbers even though they appear to be tracking the same phenomena, as the lower number of HIV cases reported for some countries are not necessarily reflective of lower incidence rates but rather less comprehensive estimates of the components that make up these numbers.

4.3.4 Hepatitis C

As is similar to the case for HIV, most Western countries report the prevalence of injection drug users testing positive for HCV antibody. However, there remains substantial variation

[13] It should be recognized that not all HIV cases among IDU's are necessarily caused by injecting drugs. Studies evaluating the fraction that can be attributed to IDU, however, suggest it is a high proportion. Given the lack of systematic information on the fraction of non-IDU drug users who might also spread or contract HIV/AIDS due to risky sexual behaviour, it is not possible to include this population in the estimate here. Non injection drug use can contribute to HIV infection as well as other sexually transmitted disease in at least three ways: (1) by facilitating sexual risk behaviour (e.g., through reducing inhibition, reducing the probability of condom use); (2) by motivating sexual risk behaviour (e.g., engaging in prostitution or hustling in order to get drugs); and (3) through physiological effects that make infection more likely if sexual contact occurs. For example, smoking cocaine in a pipe can cause lesions on the lip or the mouth, which may increase the likelihood of HIV transmission via oral sex. Similarly, use of crystal meth can prolong erection, enabling men to engage in intercourse for much longer periods, causing abrasions that facilitate HIV transmission. While it is known that these things can and do happen, there is no good population-level data that can assist in the estimation of the attribution factor of drug to HIV through STDs.

in the samples from which these prevalence estimates are obtained as well as the reliability of national estimates of IDU users for that country. Information among EU Member States regarding the prevalence of Hep C among IDU users is again systematically collected by the EMCDDA and reported in Table INF-2 of the annual Statistical Bulletin, but again countries may use national samples or sub-national samples to generate estimates of these rates. In Australia and Canada, the same systems used to report HIV/AIDS are used to monitor Hep C among injection drug users, using sub-national sample of IDU's who choose to participate in needle and syringe exchange programs. In Australia, the rate for 2006 is 61% and that for a Canada is 65.7%. For the U.S., there is no similar monitoring system to track rates of Hep C among IDU users. Instead, information on the fraction of new Hep C cases occurring among IDU users is used as a method for estimating total IDU-related Hep C. Thus, the denominator for which the estimate from the U.S. is being built is fundamentally different than that for Australia, Canada or even the EU Member States. Thus, it should not be surprising then that the attributable fraction for the U.S. looks somewhat different (that for the U.S. is 54%). These differences in approaches across countries again highlight the problems in trying to draw comparisons of indicators.

4.3.5 Hepatitis B

Hepatitis B is again approached the exact same way as HIV/AIDS and Hepatitis C, although with slightly different data sources.[14] First, an estimate of the prevalence of hepatitis B among IDUs is obtained from either a national sample or subsample. Then this fraction is multiplied by the number of IDUs estimated for each country, with the exception of the United States where the fraction represents only new cases of hepatitis B rather than all cases. Note that prevalence estimates are generally based on results from patients showing hepatitis B surface antigen (HBsAg (1)), which is considered the best marker for acute and chronic HBV infection. However, when countries do not report results for this marker, information on surface antibody (aHBs) or core antibody (aHBc) is used instead.

4.3.6 Problem drug use

A measure of the number of individuals suffering from problem drug use (PDU) is necessary to estimate the intangible cost of living with addiction. As noted in Table 3, even countries that are required to report this information have difficulty systematically constructing estimates of the number of PDUs. The EMCDDA asks EU Member States to report in the National REITOX reports estimates of the number of PDUs. In the case of Germany, Spain, Italy and the UK, the prevalence of PDU employing the standardised definition is reported in Table PDU-1. Unfortunately, data on PDU are not reported for either France of the Netherlands in the summary table, suggesting that either estimates

[14] Prevalence rates of hepatitis B are again obtained from information reported by the EMCDDA in the Statistical Bulletin (2008) (Table INF-3). For the United States, information on hepatitis B comes from the Centers for Disease Control (MMWR, 2008), but represents fraction of new hepatitis B cases that are due to IDU. Data on rates of hepatitis B among IDU for Australia again come from Australian Institute of Health and Welfare (AIHW, 2007), but do not necessarily represent new cases. We could not identify a reasonably recent source of information on hepatitis B in Canada, so we used the attribution factor published by Popova *et al.*, 2007.

were not created or could not be constructed in a manner that is consistent with measurement in the other Member States. The concept of PDU has not been widely adopted outside the EU. So for the United States, Australia or Canada an alternative approach for estimating these problem users has to be taken, immediately indicating that comparability across these countries as well as with the EU Member States is a problem. In the United States, information from the 2006 National Survey on Drug Use or Health (NSDUH) is used to identify the number of people meeting DSM-IV criteria for cocaine, heroin, other opiates, methamphetamine, and other stimulants. Thus problem drug use is operationalised as those experiencing clinically diagnosable abuse or dependence. Similarly in Australia, information from the 2007 NDSDUH is used to get number of dependent or IDU users for cocaine, heroin, or amphetamines and this number is multiplied by the 2007 population (AIHW, 2008). In Canada, information from the 2004 Canadian Addiction Survey (CAS) is used to identify fraction of Canadian population who report past year use of cocaine, speed and ecstasy. This total is then multiplied by 0.4, as the CAS study shows that between 36.7% and 42.1% of recent illicit drug users (excluding cannabis) are problem users (Aldif *et al.*, 2005).

Estimates of the total number of PDUs for each country using the methods just described are reported in Column 6 of Table 4. Again, differences in these numbers across countries cannot be viewed as indicative of real differences in light of differences in how these numbers are defined and measured, particularly when looking at the non-European countries as compared to the European countries. In the case of the U.S., Canada and Australia, considerable scepticism is likely as estimates are based again on general household populations. Furthermore, because different drugs are of concern in these countries, it may be the case that the drugs considered in non-European countries are broader than that applied by countries constructing estimates within the EU.

4.3.7 Drug related deaths

The definition of drug related death adopted here is identical to that employed by the EMCDDA, which is "those deaths that are caused directly by the consumption of drugs of abuse. These deaths occur generally shortly after the consumption of the substance(s)". By construction therefore, homicides, suicides or motor vehicle fatalities involving illicit substances are not necessarily reflected in these numbers unless a medical examiner identified in the ICD-9 codes that consumption of illicit drugs was the cause of the death.[15] While it is possible to construct a similar estimate of drug-related deaths for the United States, data from other countries are not as readily available. Thus for Canada and Australia, existing estimates of the number of drug-related deaths based off of slightly different definitions are included in the table so as to capture some deaths, even if they are not measured the same. Given the inability to collect information for all countries using the same specific definition, caution should be taken in making comparisons across countries.

[15] Information on European countries comes from Table DRD-1 of the Statistical Bulletin. Information for the United States comes from authors own analysis of CDC's WONDER data system. Data for Australia are from Collins and Lapsley (2008). Finally, information from Canada is based on Popova *et al.* (2007)'s estimate for 2002, as more recent data were not available.

4.3.8 Drug related offences

This indicator is intended to capture country-specific information on the number of arrests related to the possession, sale and/or trafficking of illicit drugs. Thus, these represent the crimes associated with engaging in drug trade or use, not crimes committed under the influence of a substance. However, given that possession of a drug is not a criminal offense in all countries, these numbers will also reflect a slightly different approach across countries to managing drug markets. Information on drug related offences for European countries comes from the Statistical Bulletin's Table DLO-2, DLO-4, and DLO-5, which attempts to reconcile country differences in regarding the treatment of offenders caught in possession of a drug. Indeed, in their data the EMCDDA has countries report administrative as well as criminal offences to improve comparability across the EU Member States. We add to these numbers information from the Federal Bureau of Investigation's Crime in the United States for the U.S., Canadian Crime Statistics for Canada, and estimates from the Australian Illicit Drug Data Report for Australia. Not surprisingly, it can be seen in the final column of Table 4, that the United States has the greatest number of drug related offenses in total. The U.S. also has the highest rate per capita (63.1 per 10,000 people versus 29.5 for Germany and 27.9 for Australia). However, the data would also suggest that Spain had more drug related offences in 2006 in total and per capita (54.7 per 10,000 population) than the UK and France (who had per capita rates of 26.3 and 16.1, respectively). This is inconsistent with our intuition for these countries given that Spain, unlike the other countries, has decriminalised possession of all illicit substances. However, the difference is likely due to the inclusion of administrative offences in the E.U. measures. Unfortunately, offence estimates from non-EU countries, like Australia, that also retain administrative offences for some drug possession offences (e.g. cannabis) are not likely to be reflected in their numbers.

As the previous discussion highlights, efforts to obtain country-specific measures for all the indicators presented in Table 4 raises numerous questions and issues regarding the probable comparability and reliability of these indicator data even for countries with relatively good data collection systems. And these questions and concerns arise even before further issues related to the measurement of unit cost estimates are considered. When additional issues related to the inconsistency in quantifying the cost of each outcome are also considered, as outlined in the next section, the reasonableness of comparing estimates of the burden of drug use by combining these indicators of harm with measures of costs becomes even more questionable.

CHAPTER 5 Determining the unit cost of drug-related harms

A significant challenge when trying to compare the economic cost of any health related behaviour across multiple countries is the development of consistent unit cost estimates. Health care systems differ, which impact the average cost of services received and who pays for those services. Further, labour markets differ, which impacts the average cost of a lost day of employment as an individual's wage may or may not be a good measure of the average productivity at work. Added to that in the case of using an illicit drug is the additional challenge of trying to prevent use of an illegal substance. The difficulty is not just in terms of thinking how one might want to measure these average costs, but also in actually obtaining reasonably good data of those costs you are trying to capture. Herein lies the greatest challenge.

Table 5 provides a summary by country of unit cost estimates that might be applied to calculate the total cost of drug use for the some of the indicators constructed thus far. As was the case with the actual indicators of harm, going through the exercise of identifying the source for potential unit cost estimates makes explicit the pitfalls and issues involved in trying to construct these estimates. To the extent possible, the unit cost estimates represent the average costs of particular events, and have all been adjusted and/or inflated to reflect 2006 Euros.[16] In many cases the method for obtaining the unit cost estimate for a particular event differs across country. To the best of our ability, we attempt to keep the unit cost estimates homogeneous with respect to the resources used to manage an event. It is not possible in all cases to cost an event in the exact same fashion, however. Differences in approaches and resources included in particular unit cost estimates are discussed in greater detail below.

[16] Costs are inflated using the country-specific inflation rate, and then converted into Euros using the average currency conversion rate for 2005. The date of 2005 for the conversion rate was done to make estimates from this report more consistent with estimates obtained in our report of the size of the global market for illicit drugs.

Table 5 Unit Cost of Estimates for Events and Indicators Captured in Report of Economic Cost of Drug Use

	Lifetime Cost of HIV infection	Lifetime Cost of Hepatitis C	Cost of Hepatitis B	Euro per QALY	Average Cost per Drug Offense
Germany	€ 70,400	€ 24,458	€ 2,401	€ 50,000	€ 7,609
Spain	€ 54,000	€ 17,564	€ 2,401	€ 50,000	€ 2,442
France	€ 90,800	€ 16,068	€ 2,401	€ 50,000	€ 7,734
Italy	€ 77,000	€ 30,914	€ 2,401	€ 50,000	€ 40,711
Netherlands	€ 50,000	€ 21,165	€ 2,401	€ 50,000	€ 96,330
United Kingdom	€ 42,500	€ 14,519	€ 2,401	€ 50,000	€ 40,084
United States	€ 49,392	€ 19,985	€ 745	€ 50,000	€ 17,842
Australia		€ 38,164	€ 1,188	€ 50,000	€ 17,499
Canada	€ 15,494	€ 24,960	€ 1,647	€ 50,000	€ 21,009

5.1 Estimates of the lifetime medical cost of HIV infection

Estimating the average cost of treating HIV over the probable disease states across countries is particularly difficult as transition rates to various stages of the disease could differ substantially across countries as well as the therapies applied in any given disease state. Given the difficulty in trying to consider these aspects, we rely on estimates generated in previous work by Postma *et al.* (2001), who estimate in 1995 dollars that the lifetime costs of HIV infection for 10 European countries varied from €42,500 to €90,800 (UK = €42,500; France = €90,800; Italy = €77,000; Netherlands = €50,000; and Spain = €54,000).[17] It is clear that the typical treatments (and hence the cost of these treatments) have changed substantially since 1995, the year in which this study estimates lifetime costs. Indeed, one study using a sample of patients in Alberta Canada reports that in 1995 the cost of antiretroviral drugs accounted for 30% of the cost per treated patient per month. In 2001, they accounted for 69% of the cost per treated patient per month due largely to the widespread use of HAART (Krentz *et al.*, 2003). Nonetheless, the Postma study takes the very important step of considering the mix of specific therapies used at various stages of the disease by country in the construction of their estimates, which represents to us a very important step for ensuring that the cost estimates are truly reflective of the cost of treatment overall.

In an effort to construct unit cost estimates for non-European countries in a fashion that is medically consistent with estimates reported by Postma *et al.* (2001) for Europe, we use a somewhat dated estimate of the cost of HIV reported by Zaric *et al.* (2000) to approximate the average lifetime cost of treating HIV in the United States. Zaric *et al.* (2000) report the average cost of treating HIV among injection drug users in 1998, which we inflate to 2006 dollars and convert to Euros. Information on the cost of treating HIV infection over its life course in Canada come from an Alberta study providing estimates for 1999 (Krentz *et al.*, 2003). We were unable to obtain an estimate of the lifetime cost for the same general

[17] The estimates for Italy, Netherlands and Spain are approximate readings off of a graph chart presenting their results for specific European countries.

period for Australia (using a more current estimate would reflect improved medicines and make the comparison inconsistent).

5.2 Estimates of the lifetime medical cost of hepatitis C

Hepatitis C is typically identified through an evaluation of liver functions or when someone goes to donate blood. As such, it usually goes undetected until the advanced stages of liver disease have occurred, and by that time treatment is less effective and liver transplants are required or the patient will die. According to Wong (2006) combination therapy with ribavirin and pegylated interferon has improved the chances of people not progressing to later stages of the disease, although Wong notes that not all untreated individuals progress to develop cirrhosis and not all treated individuals are responsive to treatment. According to research using blood donor and community cohort samples, 14-45% of patients resolve their acute HCV infection while about 1-10% develop cirrhosis within 20 years of identification of the disease (Freeman *et al.*, 2001; Seeff, 2002).

Information on the lifetime cost of HCV among drug users in Europe comes from a recent study by Postma *et al.* (2004), who attempt to estimate the lifetime costs per hepatitis C infection after introduction of HCV combination therapy. They update an earlier estimate of the lifetime cost of HCV in drug users in 10 European countries using a French Markov model that incorporates the progression of HCV disease in infected blood donors through pharmacotherapy, active HCV infection, cirrhosis, decompensated cirrhosis, transplantation and death. The disease progression model is based on Loubiere *et al.*, (2001). The model distinguishes two phases of the disease. In the first phase (the first 1.5 years of contraction) patients are merely distributed over two stages of "recovery" and "active HCV", which is treated mainly with pharmacotherapy. Only after the first 1.5 years to the Markovian annual transition rates into alternative phases of the disease take place, and they are not deterministic but probabilistic. The model allows for the combination of treatment (or re-treatment) with interferon and ribavirin with 40 to 50% success rate. The model is applied to a drug user diagnosed with HCV at the age of 25 (a fairly young age) and unit cost estimates for each stage of the disease are applied using information that is available for France (in 1999 Euros) when other country-specific estimates of the cost of each of these disease-stages are not available. The country-specific estimates come from Figure 4 (p.211) and are updated to 2006 Euro (from 1999). In 1999, the estimates by country were as follows: France = €14,140; Germany = €22,000; Italy = €26,200; Spain = €14,000; UK = €13,100. The updated study did not re-estimate costs for the Netherlands, which were included in the earlier study, but because were unable to find a comparable updated cost we use the estimate from the Postma *et al.* (2001) study.

In the case of hepatitis C, there appears to be far more convergence regarding methods for costing out the lifetime cost of the disease, as sources were identified for each of the non-European countries that used the epidemiological model for costing out the average burden of the disease. Saadany *et al.* (2005) use a Markov model to predict the progression of disease for individuals suffering with hepatitis C for the population of Canada from 2001 to 2040 so as to construct estimates of the annualised economic burden of the disease. We use their estimate of CAN $14,312 to represent the average cost of the first

year of the disease.[18] For the U.S., we use the median value of a range of estimates reported by Wong (2006) of the average wholesale price of 24 weeks of ribavirin and interferon in 1999 (assuming full compliance) to be between US $9200 and $17,612. For Australia, we use estimates from Shell & Law (2001) who estimate the lifetime discounted cost associated with each new case of HCV infection in Australia to be AUS $19,100.

5.3 Estimated cost of hepatitis B

Estimates of the average cost of treating hepatitis B by disease state for each European country were reviewed and summarised in a recent study by Brown *et al.* (2004). According to their study, the average cost of treatment increases with the progression of the disease and is indicated by progressively more costly disease states in 2001 Euros. Given that the estimates of the prevalence of hepatitis B were generally based on blood tests indicating the virus is present in the bloodstream rather than any more advance state of the disease, and given that the disease has become highly more manageable with pharmacotherapies, we use the median value of the range of estimates provided for Chronic Hepatitis B (CHB) treatment in Europe, given by €2245 in 2001 (average cost of CHB, €1,093- €3,396). We focus on the cost of this treatment alone, as it is something that can be consistently estimated for each of the non-European countries (and again, the disease has become far more manageable when diagnosed in the early stages). For Canada, we use an estimate of the pharmacotherapy cost of CHB treatment from Gagnon, Levy *et al.* (2004) and inflate this to 2006 Euros. Butler (2006) provides a comparable estimate for Australia in 2004 dollars, which we also inflate to 2006 Euros. In this case, it is the United States for which we do not have a good comparable unit cost estimate.

5.4 The intangible costs of addiction: Euro per QALY

Like any other health problem, addiction and drug dependence reduce the quality of life of those suffering from the condition, independent of its potential effects on productivity, employment, or health service utilization. Health improvements (recovery from addiction) translate into direct welfare gains for those affected by the illness as well as indirect gains for those who care for or live with the individuals afflicted. It is difficult to place a monetary value on the burden addiction places on those affected by the disease as well as their family and caregivers, but failing to do so significantly underestimates the full burden of the disease. A number of methods have been used to try to quantify the loss in well-being associated with various health conditions, including cancer, multiple sclerosis, liver disease, hypertension, and HIV/AIDS. One of the more common approaches used in health services literature today is the quality-adjusted life years (QALYs)[19] technique.

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[18] The average lifetime discounted cost of the disease per new case generated from this model actually was only CAN $4,568.21, far below lifetime estimates for any one disease and even smaller then the cost in the first year for Fulminant, which seemed implausible, so we went with this alternative estimate instead.

[19] QALY is a subset of a full class of quality adjusted life indices (QALI) that have been developed to try to measure loss in quality of life. What's unique about QALYs is that they measure quality of life both in terms of the amount of the disability and the survival probability of living with the illness. So the index is measured in

The QALY approach presumes that the impact of health problems on the overall quality of life can be quantified through trade-offs that people would be willing to make between alternative health states they might live with, given variations in the length of time they would live with each. Several generic health state classification systems, such as the EuroQol, SF-36, MILQ, and the Quality of Well-Being Scale, have been developed by researchers to assist in the translation of health functioning into numerical scales (Drummond *et al.*, 1986; Ware, 1994; Gold *et al.*, 1996; Avis *et al.*, 1996). Pyne *et al.* (2008) compare two generic preference-weighted measures for substance abuse disorders specifically to assess the burden addiction places on well-being. They examine the QWB-SA and the SF-12-SF and find that in a general population including individuals with substance use disorders that those suffering with a lifetime substance use disorder and currently experiencing symptoms have a reduction in well-being of 0.126 and 0.141 depending on which preference-weighted index was used (Pyne *et al.*, 2008). In their study of the cost-effectiveness of expanding methadone maintenance treatment for heroin addiction, Zaric *et al.*, (2000) find that a change in substance use behaviour is associated with a 0.2 change in QALY. The higher value is likely to be driven by the stronger association to HIV that was drawn by the population in the later study.

Given that the difference in QALYs suggested by Pyne *et al.* (2008) are fairly small, it suggests that differences in lost QALYs associated with drug addiction are likely to be less sensitive to the choice of preference-weighted scale and more sensitive to the population being surveyed (e.g. full population versus just a population of heroin users). Taking this into consideration, we attempt to assess the intangible burden of addiction by assuming that individuals living with addiction experience a reduction in the QALY of 0.14 per dependent user.

According to a comprehensive literature review and analysis by Hirth *et al.* (2008), there is tremendous variation in the estimates available in the literature on the dollar (or euro) value of a QALY and nothing close to a consensus has developed.[20] However, interventions are often assessed assuming a value of €50,000 per QALY (Drummond *et al.*, 2006). If we assume the reduction in QALY is the same regardless of where a person is living, we can use the estimated reduction in QALY (0.14) and multiply it by this monetary value per QALY (€50,000) to generate an estimate of the intangible cost of living with addiction in a given year.

terms of years of quality life. Other QALI indices can measure changes in well-being in terms of functioning or disability (DALYs).

[20] Much of the US and European literature presumes a value of a statistical life in the range of $50,000 - $100,000 (or €50,000 – €100,000) per QALY. One review of this literature (Tolley, Kenkel and Fabian, 1994) places the value of a life year in the $70,000-$175,000 range, while another study (Cutler & Richardson, 1997) puts the number at $100,000 but both of these study presume a value of a statistical life of $1 million. More recent studies put the value of a statistical life (which is of course a function of an individual's age, life expectancy and income) in the range of $4 million - $9 million, well above those used to monetize these QALYs (Aldy & Viscusi, 2008; Viscusi & Aldy, 2003).

5.5 Cost of law enforcement for drug offenses

No information is readily available from most countries regarding the marginal cost of arresting, processing and adjudicating drug offenders.[21] Thus, one is left only with the option of constructing an average cost estimate using a top-down approach using information on law enforcement budgets and the number of offenders going through the system. This is a common approach used in numerous national studies (e.g. Collins and Lapsley, 2008; Rehm *et al.*, 2006). The key assumption underlying this approach is that the amount of resources used in arresting, processing and adjudicating a drug offender is the same as that for any other offender (whether violent offenders or nonviolent offenders). Clearly, such an assumption is problematic. Nonetheless, without more sophisticated data systems tracking the cost of processing specific cases in each country, no other method can be implemented.

To begin, one must identify the fraction of expenditure from each country that is spent enforcing drug laws. Even in the European Community, where expenditure data are more consistently reported across countries using the international "Classifications of the Functions of Government", or COFOG, system, information on drug-specific enforcement expenditure is not readily available for all countries. Recently, some European countries have taken the initiative to collect drug-related expenditure data utilizing the COFOG system and report this information as part of their REITOX reports. These figures are reported to the EMCDDA in two forms- labelled and non-labelled. Labelled refers to planned expenditure explicitly marked in budget and/or fiscal year end accountancy reports. According to EMCDDA, these labelled expenditures do not tell the full story since "not all drug-related expenditure is identified as such in national budgets or year-end reports" (EMCDDA, 2008). In addition, the non-labelled approach is similar to the methods employed by countries outside of Europe (particularly Australia and Canada). Therefore, the non-labelled expenditures are a more realistic measure of expenditure data and are what we use here. The non-labelled data are derived from an estimation procedure referred to as a 'gross (or top-down) costing approach'. This consists of identifying the total amount of the budget in a given area (i.e. Public Order and Safety) and then determining the proportion of that area which is drug-related. The strategies for estimating these proportions vary quite substantially across countries, making direct comparisons of figures inappropriate (EMCDDA, 2008).

The UK provides a very rigorous estimation approach (in Euros) of all drug-related expenditure, including law enforcement, as part of its National Focal Report to EMCDDA, which partially explains why its figures exceed those of other countries in most drug expenditure categories (EMCDDA, 2008). The Netherlands, on the other hand, produce a single report (Rigter, 2006) using the top-down approach and includes it as official data in its annual report. Italy provides the overall social costs to the drug problem and the proportion devoted to law enforcement with little explanation of the definitions (EMCDDA, 2008a). Two countries, Germany and Spain, do not provide sufficient

[21] The ideal measure of unit cost for law enforcement is the marginal cost, not the average cost, as the infrastructure for arresting, processing and adjudicating is exactly the same regardless of the crime committed. Thus, fixed costs associated with enforcement should not be considered as part of the unit cost estimates.

information for understanding where the amounts come from. Germany provides estimates of non-labelled law enforcement expenditure of €36 billion, with no indication as to the proportion devoted to drugs (National Focal Report 2007). Spain simply provides a rough estimate for overall public expenditure related to the drug problem, €400 million; however, no information is provided on the proportion devoted to law enforcement (EMCDDA, 2008a). Thus, we estimate figures for Spain and Germany based on 1999 estimates of the proportion of drug-related law enforcement expenditures as 0.083% and 0.059% of GDP for Germany and Spain, respectively (Kopp *et al.*, 2003). Using these proportions for 2006 GDP data,[22] we find €575 million and €1,940 million on drug-related law enforcement expenditures.

Although not part of the EU reporting system, the estimates for Australia and Canada are calculated through a similar top-down procedure. Australian data utilises an updated set of fractions for drug-related crimes from the Australian Institute for Criminology and cost data from the Steering Committee for the Review of Commonwealth/State Service Provision (Collins & Lapsley, 2008). Canadian data on drug-related law enforcement expenditure is developed from surveys of the prison population on proportions of criminal activity involving drugs and expenditure data from government sources (Rehm *et al.*, 2006).

The following table displays the drug-related law enforcement expenditures for all countries except the United States, whose estimate is done in a somewhat different fashion and will be discussed shortly. The expenditure data is for 2006, except for the Netherlands which is for 2003. For Canada and Australia, the figures are 2006 adjusted for inflation using national statistics databases for CPI data and converted to Euros using European Central Bank data based on 01/07/2006 exchange rate.

Table 6 Drug Related Law Enforcement Expenditure, 2006 in Euro Millions

	Police	Law Courts	Prison	Total
Spain	n.a.	n.a.	n.a.	€ 575.0
France	€ 571.2	€ 13.1	€ 270.2	€ 854.5
Italy	n.a.	n.a.	n.a.	€ 2,783.4
Germany	n.a.	n.a.	n.a.	€ 1,940.0
Netherlands	n.a.	n.a.	n.a.	€ 1,646.0
United Kingdom	€ 3,321.0	€ 171.0	€ 1,416.6	€ 4,908.6
Canada	€ 1,107.2	€ 255.6	€ 443.0	€ 1,805.8
Australia	€ 1,066.5	€ 91.2	€ 216.5	€ 1,374.2

Source: Author's calculations for Germany and Spain; Reitox national reports, 2007 in EMCDDA (2008) for France and UK; EMCDDA (2008a) for Italy; Netherlands, Rigter (2006); Canada, Rehm *et al.* (2006); Australia, Collins & Lapsley (2008)

To convert these estimates into unit costs, we need a measure of the total number of drug offenders going through the system in each country. Drug activities that are considered unlawful offenses vary across countries. Generally, drug law offenses refer to producing, trafficking, dealing, possessing or using illicit drugs. Table 6 presents the total number of reports for drug offenses by country. The data has been reported and documented at various stages within the criminal justice system (by police, courts, or prison personnel).

[22] Eurostat, accessed on 24 November 2008.

Table 7 Drug Law Offenses, 2006

Country	Study unit	Number of offenses
Spain	offenses	235,422
France	persons	110,486
Italy	persons	68,370
Germany	offenses	255,019
Netherlands	offenses	20,769
United Kingdom	persons	122,459
Australia	persons	78,533
Canada	persons	85,953

Source: Germany, Spain, France, Italy, Netherlands, United Kingdom- EMCDDA Statistics Bulletin; Australia- Illicit Drug Data Report; Canada- Canadian Crime Statistics 2003.

Note: Data for UK is 2004, Australia is 2005, Canada is 2003.

By dividing total drug-related law enforcement expenditure by the number of drug offenders being processed through the system, one can generate a unit cost estimate of the average cost of a drug related offense, which we do in Table 7. As can be seen in that table, unit costs vary greatly across countries since the countries have different costing procedures and offenses definitions. Italy and the UK have virtually the same unit costs of approximately €40,000 per offender per year. Although France has similar offender rates as the UK, total costs are much lower and thus, the total unit cost in France is €7,734. Canada and Australia exhibit similar total unit costs for drug enforcement of approximately €20,500 and €17,500, respectively.

Results indicate court costs per drug offender are the lowest costs and policing per offender are the greatest costs for all countries. Although it is problematic to compare across countries, it is interesting to note that while total unit costs in the UK are nearly twice the amount of that in Australia, the court costs are nearly identical. Comparing Canada and Australia, which have similar total unit costs, Canada spends more per unit on prisons and Australia spends more on policing. Another potentially interesting comparison is between France and Australia in which Australia has a total unit cost more than double that of France and yet both France and Australia have similar prison unit costs.

Table 8 Law Enforcement Cost per Offender/Offense, 2006, in Euros

	Police Services	Law Courts	Prisons	Total
Spain	n.a.	n.a.	n.a.	€ 2,442
France	€ 5,170	€ 119	€ 2,446	€ 7,734
Italy	n.a.	n.a.	n.a.	€ 40,711
Germany	n.a.	n.a.	n.a.	€ 7,609
Netherlands	n.a.	n.a.	n.a.	€ 96,330
United Kingdom	€ 27,119	€ 1,396	€ 11,568	€ 40,084
Canada	€ 12,881	€ 2,974	€ 5,154	€ 21,009
Australia	€ 13,580	€ 1,161	€ 2,757	€ 17,499

Source: Author's calculations using Table 1 and Table 2 information

Note: Australia and Canada are 2006 adjusted (using CPI of national statistics databases) and converted to Euros (using ECB data based on 01/07/2006 exchange rate).

As noted previously, the estimate of the average unit cost of an arrest for the United States is actually constructed in a different manner, using information provided in Nicosia *et al.* (2009) on the marginal cost of each stage of the process (arrest, adjudication, sentence, and jail/probation/parole). The U.S. estimate represents a weighted average cost of the probable outcome of a misdemeanour possession offense or a felony sales offense. According to the Sourcebook of Criminal Justice statistics, in 2006 only 18% of all drug offenses were for sale/trafficking (which would include a jail sentence) while 82% were for possession. Taking the weighted average generates an estimate of US $21,335.

While the above exercise demonstrates the difficulty in trying to obtain reasonably consistent unit cost estimates of the significantly trimmed set of indicators that one could use to measure harms from drug use, it also highlights that there may be potential in the future depending on continuing efforts that have been initiated in some regions (i.e. Europe). The fact that the EMCDDA has been able to get some harmonization of measures for 27 different countries with very different approaches to the problem is a very promising sign. The fact that scientists are considering the cost of treating a disease by particular regions (e.g. Postma *et al*, 2004) is further indicative that efforts in the future may be possible. But the previous two sections also show that such efforts need to be initiated with the intention to develop consistent and comparable measures across countries; the indicators and unit cost measures that have developed in a consistent fashion across some countries have occurred because there was a concerted effort to make them that way. If there is a world goal to get a better idea of the cost of drug abuse globally, then coordinated efforts across countries in the identification, measurement, and costing of relevant indicators need to take place.

CHAPTER 6 Conclusions

There is clearly value in being able to compare the relative burden of illicit drug use across nations. Doing so enables policy makers to begin considering whether their own government strategy appears to be more or less effective when compared to other countries with similar use rates or harms. However, it is also important to realise that societies' response to the drug problem generate costs as well, which is why differentiating the costs of drug use from the costs of a society's response to that use is so important. Only a careful cost-effectiveness analysis of alternative approaches can provide true insights into the relative benefit of specific approaches. The first step in conducting such an analysis, however, is the consistent assessment of the burden of drug abuse across countries. And given the varying forms the burden can take across countries, a monetised metric of all the harms seems to be the most promising way of drawing comparisons across multiple harms.

The current exercise demonstrates, however, that the ability to simply compare monetised harms across countries still eludes us for a number of reasons. First, many nations are not collecting many of the relevant indicators or measures of cost necessary for participating in such a study. Second, even indicators that are regularly reported by countries are not being collected in a manner that is consistent across countries in terms of definition or universe. Some of these differences may not be easily overcome, as they could be the artefact of different national needs or different philosophies. The lessons learned from the European Community can perhaps provide the best guide for how to overcome these sorts of issues more broadly for developed countries. Third, even when fairly good indicator data are consistently collected across countries (e.g. drug-related HIV cases), there is insufficient information from which one could construct a consistent measure of the average costs of these indicators across countries. Cost information either does not exist or it does not reflect the same process across all countries. For example, in the case of HIV, some countries have estimates based on micro simulation models incorporating information on disease progression and the cost of therapies at each stage of the disease while others have estimates of just the average cost of treating a user given the stage of the disease they are at. While both are meaningful measures of costs, they are not capturing the same thing and combining disparate estimates across countries using both methods would lead to incorrect conclusions regarding the relative burden of drug-related HIV.

Steps could be taken in the future to improve the consistency of measurement in some of these areas, but significant work is still needed in other areas. A coordinated effort, like the one currently being undertaken by the EMCDDA for the European Community, is necessary for moving this forward more globally. It is not possible to simply draw on the

independent efforts being undertaken within particular nations, as such efforts – while significant and highly valuable to the nations conducting them - will not reflect the need for conformity in measurement that is necessary to enable cross-country comparisons. Thus, the ability to systematically compare the cost of drug use across nations may remain out of our reach for a few more decades.

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