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**How studies of the cost-of-illness of substance abuse can be made
more useful for policy analysis***

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Abstract

An elementary step in drug policy analysis is comparing the cost of an intervention to its benefit in the form of the social cost averted because of reduced drug use and associated consequences. One would think that cost of illness (COI) studies would provide a solid foundation for quantifying the benefits of reduced drug use, but at present they do not. This paper suggests ways the COI studies could be adapted to serve better policy analytic purposes.

Keywords: Cost of illness studies, Substance abuse, Health policy.

JEL Codes: D78, H59, I18, K42.

1. Introduction

Cost of illness (COI) studies measure the value of net resources that are unavailable for other purposes because of the effects of a health condition. Since the 1970s, they have been used to estimate the costs that result from the use of illicit drugs (often together with the abuse of alcohol and/or tobacco). Such studies, also known as “social cost” and “burden of disease” studies, have been used to estimate substance abuse costs in Australia (e.g. Collins & Lapsley, 1991; 1996; 2002), Canada (e.g. Single et al., 1998), France (eg. Fenoglio et al., 1997), Spain (e.g. Garcia-Altes et al., 2002) and the United States (eg. Harwood et al., 1998; ONDCP, 2004).

Single et al. (2003, 2-3), in the most recent edition of the *International Guidelines for Estimating the Costs of Substance Abuse*, identify four purposes for such studies: 1) determining what priority policies on alcohol, tobacco and illicit drugs should be given on the public policy agenda; 2) helping to target specific problems and policies; 3) identifying information gaps and desirable refinements in the development of national statistical reporting systems; and 4) providing baseline measures to determine the efficacy of policies and programmes intended to reduce the damaging consequences of substance abuse.

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Do COI studies achieve these purposes? It could be argued that they achieve the first and third purposes. They generate a “big number”, and therefore have the potential to provide some sense of the relative importance of illicit drug use as a problem. And, in the calculation of this number, they also provide information on a wide variety of illicit drug impacts and data sources.

However, they provide little assistance in identifying specific problems, selecting policies or evaluating the efficacy of particular policies or programmes. As an example of how substance abuse COI studies help governments to target policies, Single et al. (2001, 5) cite Collin & Lapsley’s (1991) conclusion that the costs of alcohol and tobacco far exceeds those of illicit drugs in Australia. That such an example is used is indicative of how general the insights gained through such studies are. They do not help one decide how to divide efforts between alternative drug control interventions, how to improve those interventions, or how much to invest in them.

That they fail to inform drug policy in all but the most general of terms has been recognised previously. The publication of Harwood, Fountain & Livermore’s (1998) estimate of the social costs of alcohol, drug abuse, and mental health in the United States occasioned a forum in *Addiction*. Two of the commentators, Peter Reuter and Mark Kleiman, concentrated on the limited nature of such studies. Reuter (1999, 638) described them as “an unsatisfactory answer to a question of dubious importance”, while Kleiman (1999, 638) stated that the “the measurement exercise proves much less useful for policy-formulation purposes than it might appear”.

That substance abuse COI studies are not particularly useful for policy analysis would be of little concern but for the absence of other estimates of drug-related social costs. COI substance abuse studies are the most commonly funded, indeed perhaps the only commonly funded, large-scale studies of economic consequences of illicit drug use. Under contract to the Office of National Drug Control Policy (ONDCP), Harwood and others have produced estimates of the economic costs of drug abuse in the United States for 1977, 1980, 1985, and every year between 1992 and 2002 (ONDCP, 2004, I-1). Collins & Lapsley have now estimated the social costs for Australia for 1988, 1992 and 1998/99 (Collins & Lapsley, 2002, 1). A study was conducted for Canada in 1996, and another one is currently being conducted there (CCSA, 2004).

There are many types of policy analysis; it is useful to consider two concrete examples that have already made use of substance abuse COI studies. Caulkins et al. (2002) used COI figures to estimate the per unit social costs for various drug types in order to give readers a sense of whether their cost-effectiveness numbers were large or small. McFadden & Mwesigye (2004) did something similar, apportioning social costs estimated by Collins & Lapsley (2002) to various drugs on a “per kilogram” basis in order to assess how the social cost of all drugs seized by the Australian Federal Police compared to expenditure on their operational activities. These two examples fit within one of the more important classes of policy analyses, namely, economic evaluation or return on investment analyses that evaluate quantitatively the projected performance of some intervention under consideration.

These are applications where the social costs needs to be related back to the users of the drugs or the drugs themselves within the existing regulatory framework. Miron (2003) criticises COI studies because they contain no information about whether prohibition increases the harms from drug abuse. Although we consider a number of conceptual issues that may change how costs are valued, we do not try to extend them to cover questions related to legalization.

We proceed on the basis that: (i) there is a need for measures of the societal costs generated by illicit drug use or associated with illicit drug users for policy analysis; and (ii) substance abuse COI studies will continue to be commissioned so they will continue to be an important starting point of departure. We address both changes that fit within the intent of COI studies that could be adopted at little or no additional cost and on changes to the COI approach itself that would make the estimates more useful for policy analysis.

Focus is given to the most recent COI substance abuse studies for the United States and Australia: respectively, ONDCP (2004) and Collins & Lapsley (2002). These can be considered typical of COI substance abuse studies more generally. Australian and United States approaches and data sources are as developed as those for any country. Moreover, the authors of these studies have been part of a group that have developed the *International Guidelines for Estimating the Costs of Substance Abuse* for the World Health Organisation (Single et al., 2003).

In order to focus on the overall approaches, limited attention will be given to methodological issues related to specific consequences of illicit drug use. While how they are handled will affect the utility of such studies, some of these issues – such as the causal relationship between drug use and criminal activity – are complex and impossible to cover in addition to the broader issues.

In addition to illicit drugs, some of these studies consider the social costs of alcohol and tobacco abuse. Some of the same issues will apply to these other addictive goods, although the licit status of alcohol and tobacco mean the mix will be different. We confine our comments to illicit drugs.

The next section provides an overview of substance abuse COI studies. Subsequent sections discuss three sets of issues germane to making these studies more useful for policy analysis. The first are issues of measurement and uncertainty, which should be addressed even if the current framework is to be maintained. The second set is conceptual issues that occur from transferring an “illness” approach to a complex issue like drugs. The third relate to information that can be added to improve our understanding of the relationships between drug use and social costs. We conclude by considering the relative importance and complexity of such changes.

2. Cost of illness studies

The intellectual genesis and imperative of cost of illness (COI) studies is the desire to compare various diseases’ social costs within a common framework. That framework is explicitly designed to reflect a health-oriented view of the world, and it has been applied to diverse health conditions including heart disease, cancer, diabetes, stroke, and alzheimer’s disease (ONDCP, 2004, p.xiii).

Single et al. (2003, p. 6) provides a pithy summary of the process undertaken and primary outcome sought from a COI study:

Superficially a COI study involves combining an epidemiological database with financial information to generate an amount valued in monetary terms which purports to say something about the costs to society of a particular disease. Typically the magnitude is large, or large enough, to be used to draw attention to the condition as one to which policy makers, research funders, and researchers, ought to pay attention.

The “costs to society” are relevant opportunity costs; that is, if the illness did not exist, the resources that would be available for other purposes. Whether these costs include those borne by drug users themselves depends on whether these costs have been knowingly

incurred. Collins & Lapsley (2002, 18) identify three conditions that must be satisfied for substance abuse effects to be regarded as private – consumers being fully informed, rational and required to bear the total costs of their consumption – and conclude that the stringency of these conditions justifies the approach of regarding all abuse costs as social costs.

While there is normally attention given to the individuals or institutions upon whom the costs are imposed, this is only for costs regarded as net costs to society. There is a range of substance effects where resources are transferred from one party to another. A simple and important example is government support payments (unemployment, disability income, welfare, etc.) made to drug users because of their drug use. Since such payments are merely “transfers”, the COI studies do not view them as a social cost, even though they are clearly a cost to government and, hence, to taxpayers.

Social costs may be direct, indirect or intangible. Direct costs are those resources used to deal with the substance abuse or its proximate effects, while indirect costs are secondary or flow-on effects from drug use or its direct effects. Intangible costs are non-market effects borne by individuals, such as pain and suffering. COI studies differ in whether they consider intangible costs. United States studies, in following the guidelines of the US Public Health Service, only estimate direct and indirect costs, although they note the existence of intangible costs (ONDCP, 2004, vii). Collins & Lapsley (2002, 13), on the other hand, do estimate intangible costs.

COI studies also differ in how they measure these costs. While all studies use the counterfactual scenario of no substance abuse, such a scenario can be applied in different ways depending on when the period of no substance abuse is assumed to occur. The “human capital” approach measures all current and future costs from current substance abuse, while the “demographic” approach measures the current costs from all current and past substance abuse (by comparing the current population with a hypothetical population in which no drug abuse had occurred) (Single et al., 2003, 12). ONDCP (2004) adopt a “human capital” approach; Collins & Lapsley (2002) use a “demographic” approach.

The ONDCP (2004) makes it clear that its methodological decisions are motivated by a desire to follow the guidelines of the US Public Health Service. Collins & Lapsley (2002) refer to no such government guidelines, although reference is made to the Single et al. (2003) guidelines that they co-authored. Already we have seen that there are some differences between different COI substance abuse studies. The loose rationale of these studies may be a reason for their lack of methodological consistency, a point that we turn to in Section 4.

Given the complexity of the effects associated with substance abuse, what effects are ultimately included? Single et al. (2003, p.33) identify four major types of costs that have been estimated: (1) health care costs, (2) productivity costs, (3) costs to law enforcement and the criminal justice system, and (4) other costs, such as property destruction from alcohol or drug attributable accidents or crime.

The ONDCP (2004, viii), using three major categories, estimated in the United States in 2002 that productivity costs were \$128.6 billion, health care costs \$15.8 billion and other costs (which included crime-related costs) were \$36.4 billion. Collins & Lapsley (2002, x) estimated in Australia in the financial year 1998/99 productivity costs were \$1.0 billion, crime costs were \$2.4 billion, health care costs were \$64.7 million and other costs (including intangible costs) were \$2.6 billion.

The market share of different costs across the two countries is startlingly different. The US estimate ascribes 71% of total social cost due to drug abuse to lost productivity, vs. only 16% for Australia. Conversely, the Australian estimate is 40% for crime, whereas for the US crime and “other” costs combined are only 20%. Given that drug abuse in the US is associated with a great deal of crime and violence, and that drug dependence in the US is heavily concentrated among subpopulations who may not have had high incomes even in the absence of drug use, one might have expected the opposite outcome.

The total estimates were \$180 billion for the United States and \$6 billion for Australia. They are numbers that would be considered large to the lay reader, but it is hard to judge whether they are numbers that are “large enough” to draw the attention of policy makers. The ONDCP (2004) provides some context with Table 1 in their report, reproduced below. Drug abuse ranks third of sixteen, just behind alcohol abuse and heart disease.

Table 1: United States Cost of Illness Estimates for a Variety of Medical Conditions

Health problem	Total	Direct	Indirect	Year of estimate
Alcohol abuse	\$185	\$50	\$134	1998
Heart disease	\$183	\$102	\$81	1999
Drug abuse	\$180	\$52	\$129	2002
Mental illness	\$161	\$67	\$94	1992
Smoking	\$138	\$80	\$58	1995
Alzheimer's	\$100	\$15	\$85	1997
Obesity	\$99	\$52	\$46	1995
Diabetes	\$98	\$44	\$54	1997
Cancer	\$96	\$27	\$69	1990
Pain, chronic	\$79	\$45	\$34	1986
Arthritis	\$65	\$15	\$50	1992
Stroke	\$43	\$28	\$15	1998
Kidney	\$40	\$26	\$14	1985
Eye diseases	\$38	\$22	\$16	1991
Homicide	\$34	\$10	\$23	1989
HIV/AIDS	\$29	\$13	\$16	1999

Source: ONDCP (2004); data has been re-arranged.

As we turn to various issues behind these large numbers, it is worth noting that a health approach has been applied to a “condition” for which the health cost component accounts for just 9% of the total in the United States and only 1% of the total in Australia. Inasmuch as productivity, crime, and other costs apparently dominate the cost of drug abuse, one can appreciate the wisdom of revisiting whether the conventional cost of illness approach is the best foundation for drug policy analysis.

3. Developing a better estimate of the “cost of illness”

In this section, we limit ourselves to suggestions that would not compromise adherence to guidelines (such as those of the US Public Health Service). Even within these constraints, there are two substantial improvements that could be made to substance abuse COI studies. One is to develop estimates that reflect the best available information, rather than using lower bound estimates that represent a “conservative” figure. The other is to take a more explicit approach to dealing with uncertainty, by simulation and the development of estimation ranges.

3.1 Developing “best” rather than “conservative” estimates

In common with other authors in this area, Collins & Lapsley (2002) and ONDCP (2004) talk of adopting a “conservative” approach to estimating social cost. This means: “In general, lower cost alternatives were always selected where appropriate alternatives existed” (Collins & Lapsley, 2002, ix). Often, where the information is deemed to be too inadequate, no cost is assigned to the effect; this is what Reuter (1999) refers to as the “ignorance is zero” approach.

The notion that conservatism dictates choosing the lowest possible figure at every turn may be appropriate for some accounting applications, but it is a crude and naïve approach to the development of public policy. Such an approach makes other efforts to maintain comparability amongst studies difficult to fathom.

There are numerous examples that illustrate this point. For example, Collins and Lapsley (2002) identify but do not assign values to, *inter alia*, foregone productivity of criminals, money laundering, the National Crime Authority (the main organised crime fighting body in Australia), private and home security, research, prevention programs, private legal expenses and litter.

The social costs actually included are driven by the available data, and can go in and out of the estimates depending on changes over time in data sets. Ambulance and social security costs are quantified for the first time in Collins & Lapsley (2002). On the other hand, Collins & Lapsley (1996) estimate research and education costs related to drug abuse, but Collins & Lapsley (2002, p.36) state that “the ability to estimate these expenditures has declined” and so assign a figure of zero to them.

It is also not possible to know whether certain costs are omitted because of this “conservatism”, or if the authors simply do not consider them. Choi et al. (1997) reviewed four substance abuse COI studies (including one each from the United States and Australia) and developed a list of 45 effects that should be considered as social costs. Table 2 includes these costs together with those identified by Single et al. (2003), Collins & Lapsley (2002), and ONDCP (2004). As can be seen, there are a significant number of effects estimated in some studies that are not valued by Collins & Lapsley (2002) or ONDCP (2004).

The consequences of these selective omissions can be substantial and perverse. Most observers would agree that the US has greater social problems associated with illicit drugs, per capita, than does essentially any other first world country.¹ On the other hand, the US is rather average among first world countries in alcohol consumption and related problems, whereas Australia has a strong drinking culture. Nevertheless, cost of illness studies in the US conclude that alcohol abuse imposes costs that are 1.5 times larger than does illicit drug abuse (ONDCP, 2004, xiii), whereas the comparable ratio for Australia is about 1.25 to 1 (Collins and Lapsley, 2002, ix). A principle reason for this odd finding may be that cost of illness studies exclude most of the social costs associated with drug markets, including the very considerable amount of violence that drug dealers in the US perpetrate on each other, on drug users, and on the general public.

¹One of us has noted (Caulkins, 2002) that the US and Australia have roughly comparable drug problems except that the US has far more drug market related violence, cocaine, and HIV/AIDS. Each of those three is a very large exception individually; collectively, they mean that the US problem is far more severe.

Table 2: Drug abuse social costs not measured in ONDCP (2004) or Collins & Lapsley (2002) [Direct costs only]

Category	C&L	ONDCP	Category	C&L	ONDCP
Litter	X	X	Prevention programs	X	
Money Laundering	X	X	Training costs for physicians and nurses	X	
Resources used in abusive consumption		X			X
Department of Defence	X		Customs and immigration	X	X
Health Administration	X		Extra neonatal care (neonatal complications caused by mothers' smoking)	X	X
Tuberculosis	X		Neonatal disorders and complications related to drug abuse	X	
Physician visits	X	X	Home care (care of ATD user)	X	X
Nursing home stay		X	Household help (care of house)	X	X
Specialty institutions ^d	X	X	Counselling, retraining and re-education	X	
Professional services (other than physicians) ^e	X	X	Special equipment for rehabilitation (e.g. wheelchairs)	X	X
Prescription drugs for treatment		X	Employee assistance programs provided by employers for ATD-using employees	X	X
Medical and health services research	X		Drug testing in workplace	X	X
Administrative costs of private insurance to treat ATD disorders	X		Avoidance behaviour costs	X	

Source: Choi et al. (1997), ONDCP (2004), Collins & Lapsley (2002), Single et al. (2003)

The consequences for comparing health conditions are also significant. What are we now to make of the observation that heart disease imposes greater costs on society (\$183 billion) than does drug abuse (\$180 billion)? The effects of drug abuse would be expected to be subject to far greater uncertainty than those of heart disease. If data for even a few per cent more of the costs of drug abuse than for heart disease were deemed inadequate to support estimates, then the social cost of drug abuse in the US would be higher not lower than for heart disease. So the COI studies' comparison across illnesses – purportedly their *raison d'être* – would be exactly wrong. Indeed, we have no idea of, or bound on, the consequences of this conservatism. The social costs of drug abuse could be twice as great as those of heart disease for all a COI reader knows. The COI studies lose all comparative meaning in the light of such “conservatism”.

Selection of lower bound estimates introduces biases. COI estimates should be developed on the basis of the best available information and evidence, in order to develop individual components and aggregate figures that reflect actual costs as accurately as possible.

3.2 An alternative to being “conservative”: explicitly acknowledging uncertainty

Cost of illness study results are usually described as “estimates”. That is eminently sensible because quantification of almost any population-level quantities associated with use of illicit drugs is subject to some uncertainty. The literature speaks of “hidden populations” of drug abusers for good reason. Use of illicit drugs is, by definition, illegal

and is generally highly stigmatized. Good data concerning drug use and its consequences are hard to come by.

The uncertainties are even greater when estimating social or economic costs than for, say, simply estimating drug prevalence. This is for a host of reasons, many stemming from trying to tease out hard to establish causal relations such as for aetiological fractions. The frequent need to develop cost estimates on the basis of three or four factors also leads to large uncertainties.

There is nothing wrong with estimating uncertain quantities. People do it all the time. Biologists estimate the number of individuals left among an endangered species, bidders estimate the value of merchandise on an auction block, and businesses estimate market potential and sales volume for new products.

There is, however, something wrong or at least terribly simple-minded about estimating an uncertain quantity and not taking reasonable steps to inform the reader about the amount of uncertainty associated with one's estimate. There are many ways of communicating a degree of uncertainty, but the simplest and most familiar is to report not only a point estimate but also a range. The Drug Availability Steering Committee (2002, 47) "concluded that US heroin consumption in 2001 was between 13 and 18 metric tons of pure heroin." Ranges can usefully be complemented by verbal warnings and clarifications. For example, the Drug Availability Steering Committee states prominently in the very first paragraph of the executive summary that "There is significant uncertainty in these estimates due to ... [various sources listed] Therefore, caution is urged in the application of these estimates" (p.xi).

Cost of illness studies, on the whole, do very badly in this regard. For example the ONDCP (2004, vi) reports that "economic cost of drug abuse in 2002 was estimated at \$180.9 billion." Leaving aside the question of whether it makes sense to report such a rough estimate with four digits of precision, nowhere in the introduction is there any effort to communicate quantitatively the magnitude of uncertainty associated with this estimate (e.g., no range is given). There is only a general, non-quantitative disclaimer (p.vi) "the methods used in this study yield seemingly very precise values, however, they should be treated as approximations." Collins & Lapsley (2002) report to five significant figures, and do not mention the uncertainty around their estimates until they consider some areas for future research. Even there, its role is quite opaque, as they refer to "areas of research which would permit further refinement of estimates of the social costs of drug abuse in Australia" (p.70).

The sources of uncertainty in these estimates are diverse. Certainly there is sampling variability, which can be quantified in standard ways by classical statistics. In all likelihood, however, the majority of the uncertainty comes from other sources, including response and non-response errors from surveys, but also instances in which there simply are not data or when data must be extrapolated e.g., because they are out of date or come from another jurisdiction. Hence, Bayesian methods that allow explicitly for incorporation of subjective judgments, multivariate sensitivity analyses both deterministic and through Monte Carlo simulation, and other modern methods also have a role to play.

There would not be too much more effort required to provide "low" and "high" estimates, given the relative importance of doing so. The ranges involved will be uncomfortably large, but that is more rather than less reason to provide them. The third purpose of COI studies identified by Single et al. (2003) is to identify information gaps and desirable refinements in the development of national statistical reporting systems. Understanding that the plausible range for a certain class of social costs is \$10 to \$100

billion has more chance of leading to improvements in reporting systems and the application of statistical techniques than does merely listing gaps or refinements.

4. Key conceptual issues

It is natural and reasonable to ask whether a framework developed for classic medical concerns should be applied slavishly to other health conditions that have distinctive characteristics. If the goal is to compare the social costs of these diverse health problems on a common basis, then presumably the answer is yes. Modifying the framework for the particulars of each disease would directly undermine the objective of being able to make comparisons across diseases.

However, if the goal is not just to compare the costs of different diseases but rather to inform drug policy making, then there is little justification for not adapting the cost of illness framework to the particulars of the problem at hand. There are any number of adaptations that might be called for, but there are four issues of extreme importance that must be dealt with in order to provide a sound basis for drug policy making: dependence, property crime, black markets, and spill-over effects. They are the elephants in the living room, and it is rather stunning that the cost of illness industry has persisted so long in ignoring them.

Drug dependence

The first overlooked elephant might variously be thought of as the cost of dependence or, more generally, as recognition that there are intangible costs stemming from the consumption of drugs – a consumer deficit as opposed to a consumer surplus. Kleiman (1992) makes an eloquent case that dependence-inducing substances may merit a special exception to the usual presumption in liberal society that government interventions into consumption decisions cannot improve consumer welfare. As discussed in Section 2, when it comes to drug abuse, Single et al. (2003) and Collins & Lapsley (2002) consider private costs as a component of social costs. However, neither Collins and Lapsley (2002) nor any other cost of illness study of which we are aware grapples with the dramatic consequences of this.

Kleiman (1999), commenting on Harwood et al. (1998), uses an elegant back of the envelope calculation to make the point. He notes that if 10% of the US adult population is, at any given time, suffering from an alcohol or drug related substance disorder and that such people and/or their families would be willing to pay, on average, \$10,000 per annum to alleviate such a condition, then “the total willingness-to-pay to avoid addiction itself, as distinct from the financial losses it generates, would total \$200 billion per year in the United States, nearly as much as the Harwood et al. estimate of \$246 billion” (for alcohol and drugs combined) (p.640).

The \$10,000 figure used by Kleiman is over and above any “out of pocket” expenses. What is currently estimated within COI studies are the “out of pocket” expenses; but what they miss in terms of the social costs of dependence may be ignoring a good half of the problem.

The point can be made as well with a similar calculation made from a slightly different perspective. Recall that medical cost-effectiveness studies that focus on Quality-Adjusted-Life-Years (QALYs) assign a quality level of 1.0 to someone who is perfectly healthy and smaller numbers to people suffering from various conditions (e.g., 0.84 for an ulcer or 0.87 for a migraine). Suppose that 10% of the adult population is suffering from alcohol or drug related substance abuse disorder and their average QALY score is

reduced by 0.1 because of that condition (e.g, from 1.0 to 0.9).² Then roughly 200 million adults * 10% prevalence * 0.1 QALY lost per year = 2 million QALYs lost per year due to drug dependence. Alcohol and drug abuse lead to about 125,000 premature deaths per year. Even if those premature deaths lead on average to a loss of a present value of 32 perfectly healthy life years (which seems generous), then dependence in and of itself destroys at least half as many QALYs as does premature mortality, and premature mortality is one of the main drivers of cost of illness cost estimates.

Intangible costs are acknowledged as important within these studies³. However, in the transfer of this approach to addictive goods, social costs studies have omitted a cost – drug dependence per se – that is clearly of first-order importance when estimating the social costs associated with illicit drugs (unless one holds to a strict “Chicago School” perspective that drug consumption decisions are necessarily welfare enhancing for the user). This can be regarded as but one such example of the pervasive role of intangible costs. When discussing crime victims, Cohen (1999, 646) points to the “subtle opportunity costs, such as the value of time not spent enjoying a walk in the park, pain and suffering, and the time spent worrying about being victimised again”.

Property Crime

The second overlooked elephant is crime. Crime-related outcomes are of minor importance for diseases such as cancer or stroke, but not so with illicit drugs. Indeed, for the general public, concerns about illicit drugs and crime are inextricably intertwined.

There are various types of drug-related crimes. Goldstein (1985) articulated the key distinctions in his famous “tripartite framework”. Various authors have subsequently quibbled with the details, but the tripartite framework remains extremely useful for discussions such as the present one.

Goldstein distinguished between “psychopharmacological crime” that stems from the effects of the drugs on the drug user (e.g., through intoxication), “economic compulsive crime” committed by drug users to finance drug purchases, and “systemic crime” related to drug markets and drug distribution (popularly construed as “turf wars” among dealers but probably more often pertaining to drug deals gone bad). Caulkins et al. (1997) estimated that for cocaine in the US, these three categories comprise roughly one-sixth, one-third, and one-half of all drug-related crime, respectively.

Economic compulsive crime is perhaps the category where attribution issues are understood best (although, even for this category, estimates involving ranges would undoubtedly be large). However, from a drug policy analyst’s perspective, a most vexing aspect of the COI studies is the approach taken to property crime. The social cost attributed per crime is far too low, because the basic approach taken in the cost of illness studies is to presume that theft per se has no social cost because it merely transfers property from one citizen to another. Society as a whole is no worse off.

While that rationale has solid roots in academic economic theory, but it is a non-starter for most voters and, hence, as a basis for public policy making in a democracy. This issue is of little importance when estimating the social costs of cancer or stroke, but it is absolutely central to thinking about the social costs of abuse of the expensive illicit drugs (cocaine, heroin, and methamphetamine).

² By way of comparison, Zaric et al. (2000) assume a QALY score of 0.8 for untreated injection drug use and 0.9 for time spent in methadone treatment.

³ Even though they do not estimate intangible costs, the ONDCP (2004, viii) states: “these estimates could be considered conservative in that they make no allowances for the impact of drug abuse on the quality of life of the family, neighbors and victims of drug abusers or on the drug abuser her/himself”.

Collins & Lapsley (2002, 41) attributed 40% of property crime to illicit drug use. They estimated that 60% of the value of the property stolen was transferred, while the remaining 40% was lost. It is hard to imagine that the public's "willingness to pay" to avoid property crime is not at least some multiple of the property loss⁴. (How much would you be willing to pay to avoid having someone break into your home and steal \$200?) So Collins & Lapsley's crime estimate could be an order of magnitude smaller than the social cost of property crime that is relevant for policy analysis, and that cost in turn is only a fraction of the total cost of drug-related crime, as we discuss next.

Black Markets

The largest category of drug-related crime, systemic crime and violence, is most likely ignored because the connection to the drug user (the "patient" in the medical metaphor) is indirect. Drug users (who are not also sellers) do not commit much systemic crime or violence. Most is perpetrated by the dealers who supply the users. So no amount of data collection concerning the behaviour of drug users would ever detect more than a very small fraction of the systemic crime and violence. To be fair, if a drug seller shoots another drug seller, that violence is not directly caused by anyone's substance dependence. However, inasmuch as the drug policy analyst is interested in all social costs that would be averted by reducing drug use, the analyst would want to credit drug use control initiatives with any reductions in systemic crimes they generate.

The concentration on use means that these social costs and others are excluded. Systemic crime is the sharp end of the disorder, fear, and violence associated with drug markets that disrupt entire neighbourhoods, drive people to the suburbs, and affect people's lives in many other ways. Arguably, if one leaves aside the suffering of drug dependent individuals and their families, the externalities associated with flagrant drug markets are the greatest vector for harm to society, yet they are omitted altogether by cost of illness studies.

Spill over effects

The last elephant overlooked by typical cost of illness studies are the indirect or spill over effects of substance abuse. They are perhaps the hardest to estimate, but as mentioned above, being hard to estimate is not the same as being negligible. Furthermore, longitudinal data sets and methods are steadily improving the ability to estimate spill over effects.

To illustrate what is meant by spill over effects, suppose someone's heroin dependence grows into polydrug use, including alcohol abuse, and they die in a single vehicle accident while drunk. From a cost of illness study perspective, the social costs of that premature death were caused by alcohol, not heroin. However, from a heroin policy analyst's perspective, if drug policy cut heroin dependence by 50% it may also cut by 50% the number of heroin dependent people who abuse alcohol because of their heroin dependence and die prematurely in alcohol-related crashes.

That specific scenario may not loom large relative to other social costs, but it is just one of very many indirect or spill over effects that can be associated with drug abuse.

⁴ They made their calculations using the low end of a broad range for the total value of property lost (\$812 million to \$7,312 million; another example of the distortions of the "conservative" approach). Mayhew (2003) estimates annual property losses in Australia due to crime at \$2.8 billion. Even if only property loss is considered, Collins & Lapsley's (2002) approach of ignoring 60% of property crime leads to a social cost that is \$670 million lower than it would otherwise be.

Another example would be drug dependence leading to reduced success in the labor market which leads in turn to commission of property crime to buy food or pay rent. From the cost of illness study perspective, if the crime was not committed to finance a drug purchase, then the costs associated with that crime are not a social cost of drug abuse. However, from the drug policy analyst's perspective, if reducing drug dependence reduces the number of people who fail in the legitimate labor market and, hence, the number of people who resort to property crime to buy necessities, then the drug control intervention deserves credit for preventing those property crimes.

Whether one thinks of these spill over effects as merely moderately large or as being of fundamental importance depends in part on how one views trajectories of life outcomes. Suppose a youth or young adult becomes heavily involved in hard drugs for one year and, as a result, that year is very "unproductive" in terms of earnings and human capital accumulation. They do poorly in school or, if already out of school, they do poorly at work during that year. At the end of that year, they quit using drugs and never use drugs again.

In terms of lifetime income, what happened within that year is probably not terribly important. Neither students nor young adults working full time make much money in one year whether they are drug dependent or not. So if one assumes that the consequences of that "lost year" are confined to those 12 calendar months, the lost productivity costs are not that large.

Conceivably, however, the effects of screwing up for a year spill over into subsequent years even if the cause of the initial poor performance (drug abuse) is confined to that first year. The ex-drug user who failed to develop human capital for that year might earn less in the second year than would his or her "twin" who became more educated or refined job skills through hard work during the preceding year.

The optimistic view would be that these spill over effects dissipate fairly quickly. Perhaps five years later, no one will really care what did or did not happen during that lost year. It is part of the distant past, and employers may only care about what their employees have done for them lately.

The pessimistic view is that in some sense the rich get richer and the poor get poorer over the course of a developmental trajectory, so stumbles along the way are amplified over time. A year of terrible grades as an undergraduate may block admission to selective graduate schools and lucrative careers as a professional, so the lost year's impact on earnings may actually be greater 20 years later, when the ex-drug user is not earning a doctor's or a lawyer's salary. Likewise, a lost year in high school may jeopardize scholarship money and, hence, the chance to attend college and obtaining the lifelong wage premium associated with a college degree.

Again, it is anything but clear how one would go about estimating these effects. The principal point is simply that there is no guarantee that they are small. A secondary point is to note how the characteristics of a behavioural health problem such as substance abuse pose challenges for cost of illness studies that some other diseases such as heart attack might not. If the typical heart attack victims are in their 40's or 50's, they have already established an observable career trajectory before the onset of the medical condition. Looking at earnings trajectories before and after the heart attack is more informative than is looking at earnings trajectories before and after a career of drug abuse that starts at age 15.

Furthermore, even some youth-onset medical conditions might reasonably be viewed as random shocks relative to career and earnings trajectories. The earnings impact of

juvenile onset diabetes might plausibly be estimated by comparing earnings of otherwise observably similar people who do and do not have juvenile onset diabetes. There may not be substantial concerns that who does or does not get diabetes is strongly correlated with hidden predictors of labor market success, such as creativity or ambition. However, involvement in substance abuse may quite plausibly be correlated with many personality traits that are both predictive of future earnings and difficult to control for, such as attitudes toward risk, ability to delay gratification, and commitment to or alienation from mainstream institutions.

Other Issues

These are four key issues that highlight the limitations of estimating social benefits of reduced substance abuse purely through a COI approach. There are others. For example, there is the cost to people who *avoid* becoming victims of crime (whether that is achieved by taking actions such as buying car alarms or by refraining from doing things like taking walks at night). Also, an important subset of drug-related psychopharmacological crimes may be poorly measured regardless of their “cause”, including date rape, domestic violence, and child abuse/neglect⁵. So even if the drug-related fraction is estimated correctly, if that fraction is applied to an underestimate of the total number of victimizations, the drug-related social costs will be underestimated.

There is a sense in which we are asking for Pandora’s box to be opened. While, this is true, the complexities of drug abuse are there whether or not COI studies turn a blind eye toward them. So they need to be grappled with, and addressing them might be more straightforward if substance abuse COI studies paid more attention to the particulars of substance abuse than they did to following the COI cookbook recipe.

5. Understanding the relationships between drug use and the social costs

Social cost studies, by comparing the current situation with a counterfactual of no substance abuse, provide policy makers with little information about what options they should pursue. The approach of Collins & Lapsley (2002, 16) to make an assessment of “avoidable” costs only serves to confuse the matter⁶. What is required **within these studies is information on the relationship between social costs and what government policies can affect, such as prevalence of use, level of consumption for each type of drug and, in some cases, by subpopulation of user.**

When analysts use these studies they are forced to assume there is a constant “social cost per unit used” for each drug (eg. Caulkins et al., 2002; McFadden & Mwesigye, 2004). However, the average social costs generated by one group of drug users may be much higher than that generated by other users. Some costs may be in line with drug used or frequency of use, such as the psychopharmacological costs of crime. However, for many

⁵ SAMHSA (2003) estimates that over 6 million children in the US live with at least one parent who abused or was dependent on alcohol or an illicit drug during the past year. Miller et al. (1996) estimate the average social cost per instance of child abuse to be \$60,000 (in 1993 dollars). There probably is no empirical basis for estimating what proportion of substance abusing or dependent parents abuse their children because of that substance abuse or dependence, but the proportion would not have to be very large for child abuse to loom large in social cost estimates. Even if the rate were only 10%, 6 million * 10% * \$60,000 = \$36 billion 2003 USD per year (equivalent to \$49B per year in 2005 US dollars).

⁶ To do this, they introduce the concept of “Arcadian normals”, which are the lowest levels of mortality and morbidity among a set of countries. By comparing the incidence of health conditions in Australia with those suggested by Arcadian normals, Collins & Lapsley (2002) arrive at an estimate of avoidable costs.

drugs, a frequent user will generate some social costs in much larger amounts than an occasional user. These could be expected to include chronic health conditions, economic compulsive crimes and drug treatment costs

Before exploring this issue further, it is worth returning to the process involved in a policy analysis using economic evaluation techniques. Such an analysis would normally involve two steps. First, some model would be constructed for projecting the effect of the intervention on drug use and related outcomes, such as drug prices, black market spending, numbers of users, numbers of users in certain categories (such as those in need of treatment). Second, changes in those outcomes would be monetized or otherwise converted into an expression of social benefit (averted social cost).

In principle one might wish to think of social cost as being a nonlinear function jointly of all of the outcomes, replete with various interaction terms. Realistically, one would probably want to, perhaps even have to, simplify by dividing total social cost into separate cost functions for different types of outcomes. Indeed, whenever possible one would like to model the cost of a particular outcome as being proportional to the amount or quantity of that outcome.

To illustrate, suppose there were just two drivers of social cost: lower labour productivity due to drug use and loss of quality of life associated with being drug dependent. In principle one would write the social cost function as a generic nonlinear function of two arguments:

$$\text{Social cost} = f(\text{lost productivity, person-years of drug dependence})$$

because there might be interaction effects. It is plausible that the costs associated with lower productivity due to drug use are a function of the years of life spent drug dependent.

Realistically, however, most policy analyses could not estimate such nonlinear functions of multiple variables and instead would simplify to:

$$\begin{aligned} \text{Total social cost} &= \text{Lower productivity from use} + \text{Social cost from drug dependence} \\ &= f_1(\text{lower productivity}) + f_2(\text{person-years of drug dependence}) \end{aligned}$$

Furthermore, there would be a temptation, whenever it is plausible, to assume that the individual components of the total social cost function were proportional to their arguments. I.e.,

$$\text{Total social cost} = c_1 * \text{lower productivity} + c_2 * \text{person-years of dependence}$$

Naturally there are many more than two types of drug-related social costs and there is no consensus or even body of literature debating what is a reasonable way to model social cost of drug use in a way that support quantitative evaluation of public policies, where being “reasonable” means balancing the competing virtues of simplicity or tractability on the one hand and being accurate or realistic on the other hand. Nevertheless, to push this argument forward with some concreteness, consider the following as a rough first pass for a typical expensive drug, such as heroin, cocaine, or methamphetamine. In practice, the analysis should be done drug by drug, a point to which we return below.

We identify below seven primary drivers of drug-related social costs, including such things as crime, dependence, and blood-borne disease. One subset of these seven might reasonably be viewed as being proportional to some underlying drug-related outcome. For example, the social costs of psychopharmacological crime might reasonably be modelled as being proportional to the quantity of drugs consumed, whereas the social

costs of economic-compulsive and systemic crime might be modelled as being proportional to black market spending on drugs.

A second subset might depend on a well-defined outcome but not be proportional to that outcome. For example, community disorder associated with drug markets might be driven primarily by total revenues of those markets, but the relationship could be nonlinear. When total revenues are low, the markets might operate surreptitiously, e.g., by beeper sales, generating relative few externalities. Then when total revenues exceeded some threshold, enforcement swamping (Kleiman, 1993) might allow the markets to change structurally into flagrant street markets. Right around the tipping point, small changes in drug market revenues might lead to large changes in social costs, so the relationship between market revenues and market-related social costs might be nonlinear. Likewise, social costs associated with blood-borne diseases might be a nonlinear function of the number of drug injections because of the nonlinear dynamics associated with diffusion of contagions (cf., Anderson and May, 1991).

A third subset of social costs might not vary appreciably with any drug-related outcome, at least over the range of outcomes that is plausible. For example, the amount spent on universal – as opposed to indicated – prevention programs depends on the intensity of the programs, not on how many drug users there are. The same may be true of workplace drug testing, border interdiction and research on drug treatment. If drug use disappeared entirely, those programs could be cancelled. However, spending on those programs would not go up or down appreciably if drug use went up or down within plausible ranges (i.e. the marginal social costs are zero).

Enforcement against drug-law violators is a special case. If arrest probabilities were fixed, then reducing drug use would reduce drug arrests and associated adjudication and corrections costs. However, if drug laws were policed using fixed resources (eg. 100 officers working on the drug squad at all times), then reductions in drug use might have little effect on the costs of drug enforcement. There could be other cases too, such as outreach services, where the relationship between the social costs and cost drivers depends on the policy rules.

Table 3 summarizes these perspectives on all three subsets of social costs and their drivers.

Table 3: Modelling social costs as a function of drug-related outcomes (a rough guide)

Category	Cost Driver	Are social costs approximately proportional to the cost driver?
Subset #1		
Cost of addiction	Person-years of drug dependence	Yes
Crime		
• Psychopharmacological	Quantity (weight) of drugs used	Yes
• Economic-compulsive & systemic	Black market spending on drugs	Yes
Health consequences of use	Quantity (weight) of drugs used	Yes
Subset #2		
Community disorder associated with drug markets	Black market spending on drugs	No
Blood born diseases (BBD)	# of injections or # of injectors	No
Subset #3		
“Fixed cost” control programs (primary prevention, etc.)	None	NA
Enforcement of drug laws	Various; Subject to interpretation	Perhaps, depending on interpretation

When applying this framework, one can think broadly of two types of policy interventions. The first, which might be termed “classic” interventions, work by changing the cost drivers, e.g., by reducing the amount of drug-related crime or the quantity of drugs consumed. The second, which might be termed “harm reduction” interventions, reduces one or more of the social cost function’s coefficient that are multiplied by a cost driver. For example, safe injection rooms might reduce the health-related social cost per kilogram of heroin consumed by reducing the likelihood that overdoses are fatal. Both types of interventions can be accommodated within this framework, as can interventions that affect both a cost driver and its coefficient. For example, punitive policies toward drug dependent individuals might reduce the number of people who are drug dependent but increase the social cost per person year spent in drug dependence.

For quantitative evaluation of drug control interventions to proceed, one needs estimates of (1) the total social cost associated with each of the rows in Table 3 and (2) models of how those social costs depend on the associated cost driver. By definition, the second is trivial for components that can reasonably be modelled as being proportional to their cost driver (i.e. Subset #1). Merely dividing the current social cost estimate by the current value of the cost driver yields the proportionality constant, and that constant is all one needs to know when costs are proportional. For cost components that cannot reasonably be modelled as being proportional to the cost driver more research is needed to understand the shape of those functions, but at least it is clear conceptually what needs to be done.

What is missing for all these cost components, though, is estimates of the social cost by cost component. There is now some conceptual clarity around the information ideally available to policy analysts. In seeking to develop such information, it is natural to ask whether we have estimates of the social costs associated with categories of the kind identified in Table 3?

The short answer is no. Current COI studies group social costs based on where the costs reside – in the health system, in the criminal justice system, and so on – not by their cost driver. Some health-related costs may be driven primarily by the number of doses or the quantity consumed. Others, notably costs associated with dependence, probably depend more directly on the number of person-years spent drug dependent. An increase in heroin prices might reduce the quantity of heroin consumed – and hence associated health consequences such as OD deaths or injection related costs – more than it would the number of heroin dependent individuals and, hence, the social costs associated with dependence itself. Likewise, an increase in heroin prices might reduce drug use and, hence, psychopharmacological crime but – depending on the elasticity of demand – spending on heroin might fall by much less (or even rise), and hence so would economic-compulsive and systemic crime.

Similarly and crucially, COI studies typically do not disaggregate by substance and rarely disaggregate in a bivariate manner by both substance and type of social cost simultaneously. Yet few drug interventions affect the use of all substances equally. Hence, this consideration of the role of social cost estimates in policy analysis yields two general lessons for COI studies:

- Provide detailed disaggregates, not just the total social cost estimate; and
- Disaggregate to levels corresponding to specific drivers (such as those in Table 3).

Policy analysts need social costs to be broken down by cost components associated with cost drivers, not by where the costs reside. A huge step in that direction can be made

simply by disaggregating social costs by drug and, within each drug type, by type of user (e.g., heavy vs. light or dependent vs. not dependent). We illustrate the feasibility of this for two of the most important categories of cost: health costs and crime costs.

Health costs. There are comprehensive mortality and morbidity datasets collected in Australia and the United States. The proportions attributable to substance use are estimated on the basis of condition-specific studies or using epidemiological databases to calculate the role of drug use as a risk factor. Collins & Lapsley (2002) and ONDCP (2004), get to total figures by adding up things like *cannabis* abuse costs plus *amphetamine* abuse costs plus accidental *opiate* poisoning costs. Most of the conditions are directly tied to a specific substance. For the handful that are not, such as road injuries and blood-borne viruses, there are normally ways they can be worked out. For example, in the United States the Drug Abuse Warning Network contains information on what number of drug-related suicide attempts mention each type of drug (SAMSHA, 2004), while injecting frequency by drug type is recorded in various studies (eg. Southgate et al., 2003).

Crime costs. Collins & Lapsley (2002) use the Drug Use Monitoring in Australia (DUMA), which contains interview and urinalysis information on arrestees, to assess what proportion of crime should be attributed to illicit drug use. DUMA is similar to the Arrestee Drug Abuse Monitoring (ADAM) survey, and both form part of an eight-country data collaboration (called I-ADAM). In all countries, at least five common drugs (marijuana, cocaine, heroin/opiates, amphetamines, and benzodiazepines) are tested. This information can be used to allocate crimes to various drug types. In addition, distinctions can be made between users either using self-report frequencies of drug use prior to arrest, or via a dependent/non-dependent classification (Makkai & Payne, 2003).

In the United States, estimates of quantities consumed, price, and hence amounts spent by drug are broken down by “hardcore” and “occasional” users (ONDCP, 2001). The information in Australia is less comprehensive, although some estimations have been made (eg. Degenhardt et al. (2004): frequent vs. occasional heroin consumption). This information goes a long way toward providing the cost drivers broken down by drug and type of user for crime.

While these examples perhaps demonstrate how much a long-term proposition the comprehensive assessment of cost drivers is, they also show that there is policy relevant information that is being lost in pursuit of a handful of large numbers. The disaggregations commonly require no extra calculations and little extra effort.

6. Conclusion

We have identified a number of aspects of the social costs of substance abuse that are neglected or mistreated by COI studies. Addressing all of them and generating rigorous, scientific estimates for all drug abuse effects would be a daunting undertaking. COI study authors might object that the task is simply too hard for them to complete to the usual standards of scientific precision.

Yet, if they don't do it, who will? There are three possibilities. One is that no one will. That essentially means there will be no quantitative policy analyses projecting the monetary value of implementing different drug policy strategies. The public could be forgiven if they rebelled against further funding of drug related research if the scientific community fails to even attempt to address so basic a need. The second possibility is that policy analysts will attempt to cobble together plausible figures. The results may be rather poor, both because the analysts are not as familiar with the details of the COI studies as the authors themselves, and because the analysts would not necessarily have

access to the underlying calculations. The third possibility is that COI study authors will recognize both the societal need for quantitative projection of drug policy performance and that they are uniquely positioned to produce the most credible estimates of social costs. As a result, they will give it their best shot, even recognizing the great many limitations their estimates will suffer.

We clearly favour the third possibility, and note that it is the only alternative which can feed back directly to the COI study authors how their studies should be extended or modified to better serve this need of policy analysis. In this feedback, the best should not be the enemy of the good. That is, the best policy-relevant social cost estimates that could be produced from today's COI studies might still be seriously deficient. However, as we have identified, there are a number of suggestions that would lead to significant improvements in the accuracy and utility of such studies at little additional effort or cost.

Social cost estimates will continue to be used by policy analysts. Suppose the COI study authors themselves were confronted first hand with those deficiencies as they themselves tried to produce the input that must underpin any quantitative policy analysis of this sort. That experience might be more effective than this paper or any other collegial cajoling at inducing changes in the COI study methods and reporting that would allow better policy-relevant estimates to be produced in the future.

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