



# Looking at Economic Analyses of Drugs and Economic Recession (LEADER)

## Review of existing guidance documents in estimating the social costs of drugs

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## Abstract

The last decades have seen the emergence of a strong interest from different stakeholders (policymakers, scholars, authorities) with regards to the definition of rigorous and reliable estimates of the social costs of illegal drugs, alcohol and tobacco. Credible estimates in this setting would provide relevant information related to the extent of the problems related to the use of these substances and the effectiveness of interventions aimed at reducing it. Nonetheless, few countries have attempted to estimate these costs and the estimates they generated are jeopardized by the various methodological disputes that characterize the research in this field.

The purpose of this work is to provide an overview of the indications coming from published guidelines for the estimation of the social costs of illegal drugs, alcohol and tobacco. The methodological issues that will be presented will include the different approaches proposed by the literature and, where available, the effects of the adoption of different methods on final estimates. As a result of the systematic review, two frameworks are proposed for future research: a minimum standard and an ideal framework for performing such estimations.

## 1. Introduction

The literature on estimates of social costs of illegal drugs, alcohol and tobacco, which dates back to the '80s (Hardwood et al., 1984; Heinen and Pittman, 1989; Markandya and Pearce, 1989), has been characterized from its early beginning by an intense dispute of what should be considered as the most appropriate and rigorous analysis method. The main reasons behind this theoretical debate have been two:

- the controversy regarding the definition of some of the analysis' basic concepts, as "social cost" and the counterfactual (Collins and Lapsley, 2002; Diomidous et al., 2013);
- the complexity regarding the nature of the causal relationships between the consumption of illegal drugs, alcohol and tobacco and their negative effects on individuals and society (Kopp, 2002)

By rigorously outlining the methodological issues connected with illegal drug, tobacco and alcohol consumption's social cost calculation, many published contributions aimed at systematizing these open issues and provided guidelines for properly addressing them.

The objective of this report is to review these documents in order to provide an updated overview of internationally recognized guidelines on the estimation of the social and economic cost of the consumption of illegal drugs, alcohol and tobacco.

The document is organized as follows: after a brief introduction of the strategies adopted for the literature systematic review, the debate on the principal concepts underlying illegal drugs, alcohol and tobacco consumption's social cost estimation will be presented; then the main issues of the methodological approaches for addressing these estimations and the analytical framework will be presented; the issues regarding the application of the framework itself, together with the matrix of costs, will be discussed in the final part.

## 2. Methods

The strategy for the literature review consisted of three steps. The search was divided into two pathways, one focused on illegal drugs, the other one on tobacco and alcohol.

For illegal drugs, the first step consisted in investigating academic databases. We conducted a search in databases such as MEDLINE/PubMed, Web of Knowledge, Scopus and NHS Economic Evaluation. We also consulted the US National Library of Medicine, US Library of the Congress and British Library. No restriction by publishing date was applied. A first approach in PubMed retrieved 127 references. In this case, we used the following combination of keywords:

("non legal"[ti] OR illegal[ti] OR illicit[ti] OR abus\*[ti] OR depend\*[ti] OR disorder\*[ti] OR addict\*[ti]) AND (drug\*[ti] OR substance\*[ti] OR cocaine\*[ti] OR heroin\*[ti] OR morphin\*[ti] OR opioid\*[ti] OR "street drugs"[ti] OR "Drugs consumption"[ti] OR "Substance Abuse Treatment Centers/economics"[mesh] OR "Substance-Related Disorders/economics"[majr] OR street drugs/economics[majr] OR "Designer Drugs/economics"[majr]) AND (socioeconom\*[ti] OR social[ti] AND cost[ti] OR costs[ti] OR burden\*[ti] OR Cost-Benefit Analysis/methods[mesh] OR "Costs and Cost Analysis/methods"[mesh] OR Cost of Illness[mesh] OR drug costs[mesh]) AND (guideline\*[ti] OR guidance\*[ti] OR theoret\*[ti] OR approach\*[ti] OR model\*[ti] OR dimens\*[ti] OR measur\*[ti] OR standard\*[ti] OR method\*[ti] OR frame\*[ti] OR refram\*[ti] OR simulat\*[ti] OR estim\*[ti] OR value\*[ti] OR valuing[ti] OR count\*[ti] OR assess\*[ti] OR evaluat\*[ti] OR quantifi\*[ti] OR interpret\*[ti] OR concept\*[ti] OR methods[sh] OR "Models, Economic"[mesh] OR "Computer Simulation"[MESH] OR "Decision Support Techniques"[mesh] OR "Models, Theoretical"[mesh] OR "Models, Statistical"[mesh] OR "Models, Biological"[mesh] OR "Models, Econometric"[mesh] OR "Models, Economic"[mesh] OR Guidelines as Topic[mesh] OR standards[sh])

A second, more stringent search was carried out using the following terms:

((((econom\*[ti] OR cost[ti] OR costs\*[ti]) AND (drug\*[ti] OR substance\*[ti]) AND (illegal[ti] OR illicit[ti] OR abus\*[ti] OR misuse[ti]) AND (guideline\*[ti] OR method\*[ti] OR theor\*[ti]))) OR (Substance-Related Disorders/economics[majr] AND (guideline\*[ti] OR concept\*[ti] OR method\*[ti] OR theoret\*[ti] OR estimat\*[ti]))) OR (Substance-Related Disorders[majr] AND (framework\*[ti] OR guideline\*[ti] OR concept\*[ti] OR method\*[ti] OR theoret\*[ti] OR estimat\*[ti]) AND (cost[ti] OR costs[ti] OR econom\*[ti])))+

This retrieved about 95 references.

The search strategy carried out in Scopus provided 23 additional references. The combination of keywords used was the following:

((((TITLE ("social cost" OR "social costs") OR TITLE (cost\* OR econom\* OR expenditur\* OR calculat\* OR burden))) AND ((TITLE((illegal OR illicit OR abus\* OR depend\* OR disord\* OR addict\*) W/1 drug\*)) OR (TITLE ((illegal OR illicit OR abus\* OR depend\* OR disord\* OR addict\*) W/1 substan\*)) OR (TITLE (cocaine\* OR heroine\* OR morphine\* OR opioid\* OR "street drugs")))) AND (TITLE (guideline\* OR guidance OR method\* OR frame OR framing OR theor\* OR concep\*))

The final outcome of this search step was 150 articles. They were analysed in order to verify their coherence with the research objectives. This led to the selection of 15 results.

The second step of the literature search investigated the grey literature using Google and Google Scholar, as well as library catalogues such as the US National Library of Medicine, US Library of the Congress and British Library. These sources were consulted using the three combination of keywords defined in the first step. The search led to the identification of 8 relevant studies.

Finally, in a third step, the reference section of the studies selected in step I and II were reviewed using a snowball search approach. This led to the identification of an additional 6 contributions.

In conclusion, the literature search on guidelines for estimations illegal drugs social costs generated 27 results. 8 results from this search provided a general theoretical background. Even though they do not refer to the specific contest of social cost of illegal drugs calculation, they were considered as relevant and coherent with the purpose of this study. The remaining 19 results of the literature search, the ones providing specific guidance on estimating social cost of drugs, can be seen in appendix A. The appendix also includes each study's aim and main contribution to the literature.

The search on alcohol and tobacco conducted through academic databases was performed using two different strategies, as reported below:

1.

(Smoking[ti] OR smoker\*[ti] OR Cigarette\*[ti] OR Nicotine[ti] OR Tobacco[ti] OR Alcohol\*[ti]) AND (socioeconom\*[ti] OR econom\*[ti] OR social[ti] AND cost[ti] OR costs[ti] OR burden\*[ti] OR expens\*[ti] OR expenditur\*[ti]) AND (guideline\*[ti] OR guidance\*[ti] OR method\*[ti] OR frame\*[ti] OR framing[ti] OR theor\*[ti] OR concept\*[ti] OR research[ti] OR modelling[ti] OR measur\*[ti])

2.

(Smoking[ti] OR smoker\*[ti] OR Cigarette\*[ti] OR Nicotine[ti] OR Tobacco[ti] OR Alcohol\*[ti]) AND (socioeconom\*[ti] OR econom\*[ti] OR social[ti] AND cost[ti] OR costs[ti] OR burden\*[ti] OR expens\*[ti] OR expenditur\*[ti]) AND (guideline\*[ti] OR guidance\*[ti] OR method\*[ti] OR frame\*[ti] OR framing[ti] OR theor\*[ti] OR concept\*[ti] OR research[ti])

The search produced 36 results, of which 4 were selected after abstract revision. The review of the selected papers' references contributed in identifying 3 additional relevant documents. The grey literature search (Google and Google Scholar, US National Library of Medicine, US Library of the Congress and British Library) generated 2 additional results. The 9 results for the alcohol and tobacco search can be seen in appendix B. The appendix also includes each study's aim and main contribution to the literature.

In conclusion, the review strategy led to 36 results. These can be classified in two groups:

- the first group includes all the contributions that are directly related to the topic, such as guidelines/guidance documents and articles with estimations of the social cost of drugs which included the rationale of the choices related to the framework design;
- the second group includes the contributions that provided references regarding the general theoretical background – all these were included in the presented review.

All the results, following the distinction presented before, are listed in Appendix C.

The following sections of the documents will analyse those methodological open issues that emerged as most relevant during the paper revision exercise. A synthetic exposition of those issues and the related alternative analytical solutions presented in the literature are provided in Appendix D.

### 3. Results

The review of the results of the literature search has highlighted that the three literature sets on illegal drugs, alcohol and tobacco share the majority of methodological issues in relation to social cost estimation. In fact, researchers in all the three fields have widely debated regarding the general framework to adopt, selecting between the cost of illness (COI) or approaches based on the utility theory (illegal drugs: French et al., 1991; alcohol: Moller and Matic, 2010; tobacco: Lightwood et al., 2010). The definition of social cost and the selection of cost categories that should be included in the analysis, with intangible costs and private costs as the most debated categories, can be also considered as one of the key issues in three areas of research and has been extensively discussed in all of them (drugs: Single et al., 2003; alcohol: Thavorncharoensap M. et al., 2009; tobacco: Collins and Lapsley, 2010). The same can be said regarding the methodologies for identifying which part of the social cost can be targeted by policy and how to determine the real impact of the consumption of the three substances in terms of the health events generated (alcohol: Jarl et al., 2010; Collins et al., 2006).

The literature sets on the three fields share similar results regarding recommendations made with respect to the methodological issues described before. As the COI framework has been considered by the academic community as the most appropriate for estimating illegal drugs social costs (Single et al., 2003), the same can be said for alcohol (Collins and Lapsley, 2008; Moller and Matic, 2010) and tobacco (Lightwood et al., 2010). At the same time, the debates related to the management of private cost and the challenges in defining intangible cost generated by illegal drugs' consumption (Single et al., 2003) can be found in both the alcohol (Collins and Lapsley, 2010) and the tobacco (Collins and Lapsley, 2010) literature. In the three areas of research, the questions regarding these topics are still not all answered and the debates have developed in similar ways. Moreover, in the three streams of research the use of the attributable fraction, feasible minimum and avoidable cost were found as the most widespread and reliable methodologies for calculating policy targets and health events related to the use of these substances (Jarl et al., 2010; Collins et al., 2006). Finally, the three literature sets share the debate regarding a set of issues in the framework application, as the selection between human capital or demographic approach and between incidence or prevalence approach (alcohol: Collins and Lapsley, 2010; smoking: Collins and Lapsley, 2008; Single et al., 2003).

The evidence found in the literature has provided various indications regarding the common ground shared by the literature of the three fields. This has led to the development of contributions that analyse two or all the three with the same framework (Fenoglio et al, 2003; Collins and Lapsley, 2008). Moreover, some of the most relevant guidelines for social costs estimations address the three areas together, proposing a single framework for all of them and adopting the 'substance' concept as an umbrella that includes illegal drugs, alcohol and tobacco together (Single et al., 2003; Collins et al., 2006; Rehm et al., 2006).

In sum, the literature review of guidance documents for estimating social costs of illegal drugs, alcohol and tobacco shows that: the methodological aspects analysed by the guideline documents on social costs are the same across literature sets for illegal drugs, alcohol and tobacco; the methodological solutions they provide for solving them are similar; and the main contributions in the field provide a single framework and same tools for addressing the estimation of social cost in the three areas of research. Bearing this in mind, and taking into account that one of the final goals of the LEADER project is to provide a coherent step by step guidance in estimating the social costs of illegal drugs that can be used in a standardised format across jurisdictions, and that the purpose of this review is to inform the development of such guidance, the following sections report on the outcomes of the analysis of materials relevant predominantly to illegal drugs, putting forward conclusions and recommendations for the estimation of social costs of illegal drugs.

Appendix E lists those results that can be considered as the most relevant regarding the literature search on drug use. Studies are presented together with the approach adopted by each one in addressing the main methodological issues related to social cost of drugs calculation. This appendix should serve as a synthetic presentation of the principal studies and analytical topics that will be analysed in the following sections.

### **3.1 The estimation framework: founding concepts**

#### **3.1.1 Methods to estimate social costs of drugs**

The literature on social cost of drugs estimation relies on different general framework approaches. French et al. (1991) provide an overview of those that can be considered as the most relevant and most widely used.

##### *Cost-of-Illness (COI)*

Cost-of-Illness (COI) analysis is based on human capital approach and opportunity cost. According to this method, the estimation of the impact of drugs consumption on society (e.g., illness or premature deaths, use of assets for drug production and purchasing) is calculated as the sum of the value of medical resources used to diagnose and treat the use cases minus the discounted market value of losses (productivity, use of resources, property destruction and losses, etc.) (French et al., 1991).

The main controversy of this approach is represented by the definition of the counterfactual, i.e., the alternative scenario that should be used for opportunity cost assessment. In the case of drug use, the definition of the counterfactual is not easy: cases of a world with no drug or a switch towards lower level of consumption or other legal substances, e.g., alcohol, are both plausible in theory, but they do differ in terms of their level of realism (Single et al., 2001): a reduction of consumption, rather than a total abandonment, can be considered a more realistic scenario. Nonetheless, it is unclear which level of drugs use can be considered as low and not harmful. The stream of research that has focused on analysing any use of illegal drugs proposed as a counterfactual the absence of illegal drug consumption. This approach will be the one followed by this document.

COI relies on the “value theory” framework, which assumes consumers to rationally maximize the utility derived from their consumption. Whether addictive drugs users respect this is still not verified, though (Domidious et al., 2013).



In spite of its limitations, COI has emerged as the most widely adopted method for assessing drug use social cost during the last decade (Single et al., 2003).

#### Averting Behaviour Method

Averting Behaviour method aims at calculating expenditures made by individuals to protect them from and mitigate negative effects of risks. It assumes that a rational individual will take defensive behaviour as long as the value of the damage avoided exceeds the costs of the protective action (Whitehead et al., 2008).

Although the method's basic assumptions are generally accepted as rational and it is used often in other domains (e.g., environmental economics), its adoption for the calculation of illegal drugs' social cost has been limited so far. One of the main issues is the lack of an exact and reliable calculation of averting behaviour cost. Nonetheless, averting behaviours represent a wide spread reaction to drug use by many categories of individual that may be involved in the analysis (e.g., family and community members, drug users, victims of drug related crimes), therefore it should be considered in social cost calculations (French et al., 1991).

#### Utility Valuation Methods

Utility Valuation Methods (UVM) is based on utility theory. They both aim at associating economic values to individuals' preferences. They have been extensively used in the social cost literature, especially for addressing the estimation of intangible cost.

These methods have relied mainly on utility theory and willingness to pay approach. In health economics studies, this concept has been used extensively to estimate the value that individuals put on changes in the probability of mortality and morbidity (French, 1991) and they represent the base of the Quality Adjusted Life Years (QALY) measurement.

Leading utility valuation techniques are:

- hedonic price method, which estimates the value of a non-market good by observing which behaviours are associated to a similar private good that do has a market (Pearce et al., 2006);
- quality of life method, based on the health status index literature. Health status scales are defined in order to provide a cardinal ranking of adverse health states based on relative disutility weights (Bayoumi and Redelmeier, 1999);
- contingent value method, which constructs hypothetical risk markets and then elicit individual preferences regarding risk trade-off scenarios using surveys and questionnaires (Folland, 2006).

Though utility theory is widely diffused in any economics domains, its use as a drug use social cost estimation method has been criticized because it relies on probabilities of adverse health rather than real consequences generated by cases of adverse health effects (French et al., 1991).

### **3.1.2 Social cost: definition and the rationality assumptions**

Scholars have thoroughly debated the correct interpretation of the "social costs" concept. Currently there is no universally accepted definition of this concept in the economic literature. The main reason behind this is the normative, thus subjective, nature of this concept. In fact, many of its components (e.g., danger, risk) rely heavily on personal perspectives.

From a research point of view, the main consequence of this heterogeneity in the definition of the concept is the variety of approaches regarding the selection of the types of cost that should be included in the analysis.

One of the most diffuse categorisations of social cost of drugs is represented by the dichotomy between tangible and intangible cost. Tangible costs can be defined as those costs which, when reduced, yield resources which are then available. Intangible costs, instead, do not determine any increase of available free resources when reduced or eliminated. Intangible costs include cost items such as pain and suffering. Though their importance is generally recognized, it is difficult to quantify them.

Another criterion for social cost categorisation identifies three main categories:

- private costs, the costs borne only by an individual, in this case the illegal substance user (Pacula et al., 2003);
- public costs, i.e. expenditures incurred by central and local government in combating use (and trafficking) of psychotropic substances (Kopp and Fenoglio, 2002);
- external costs or externalities, referring to those public costs that are generated by the individual making the consumption decision but external to the same individual (Single et al., 2003)

While the pertinence of the last two categories is agreed, the inclusion of private costs has generated different approaches. The issues related to private costs management are determined by the complex system of consequences that the use of illegal drugs generates and by the assumption of rationality (or non –rationality) of drug users. In this setting, part of the private decision costs involves addictive consumption, which could potentially violate the rationality postulation (Single et al., 2001), and which also entails a fully informed decision maker, a questionable case for a dependent consumer. Moreover, drug consumption and addiction do have consequences and generate additional costs that are not limited to consumers themselves but are shared by household and society through different mechanisms (Disley et al., 2001). This would justify the inclusion in social cost calculations of part of private cost, but still leaves unclear which part of it and how it should be calculated.

Following the definition of social cost as the sum of private and external costs by Stiglitz and Walsh (2002), a line of research in this field has adopted an inclusive approach, according to which social cost should be interpreted as total cost. This is well represented by Kopp and Fenoglio (2002), which included all private expenditure in their proposed framework. Their decision is mainly determined by the cost of illness (COI) approach which they adopted, which, according to their framework, should cover all tangible cost borne by society. Kopp and Fenoglio's (2002) approach is shared by many authors, such as Hardwood (1999).

Rehm et al. (2002) opted for a definition of social costs which includes only externalities and public costs, thus excluding private costs, as they assumed drug users simultaneously respect three conditions:

- they are fully informed as to the costs which the substance use imposes upon themselves;
- they bear the full (internal and external) costs of the consumption;
- they make rational consumption decisions in the light of all the information available to them

Their approach is coherent with the consumer value paradigm, which assumes that consumers seek for maximum utility in any of their consumption choices. According to this methodology, which has its foundation in standard marginal economic theory and revealed preference

theory (Dowding, 2002), consumer decisions driven by addictive consumption do respect the condition that private benefits offset private costs. This approach has been criticized by authors like Sen (1986), who criticised the inference from choice to preferences when not based upon rational deliberation, as in the case of addictive consumption.

### 3.1.3 Avoidable cost and attributable fraction

The cost related to substance use can be divided in two groups (Collins et al., 2006):

- unavoidable costs, consisting of already existing drug-related diseases and new cases due to prior consumption, plus cases due to continued (irreducible) consumption (consumption which cannot be reduced further regardless of the degree and number of interventions implemented, given current level of knowledge) ;
- avoidable costs, those that are amenable by interventions and behaviour changes.

This last category is the one that really provides information regarding the benefits that intervention for reducing drug uses can generate. As suggested by the authors, it's difficult to assess performance of programmes that devote resources to preventing drug use or treating the consequences of drug use without a reliable estimation of avoidable cost of substance use.

Avoidable cost is one of the pillars of attributable fraction (or aetiological fraction or attributable proportion). This concept relies on the assumption that medical conditions or events can have more than a single cause. In these cases, it is not possible to associate the whole burden of the disease to a single cause, but each cause should be associated to its related part of the burden (Rehm et al., 2002). Attributable fraction calculation requires two types of data: relative risk data, i.e., the measurement of causal relationship between the exposure to the risk and the condition analysed) and prevalence data. Attributable fractions should be derived from population- or country-specific calculation. Grouping countries, even those with similar economic development, should be avoided, as the burden calculated includes consequences that are strictly related to a country's legal, social and cultural setting (Collins et al., 2006).

### 3.1.4 Feasible Minimum estimation methods

Together with attributable fractions, the estimation of the potential impact of policies aimed at contrasting drug use must take into account the lowest achievable level of substance use that policies should be expected to realistically aim to. This issue is addressed by the Feasible Minimum estimation. Authors identify four alternative methods for calculating Feasible Minimum: the epidemiological method; the Arcadian Normal method; the use of proxies from comparable settings; the use of already available evidences on interventions effectiveness extracted from the literature.

#### Epidemiological method

This method has two alternative approaches:

- the classical approach, which derives Feasible Minimum from each population's exposure and non-exposure to an illness-specific risk factor. This approach is mainly retrospective, as it's based on a population exposure in the past;
- the distributional approach, which entails a scenarios analysis considering different changes to risk factor exposure distribution. This is a prospective analysis, as it aims at analysing the consequences of future changes to risk exposure.

While the classical approach has not attracted researchers' attention because of its static

design, the distributional one has been extensively adopted in social science due to allowing for scenario analysis. A key methodological aspect here is represented by the selection of distributional changes in the exposure variable that can be considered realistic. Scholars have generally relied to the experience of similar countries or historical trends in order to find realistic changes (Collins et al., 2006).

#### The Arcadian normal

The Arcadian normal method is based on the assumption, described by Armstrong (1990), that for each population “a level of disease that might be reasonably achieved if only we all knew that which might reasonably known about the causes of the disease in question” can be identified. This level of disease is called Arcadian Normal. The author further concluded that groups of countries with genetically similar populations and comparable living standards share the same Arcadian Normal, which is defined as the within-group lowest age-standardised mortality rate for each cause of death. From this, potentially avoidable mortality and Feasible Minimum can be estimated.

Scholars have highlighted three main shortcomings of the Arcadian normal approach (Collins et al., 2006):

- it is disease based and does not take into account each country exposure-specific profile, as it groups countries by taking into account more general outcome measures;
- it is not disease-specific. Instead, it consider the burden of disease across different illnesses and thus identify the Feasible Minimum considering risk factors which may not be strictly related;
- it groups countries according to a non-comprehensive approach (only genetic profile and living standards), not considering differences regarding other relevant factors not related to the above. These differences can make the grouping unreliable for the Feasible Minimum calculation.

#### Exposure-based comparators

A methodological issue that both of the two approaches outlined above share is that they require considerable amount of data to perform the analysis. This can be problematic, especially for countries that do not have a long tradition of data collection in healthcare (Collins et al., 2006). A practical alternative is represented by the use of prevalence data as a proxy for attributable fraction. This method relies on World Health Organisation estimations on relative risks, which are performed grouping countries in sub-region (Ezzati et al., 2004). Accordingly, within-group prevalence variation could be considered as a proxy for variations in attributable fractions, while the country that within a group has the best performance can be considered as the sub-region Feasible Minimum. Though this approach has evident limitations and it is based on simplified assumptions, it does still offer the advantage of being exposure data based, rather than outcome data based (Collins et al. 2006).

#### Using evidences on interventions’ effectiveness

Avoidable cost estimation can also be supported by evidences generated by the literature on drug use interventions and policies. Where available, these evidences can provide suitable information and valuable additional indications to avoidable cost methodology (Collins et al., 2006). However, these measures alone cannot be considered as sufficient to approximate avoidable costs (Collins et al., 2006)

## 3.2 Theoretical issues in the framework applications

### 3.2.1 Definition of use

The focus of the present study is the use of illegal drugs, including any form of illegal drugs consumption. No distinction is made between harmful use, use for leisure or other levels or reasons for use. This stands in contrast with studies that focused on the “abuse” of illegal drugs, a term that, according to the WHO Lexicon of Alcohol and Drug Terms<sup>1</sup>, has a clinical meaning and is defined as “a residual category, with dependence taking precedence when applicable”. Focusing on abuse only would exclude a set of relevant cases and costs, including those related to occasional users. Therefore, it was decided to consider any form of illegal drugs use.

### 3.2.2 Estimation approach: human capital vs. demographic approach

In relation to the estimation of production losses determined by substance use, two main approaches have been proposed:

- human capital approach, which is based on the actualization of the hypothetical production stream each user would have generated if she/he had not suffered from the consequences of drug use (Xie et al., 1999) ;
- demographic approach, based on the comparison between the output produced by the actual population and that that would be produced by an ideal population with the same structure but no cases of use (Godfrey et al., 2002).

Both approaches compare reality with an alternative, hypothetical population. The main difference between the two stands in the evaluation’s temporal horizon: the human capital approach estimates losses related to the present and the future, while the demographic approach is focused on calculating losses related to the past and the present situation (Collins et al., 2002). The selection of one over the other depends on each study’s objectives and data availability. Moreover, rather than alternatives, the two should be considered complementary, as their focuses are different (Kopp and Fenoglio, 2002).

### 3.2.3 Incidence vs. prevalence perspective

Another critical decision is represented by the choice of an incidence- or prevalence-based approach. Prevalence is defined as “the percentage of a population that is affected with a particular disease at a given time”. When adopted in social cost studies, it focuses calculation not only on the cost generated by new users, but also on those related to mature users and those former users that still face consequences from their past consumption, as illnesses (Collins and Lapsley, 2002). Incidence can be defined as “the rate of occurrence of new cases of a particular disease in a population being studied”. In social cost studies, incidence-based estimations calculate costs related to new cases and project them throughout the whole life of an individual. In this sense, they provide an estimate of the avoided cost that prevention may generate, if effective (Xie et al., 1999).

From the above descriptions, the two approaches have different objectives and aim at analysing different policy/research issues. As for the previous dichotomy between human capital and demographic approach, the two methods should be considered as complementary

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<sup>1</sup> [http://www.who.int/substance\\_abuse/terminology/who\\_lexicon/en/](http://www.who.int/substance_abuse/terminology/who_lexicon/en/)

rather than alternative (Kopp and Fenoglio, et al., 2002; ONDCP, 2004; Single et al., 2003).

### 3.2.4 Intangible costs

Intangible costs estimation can be considered as a key aspect and one of the most debated issues of drug social cost framework (Kopp and Fenoglio, 2002). Issues in their estimation stem from the nature and characteristics of this category, in fact:

- any change in intangible costs does not imply a change in productivity or consumption, thus it does not generate any direct transfer of these benefits to any other person;
- as a consequence, there is no market for benefits generated by intangible cost reduction.

The most debated and controversial aspect related to intangible costs inclusion is their conversion into a monetary value. Single et al. (2003) proposed a set of methodologies for estimating intangible costs:

- human capital approach, which estimates the actualized value of future potential earnings. Considering only future earning potentially exclude relevant cost categories, as pain and bereavement, therefore there is the risk of undervaluing intangible cost and life in general;
- willingness to pay, instead, involves calculating intangible costs by identifying the amount of money would be spent by an individual for reducing the risk of death associated to an illness, using this as an instrument for calculating the value of life. Many have highlighted the weaknesses of this method, which are related to the accuracy and consistency of estimates (Sunstein, 2003, among others).

Scholars have debated the best approach for managing and estimating intangible cost. Therefore, the literature includes studies that have addressed the issue very differently. According to Disley et al. (2013), intangible cost estimation should be limited to a subset of cost/harms for which robust data are available, in order to reduce the risk of producing inaccurate estimations. In Single et al. (1998) and Kopp and Fenoglio (2002), intangible cost are entirely excluded from calculation due to the lack of both data and estimation reliable methodologies. In Pacula et al. (2009), intangible cost are included using a comprehensive approach, as authors consider them as a fundamental category in social cost of drug estimation studies. Quality-adjusted life years are proposed as a measure for reducing the methodological issues connected with their inclusion. In Kleiman's (1999) paper, a method to define a cost of human suffering through the identification of a cost lower boundary is considered as a possible solution to estimation reliability issues.

In general, intangible costs are difficult to value, but their importance and relevance in social cost of drugs estimations is certain. In this sense, further research for defining reliable methods for estimating intangible cost should be conducted (Collins et al, 2006).

## 3.3 The matrix of costs and calculation's open issues

The literature on illegal drugs social costs contains a wide variety of proposals regarding the categories and sub-categories that should be included in the estimation framework. While there is a broad agreement regarding the principal cost categories at a general level (1. healthcare costs; 2. productivity losses; 3. crime and law enforcement costs; 4. other costs - accidents, administration, etc.), there is greater variability and less agreement on the definition of cost sub-categories. Starting from a more general distinction between private and

public costs, Kopp and Fenoglio (2002) provide a very detailed study regarding social cost of drugs categorisation (reported below). An important peculiarity of their work is the identification of a specific cost category devoted to prevention programmes, which entails costs for policies sustained from different public entities, not necessarily related to healthcare (e.g., the Ministry of Education).

Figure 1 - Matrix of cost, from Kopp and Fenoglio, 2002

Private costs
<b>Costs to substance users</b>
Purchase of substances
Lawyers' fees
Non-reimbursed medical expenses
Including: - Pharmaceuticals not reimbursed by social security
Proportion of pharmaceutical costs not reimbursed by social security
Proportion of hospital expenses not reimbursed by social security
Years of life lost by substance users
<b>Private bodies' expenditure on prevention and research</b>
Staff costs
Running costs
Prevention campaigns (radio, TV, poster, etc.)
Medical research by private bodies
<b>Support for patients and patients' and victims' families (expenditure by private bodies)</b>
Staff costs
Running costs
Direct payments
<b>Workplace costs</b>
Absenteeism
Lost productivity
Including: - Due to a wage earner's illness-related days of absence
- Due to lost skills as a result of a wage earner's death
Recruitment costs due to a wage earner's death
Training costs due to a wage earner's death
Costs relating to destruction of equipment
<b>Industrial accident costs</b>
<b>Other costs borne by private individuals</b>
Illness due to passive use
Destruction of private property (vehicles, forests, etc.)
Theft
Lost years of life (crime victims, passive smokers, etc.)
Extra cost of insurance premiums
<b>Intangible private costs</b>
Illness-related suffering of users
Suffering of a user's close relations due to his death
Suffering of a crime victim's close relations
<b>Public costs</b>
<b>Public spending on health</b>
Medical expenses covered by social security
Including: - Medical consultations
Pharmaceuticals
Hospital expenses
Ambulance service (accident attendance – first aid)
Fire brigade (accident attendance – first aid)
Local-government health spending
Medical research
Spending by Ministry of Employment and Solidarity
<b>Public spending on prevention</b>
Prevention expenditure by Ministry of Education
Prevention expenditure by Ministry of Youth and Sports
Prevention expenditure by police
Prevention expenditure by gendarmerie
Grants to private associations (central government budget)
Grants to private associations (local government budget)
Public-body campaigns funded from central government budget
Public-body campaigns funded from local government budget
<b>Public spending on enforcement</b>
Spending by Ministry of Justice
Spending by General Directorate of Customs and Excise
Spending by gendarmerie
Spending by police
Police spending by local government
<b>Other public costs</b>
Public spending on international measures
Including: Spending by Ministry of Foreign Affairs
French contribution to European Union budget
Contribution of Ministry of Co-operation

Another relevant work in the field of cost categorisation is that of Collins et al. (2006). They focused on tangible cost, presenting a highly detailed (though not exhaustive) list of sub-categories.

**Figure 2 – List of tangible cost sub-categories, from Collins et al., 2006**

<b>1. Consequences to health and welfare system</b>	
1.1 Medical	
1.2 Hospital	
1.3 Nursing homes	
1.4 Pharmaceuticals	
1.5 Ambulances	
1.6 Research and prevention	
1.7 Welfare administration	
<b>2.1 Productivity consequences in the workplace</b>	
2.1.1 Reduction in paid workforce	
2.1.2 Absenteeism	
2.1.3 Reduced on-the-job productivity	
<b>2.2 Productivity consequences in the home</b>	
2.2.1 Reduction in unpaid workforce	
2.2.2 Sickness	
<b>3. Crime, law enforcement and criminal justice</b>	
3.1 Law enforcement	
3.2 Courts	
3.3 Legal charges	
3.4 Incarceration and corrections	
3.5 Violence	
3.6 Property damage	
3.7 Lost productivity of prisoners	
3.8 Lost productivity of criminals	
3.9 Insurance administration	
<b>4. Road accidents</b>	
4.1 Productivity in the workplace	
4.2 Productivity in the home	
4.3 Health care	
4.4 Law enforcement	
4.5 Legal charges	
4.6 Incarceration	
4.7 Vehicle damage	
4.8 Insurance administration	
<b>5. Fires</b>	
5.1 Productivity in the workplace	
5.2 Productivity in the home	
5.3 Health	
5.4 Fire services	
5.5 Property damage	
5.6 Insurance administration	
<b>6. Environment</b>	
6.1 Clean up	
6.2 Pollution	
<b>7. Research and prevention</b>	
7.1 Research	
7.2 Prevention	

Single et al. (2013) provide a less detailed list of cost categories and subcategories. Their objective is to provide general indications regarding which cost should be included in a study aiming at calculating social cost of illegal drugs; they try to reach this objective by providing a series of example for guiding future research. The categories included in their proposed framework are those that were most frequently found in a review of studies in the field.



**Figure 3 – Matrix of cost, from Single et al., 2003**

COSTS	PRIVATE COSTS (not generally included)	SOCIAL COSTS (included in cost estimates)		
	COSTS TO USERS	COSTS TO USERS AND INDIVIDUALS	COSTS TO FEDERAL AND OTHER GOVERNEMENTS	COSTS TO BUSINESS AND OTHER PRIVATE
<b>(A) Tangible costs</b>				
<b>1. Consequences to health and welfare system</b>				
+ Treatment for substance abuse	user paid insurance; out-of-pocket costs	excess insurance premiums	hospital + other health costs	contribution to health insurance
+ Treatment for comorbidities and trauma	user paid insurance; out-of-pocket costs	excess insurance	hospital + other health costs	contribution to health insurance
+ Prevention, research, health & welfare services			research, training, prevention, welfare	corporate research + prevention (EAP)
<b>2. Productivity costs, i.e., consequences to the workplace</b>				
+ Premature mortality			foregone taxes	production losses due to premature death
+ Lost employment or productivity	forgone income net of taxes	victims' forgone income net of taxes	foregone taxes	workman's comp., reduced productivity
<b>3. Law enforcement and criminal justice costs</b>				
+ Criminal justice response	penalties (e.g. fines)	victim's time	enforcement, court incarceration costs	victim's time (productivity loss); criminal careers
<b>4. Other costs, e.g., property destruction</b>				
	unreimbursed property damage	fire losses, accident property damage	accident and fire prevention, fire	fire losses + accident damage to industry
<b>(B) Intangible costs (not included in estimates)</b>				
	pain and suffering to user quality life years lost	suffering to dependents crime victims, + restrictions of public's legal rights to expedite		

Two key messages that can be drawn from this table are:

- private costs are generally excluded from the analysis. In the coming sections, this assumption will be challenged by other scholars;
- intangible costs are generally not included in the analysis, this is in contrast with some of the authors presented in section 2.4

### 3.3.1 Healthcare costs

Healthcare costs can be divided in two main subcategories:

- cost for substance use treatment:
- cost for co-morbidity treatment.

The first represents the typical costs associated to drug use treatment. Their estimation is generally easier compared to other categories: their strict correlation with the cause of interest, together with the ease in identifying them thanks to international disease classifications (where adopted), allow for a direct identification of their amount. Estimations for the second group are not as easy. The use of a comprehensive treatment classification is necessary, but not sufficient: raw data may not provide a correct picture of the total amount, as for comorbidities a higher sophistication of ICD is required. Calculation of attributable fraction is thus determinant in this setting

### 3.3.2 Productivity losses

In various studies, especially cost of illness studies (Xie et al., 1999; Hardwood, 1999), productivity losses represent the greatest cost category, the one with the higher impact on total social cost estimation. In Harwood (1999), for example, they account for 72% of total cost.

Three sub-categories of productivity losses can be identified (Single et al., 2003):

- premature mortality, which can be generally retrieved from national database. A more complicated case is represented by deaths caused only indirectly by illegal drug use;
- morbidity-lost work-time or productivity, connected to events as days of work or work performed lost due to harms or disabilities generated by long- or short-term consumption of illegal drugs. This sub-category includes time spent in treatment for drug use or illness related to substance consumption and lost productivity due to drug use. This last case is of particular problematic, as its calculation entails a set of theoretical and empirical assumptions (Single et al., 2003);
- non-workforce productivity losses, related to production lost from unemployed, retired or individuals outside the workforce, who can still produce output through unpaid work. The approach proposed in this case is to assign to those activities a value from equivalent services purchased from outside sources (Godfrey et al., 2002).

### 3.3.3 Crime and law enforcement costs

Criminal and justice costs due to drug use refer to a broad and complex domain (Collins and Lapsley, 2002). Three sub-categories can be identified (Single et al., 2003):

- criminal justice costs, those that are directly related to the activities aimed at combat criminal activities connected to illegal drug use;
- drug crime's victims losses, which is mainly connected to the time lost, and related loss in work productivity, experienced by those who are victims of drug-related crime;
- incarceration-related loss of productivity from those who spend a period of time in jail due to drug-related crimes and are thus excluded partially or totally from workforce.

The estimation of crime and law enforcement costs and its exact definition has generated an intense debate. One case of discussion is the inclusion of stolen goods value as part of this category. In Healey et al. (1998) research, 78% of total social cost of drugs is generated by crime and law enforcement and 61% by the value of stolen good. ONDCP (2004), instead, considers in its estimation only properties that were damaged, and theft without property value reduction is considered just as a transfer of ownership. Godfrey et al. (2002) highlights the importance of control costs (police, prison, treatment), which are generally neglected in the literature. There is strong indication that the control costs are substantial. For instance, it has been argued that In USA control costs are four times larger than private expenditures for buying drugs (Robinson and Scherlen, 2007)

### 3.3.4 Other costs

This category includes those costs which are not strictly related to those previously described. Examples are represented by:

- money spent on drugs and alcohol, as it is not straightforward whether the consumer receives a benefit equal to the cost of these products;
- property losses due to crime caused by substance use, as the loss of value that is generally registered regarding stolen property once they are stolen. However, it is still not clear which method should be used to calculate the loss;
- welfare costs, i.e. the costs borne by the state (such as invalid pensions and sickness benefits) in relation to drug use. This should include attributable administrative costs of the social welfare system.

## 4. Discussion, conclusions and recommendations

In this contribution, the principal recommendations proposed by published guidelines for the estimation of social cost of illegal drugs were presented. This overview has allowed the analysis of the advantages and shortcomings of this domain's most diffuse methods. The first purpose of the document is to describe the variety of methodological alternatives and the number of logical and analytical decisions that should be taken into account when designing a framework for the estimation of social costs of illegal drugs.

By presenting some of the most debated issues related to the field, the document highlights the absence of a comprehensive and complete approach in this field. No approach can be considered as optimal or without limitations. Scholars must take into account benefits and shortcomings of each components of their framework and decide according to research purposes and data availability.

Another criterion that researchers should take into account when developing their methodology is the level of inference and forecast they are willing to include in their analysis. A more conservative approach would probably not take into consideration an incidence-based or a demographic approach and would exclude any estimates on intangible costs and any type of cost for which a reliable set of data is not available. This would result in the exclusion of relevant categories of cost, thus impacting relevantly on final estimations.

A practical problem that is directly related to the absence of an established and comprehensive methodology is the variety of estimations regarding the social cost of drugs and the impossibility of defining a single measure, neither at the single drug or class of drug level, not at a country level. This has relevant implications, especially regarding the definition and prioritization of the interventions aimed at reducing the social cost of drugs.

The review presented in this document can be seen not only as an exercise aiming at presenting the state of the art for methods estimating the social cost of illegal drugs, but also as a starting point for proposing innovative analytical approaches for future research. Although all the estimation techniques presented in this contribution have shown limitations in their application, the current debate on methods for assessing drugs' social cost would significantly benefit from the identification of new estimation frameworks that, taking into account the mentioned shortcomings, can represent standards for guaranteeing reliability and rigour of future illegal drugs' social cost estimation. With this regard, the authors used the theoretical background provided by this document to put forward two analytical frameworks for the estimation of the social cost of drugs. Their structure is represented in the table below.

**Table 1 – Proposed frameworks for the estimation of the social cost of drugs**

	Minimum framework	Optimal Framework
<b>Theoretical framework</b>	Cost of Illness	Utility Evaluation Methods
<b>Private cost</b>	Not included	Included
<b>Feasible Minimum calculation</b>	Arcadian Normal or exposure based comparators	Epidemiologic-distributional approach with scenario analysis
<b>Estimation approach</b>	Human capital & prevalence approach	Willingness to pay, Prevalence and incidence
<b>Intangible cost</b>	Not included	Included
<b>Cost categories</b>	Healthcare costs <ul style="list-style-type: none"> <li>• Treatment for substance use</li> <li>• Prevention and research</li> </ul> Productivity cost <ul style="list-style-type: none"> <li>• Premature mortality</li> <li>• Loss of employment/productivity</li> </ul> Law enforcement <ul style="list-style-type: none"> <li>• Criminal justice costs</li> </ul>	Healthcare costs <ul style="list-style-type: none"> <li>• substance use treatment:</li> <li>• co-morbidity treatment</li> <li>• prevention and research</li> </ul> Productivity costs <ul style="list-style-type: none"> <li>• Premature mortality</li> <li>• Loss of employment/productivity</li> <li>• Non workforce productivity losses</li> </ul> Law enforcement <ul style="list-style-type: none"> <li>• Criminal justice costs</li> <li>• Drug crime’s victim losses</li> <li>• Incarceration-related loss of productivity</li> </ul> Intangible costs Other costs <ul style="list-style-type: none"> <li>• Money spent on drugs and alcohol</li> <li>• Property losses due to crime caused by substance use</li> </ul>

The first proposed framework can be considered as a minimum standard which researchers should refer to for conducting social cost of drugs’ estimation studies. This framework can be seen as defining a level of quality in the estimation that all future research in the field should meet in order to be considered as reliable. Its main components are the following:

- Cost of illness as the reference conceptual framework. COI has the advantage of relying on cost-per-unit approach, which insures a high level of reliability. On the other hand, COI does not allow the calculation of intangible and relevant private cost, which can be considered a limitation;
- Arcadian Normal or exposure based comparators methods for Feasible Minimum calculation. Though they both do not take into account the risk exposure of each

country or region specific, they represent relatively reliable estimation methods for identifying a realistic target for drug control policies;

- human capital approach which, by calculating potential missed earnings due to drug use, allows a reliable estimation of a relevant part of cost generated by drug use;
- prevalence approach, which allows a reliable estimation of present and past cost associated to drug use;
- in terms of cost categories, a minimum standard should include those categories for which data are frequently available: treatment for substance use and prevention and research costs (healthcare costs); premature mortality and loss of employment/productivity (productivity costs), criminal justice costs (law enforcement costs).

The second proposed framework, instead, represents an ideal approach for estimating the social cost of drugs. Though still affected by shortcomings, the components of this framework contribute in generating the most comprehensive estimations. The higher level of comprehensiveness comes at the price of a higher risk of error, as the pieces of the framework require additional assumptions with respect to the previous approach. For this reason, this second framework can be considered also as a guidance for methodological and data collection improvements in the field of social cost of illegal drugs estimation.

The ideal framework components are the following:

- utility valuation methods as the conceptual framework. Utility theory is a quite robust methodology, widely used in any domain of economics. Its adoption would allow a reliable calculation of not only direct costs, but also intangible cost and relevant private costs;
- epidemiological-distributional approach, which allows the most reliable calculation of Feasible Minimum for each element of the studied population and for scenario analysis;
- willingness to pay approach for the calculation of intangible costs and other cost categories for which there is lack of available data;
- both prevalence- and incidence-based approach. If taken as complementary, these approaches would offer a comprehensive time horizon perspective for the analysis, including past, present and future costs;
- all the cost categories presented above.

In conclusion, the intense debate over the definition of a structured and rigorous method for estimating social costs of drugs presented in the document should support further research in this field, focusing on resolving the various analytical issues that have been presented. In fact, social costs of drugs and their estimation have generated an intense debate and a prolific literature. Nonetheless, the absence of consensus regarding the most appropriate methodological approaches have resulted in a fragmented literature, where it is not always possible to find coherence between estimation results coming from different sources. This has affected the potential that the estimation of social cost of illegal drugs could have had as a tool for informing drug policy decisions. In this contribution the provision of standard frameworks can be seen as an input for solving the literature fragmentation and stressing the need for a higher agreement regarding suitable methods for the analysis.

The first presented framework was designed as a methodological minimum standard. In this case, the data requirements were minimized: the data that should be included in the framework are those for which there is a relatively easy access. The methods proposed for data analysis are not sophisticated and the cost categories included are easy to calculate and

are among those that have generated less debate regarding their pertinence. For all these reasons, existing research that does not comply with this framework should be carefully revised.

The second framework, given its aim at representing the best methodology for calculating the social cost of drugs, should be considered as an input for filling the data gaps mentioned during this contribution. Moreover, it should provide indications for resolving the analytical and theoretical issues that still are not solved with regards to the methods for estimating the social cost of drugs.

## 5. Appendix A – Results for the illegal drugs literature search

Author(s)	Study Aim	Main contributions
Bayoumi, Redelmeir (1999)	Test the adequacy of three common utility elicitation methods for individuals with Human Immunodeficiency Virus (HIV) disease.	1. Quality of Life Methods within the Utility Evaluation general framework.
Collins, Lapsley (2002)	Present estimates of social cost of drugs in Australia for the 1998-9 period	1. Prevalence approach 2. Description and definition of Criminal and law enforcement costs
Collins et al. (2006)	Propose guidelines for the estimation of drug use social cost attributable fraction	1. Introduction of: <ul style="list-style-type: none"> <li>• Avoidable cost</li> <li>• Feasible cost</li> <li>• Attributable fraction</li> </ul> 2. Methods for Feasible cost calculation
Diomidous et al (2013)	Theoretical foundation behind the definition of a drug social cost estimation framework	1. Controversies regarding basic concepts definition
Disley et al. (2013)	Review of the harms of drug dependence. Presenting a framework for developing estimates of the drug dependence costs.	1. Type of indirect costs generated by private drug consumption
Ezzati et al. (2004)	Provide an assessment of the health effects caused by a range of risk factors.	1. Provide attributable fractions for substance use-disease relationship
French et al. (1991)	Outline a comprehensive framework for estimating social cost of drug.	1. Review of theoretical frameworks for social cost estimation
Godfrey et al. (2002)	Provide an overview of the costing methodology and present estimates of social cost of drugs in England and Wales for 2000	1. Description of demographic approach.
Healey et al. (1998)	Present framework and estimates for calculating social cost of drugs	1. Inclusion of stolen goods value, with relevant impact on total cost calculation
Hardwood (1999)	Review of methods for calculating social cost of drugs	1. Inclusion of private cost in the social cost calculation.
Kopp, Fenoglio (2002)	Review of methodologies for devising an indicator of drugs social costs	1. Review of the principal methodological issue in framework developing. 2. Identification of the settings which determines the best analytical framework
ONDCP (2004)	Present framework and estimation for social cost of drugs calculation for US in 2004	1. Inclusion of damaged property in total calculation 2. Comparison between prevalence and incidence approach.
Pacula et al (2009)	Present framework and estimation for social cost of	1. Inclusion of intangible cost using quality of life approach.

Author(s)	Study Aim	Main contributions
Rehm et al. (2002)	drugs calculation with a focus on consuming nations Present framework and estimation for social cost of drugs for Canada in 2002	1.Assumption of rationality for drug users 2.Attributable fraction concept description and use
Robinson, Scherlen (2007)	Assessment of ONDCP social cost of drugs estimation framework and analysis of US drug policy during 2000-5	1.Calculation and inclusion of control cost in crime and law enforcement costs
Robson, Single (1995)	Literature review of studies regarding the estimation of social cost of drugs	1.Calculation and inclusion of private cost for the buying of drugs
Single et al. (1998)	Estimation of Canada economic costs of alcohol, tobacco and illegal drugs in 1992	1.Exclusion of intangible cost
Single et al. (2003)	Assessment of literature (papers, guidelines) on social cost of substance estimation. Presentation of alternative methodologies for solving methodological and research development issues.	1.Analysis of main issues in framework development. 2.Identification of main alternative approaches advantages and shortcomings 3.Identification of main cost categories
Xie et al. (1999)	Review of methodological issue in developing social cost of drugs estimation framework	1.Description and use of human capital approach 2.Description and use of incidence-based approach 3.Relevance of productivity costs and their share



## 6. Appendix B – Results for the alcohol-tobacco literature search

Author(s)	Study Aim	Main contributions
Collins, Lapsley . (2008)	Identify alcohol use avoidable cost in Australia, identification of policy for which there are evidences regarding their benefits in curbing alcohol social cost	1.Calculation of intangible cost 2.List of policy with potential benefits for alcohol social cost reduction
Collins, Lapsley . (2010)	Provide estimates of tobacco social costs in NSW and present estimates of benefits which would accrue from the implantation of policy aimed at curbing cost.	1.Estimation of intangible cost 2.Estimation of potential effects of policies aimed smoking reduction
Fenoglio et al. (2003)	Calculation of social cost of alcohol, tobacco and illegal drugs in France in 1997.	1.Definition of a single estimation framework for the three fields of research.
Heinen, Pittman (1989)	Review of methodologies for estimating social cost of alcohol	1.Revision of pro and cons of principal methodologies of estimation.
Jarl et al. (2010)	Estimation of alcohol social cost in relation to liver cirrhosis.	1.Distinction of avoidable and unavoidable cost using different scenario analysis
Lightwood et al (2000),	Review of methods and issues in tobacco social cost estimation	1.Analysis of pros and cons of general frameworks 2.Deep review of methods for estimating healthcare cost
Markandya, Pearce (1989)	Define a methodology for the estimation of tobacco social cost	1.Analytical review of methodological issues behind the design of a framework for social cost estimation
Moller, Matic (2010)	Summary of best practice in estimating the attributable and avoidable costs of alcohol. Present suggestions for future research.	1.Identification of best practice in social cost estimation 2.Set of recommendation for future studies
Thavorncharoensap M. et al. (2009),	Review of research in social cost of alcohol estimation.	1.Identification of best practices in alcohol social cost estimation.

## 7. Appendix C – Results from the illegal drugs and alcohol-tobacco literature search strategies

### Specific guidance on estimating social costs of drugs

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## 8. Appendix D – Table of methodological issues and approaches

Issues	METHOD 1	METHOD 2	METHOD 3	METHOD 4
Conceptual Framework	<p>Cost of Illness (COI)</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>• Cost per unit approach, Suitable for tangible cost</li> </ul> <p><u>Disadvantages:</u></p> <ul style="list-style-type: none"> <li>• Rationality challenged by addictive behaviour</li> </ul>	<p>Averting Behaviour Method</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>• Appropriate for indirect costs calculation</li> </ul> <p><u>Disadvantages:</u></p> <ul style="list-style-type: none"> <li>• Lack of exact estimation of averting behaviour costs in healthcare</li> </ul>	<p>Utility valuation</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>• Appropriate for indirect costs</li> </ul> <p><u>Disadvantages:</u></p> <ul style="list-style-type: none"> <li>• Relying on probability estimation rather than real cases</li> </ul>	
Social cost definition	<p>Including private cost</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>• Comprehensive of those part of private cost which are bear not exclusively by consumers ( e.g., relatives)</li> </ul> <p><u>Disadvantages:</u></p> <ul style="list-style-type: none"> <li>• Estimation methods of relevant private cost share have limitations</li> </ul>	<p>Excluding private cost</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>• Including only cost representing a direct consequence of drug use</li> </ul> <p><u>Disadvantages:</u></p> <ul style="list-style-type: none"> <li>• Not including types of cost which are not direct but can represent a relevant share of the total</li> </ul>		
Feasible Minimum	<p>Epidemiological approach</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>• Comprehensive of those part Allow for scenario analysis</li> </ul> <p><u>Disadvantages:</u></p> <ul style="list-style-type: none"> <li>• Realism of analyzed scenarios is not straightforward</li> </ul>	<p>Arcadian Normal</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>• Relatively easy to determine</li> </ul> <p><u>Disadvantages:</u></p> <ul style="list-style-type: none"> <li>• Not specific to each country exposure to risk factors</li> <li>• Groups countries according to a partial approach</li> </ul>	<p>Exposure based comparators</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>• Relatively easy to determine</li> </ul> <p><u>Disadvantages:</u></p> <ul style="list-style-type: none"> <li>• Based on simplifying assumption</li> </ul>	<p>Literature evidences on policy effectiveness</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>• Relatively easy to determine</li> </ul> <p><u>Disadvantages:</u></p> <ul style="list-style-type: none"> <li>• Based on simplifying assumptions</li> </ul>

Issues	METHOD 1	METHOD 2	METHOD 3	METHOD 4
Human Capital vs. Demographic Approach	<p>Human Capital approach</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>• Allow for the analysis of future scenarios</li> </ul> <p><u>Disadvantages:</u></p> <ul style="list-style-type: none"> <li>• Future projection methods entail a degree of estimation errors</li> <li>• Should be considered as complementary of the demographic approach</li> </ul>	<p>Demographic approach</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>• Analyse both present and the past</li> </ul> <p><u>Disadvantages:</u></p> <ul style="list-style-type: none"> <li>• Do not allow for the analysis of future scenarios</li> <li>• Should be considered as complementary of the demographic approach</li> </ul>		
Prevalence vs. incidence. perspective	<p>Prevalence perspective</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>• Focuses on estimation of present and past costs</li> </ul> <p><u>Disadvantages:</u></p> <ul style="list-style-type: none"> <li>• Provide no indication on perspectives costs</li> </ul>	<p>Incidence perspective</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>• Allow for the analysis of future scenarios</li> </ul> <p><u>Disadvantages:</u></p> <ul style="list-style-type: none"> <li>• Future projection methods entail a degree of estimation errors.</li> </ul>		
Intangible costs	<p>Inclusion: human capital.</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>• Focuses estimation on reliable future scenarios (potential future earnings)</li> </ul> <p><u>Disadvantages:</u></p> <ul style="list-style-type: none"> <li>• By focusing on future earnings only, there is the risk of excluding relevant intangible cost categories</li> </ul>	<p>Inclusion: willingness-to-pay</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>• Focuses on estimation of present and past costs</li> </ul> <p><u>Disadvantages:</u></p> <ul style="list-style-type: none"> <li>• Provide no indication on perspectives costs</li> </ul>	<p>Exclusion</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>• Reduce the level of estimation error</li> </ul> <p><u>Disadvantages:</u></p> <ul style="list-style-type: none"> <li>• Risk of undervaluing social cost by excluding relevant cost categories</li> </ul>	

## 9. Appendix E – Main literature search results and related methodological approach towards open issues in social cost of drugs calculation

ISSUES	SOCIAL COST COMPOSITION	AVOIDABLE COST CALCULATION	COUNTERFACTUAL	"USE" DEFINITION	PREVALENCE VS. INCIDENCE	RATIONALITY IN DRUG CONSUMPTION	INTANGIBLE COST	MATRIX OF COSTS	PRODUCTIVITY LOSSES APPROACH	LOST EARNINGS COST	STOLEN PROPERTY COST	COST FOR CONTROL OF LAW ENFORCEMENT	COST MNGT: MONEY SPENT ON BUYING ILICIT DRUGS	DRUG INDUSTRY: OUTPUT
Collins & Lapsley (2002)		Attributable fraction calculation should be population-or country-specific	No consumption: an implausible option. If used as the counterfactual, risk of overestimation		Complementary	Rationality can't be assumed: drug users are not fully informed, neither rational	While intangible costs are admittedly difficult to value, further research is required to fully account for intangible costs.	Productivity/Healthcare/Road accidents/Fires/Crime/Resourses used in abusive consumption	Also unpaid household workforce should be valued and included	To be included				Not to be considered, due to full factor employment assumption
Collins et al. (2006)	Social costs include private costs	Feasible Minimum method, 4 methods for calculation: 1. epidemiological, 2. Arcadian normal, 3. use of exposure-based comparators, 4. use of evidences on policies effects	NO substance use cost: zero use situation				Hard to estimate, but they should be included. Thus, further research is needed	Tangible(health-welfare_ productivity,_ crime-law,_ road accidents_ fire_environment_research&prevention)/ Intangible(los of life_pain&sufferings)			To be included			
Disley et al. (2013)				It is specific for each type of drugs	An incidence-based approach might be useful in some contexts,		Should be limited to being limited to a subset of harms for which robust data are	Mortality/physical health/mental health& wellbeing/ crime and law enforcement/						

ISSUES	SOCIAL COST COMPOSITION	AVOIDABLE COST CALCULATION	COUNTERF ACTUAL	"USE" DEFINITION	PREVALENCE VS. INCIDENCE	RATIONALITY IN DRUG CONSUMPTION	INTANGIBLE COST	MATRIX OF COSTS	PDTIVITY LOSSES APPROACH	LOST EARNINGS COST	STOLEN PROPERTY COST	COST FOR COPNTROL OF LAW ENFORCEMENT	COST MNGT: MONEY SPENT ON BUYING ILICIT DRUGS	DRUG INDUSTRY: OUTPUT
					measuring the lifetime costs of use.		available	welfare/relationship/environmental						
Godfrey et al. (2002)			NO substance use cost: zero use situation		Prevalence: retrospective study	Drug users are considered as fully informed when making a decision regarding consuming or not illegal drugs		Healthcare and social service/work and productivity/incidents/crime/					cost for control effort should be included	
Hardwood (1999)	Social costs include private costs		NO substance use cost: zero use situation		Prevalence: retrospective study			Human capital: preferred for its simplicity and general scepticism on intangible cost calculation (pp14)		to be included: representing 72% of total				
Healey et al. (1998)													615 of total cost estimation is represented by stole property value	



ISSUES	SOCIAL COST COMPOSITION	AVOIDABLE COST CALCULATION	COUNTERF ACTUAL	"USE" DEFINITION	PREVALENCE VS. INCIDENCE	RATIONALITY IN DRUG CONSUMPTION	INTANGIBLE COST	MATRIX OF COSTS	PDTIVITY LOSSES APPROACH	LOST EARNINGS COST	STOLEN PROPERTY COST	COST FOR COPNTROL OF LAW ENFORCEMENT	COST MNGT: MONEY SPENT ON BUYING ILICIT DRUGS	DRUG INDUSTRY: OUTPUT
Kopp-Fenoglio (2002)	Private expenditure+ Public Expenditure+ External cost = Social cost		Multitude of alternatives	The type of drug analysed also define the counterfactual that should be use for defining the level of use	Complementary		Excluded (pp.97)	Health(treatment_health consequences)/Productivity losses(foregone earnings_premature death)/other(crime_Justice_social system)	Willingness to pay and human capital: not suitable	to be included			to be included	Not to be considered, due to full factor employment assumption
Kleiman (1999)							Calculating intangible costs using a method aiming at estimating human suffering lower bound							
ONDC P 2004					Used both in a complementary fashion		Not included	Healthcare cost (treatment_infrastructures)/ productivity losses(premature death_crime_victims of crime or incidents)/ other effects(loss of goods and services due			Not included, only property that was damaged		Not included	

ISSUES	SOCIAL COST COMPOSITION	AVOIDABLE COST CALCULATION	COUNTERF ACTUAL	"USE" DEFINITION	PREVALENCE VS. INCIDENCE	RATIONALITY IN DRUG CONSUMPTION	INTANGIBLE COST	MATRIX OF COSTS	PRODUCTIVITY LOSSES APPROACH	LOST EARNINGS COST	STOLEN PROPERTY COST	COST FOR CONTROL OF LAW ENFORCEMENT	COST MGMT: MONEY SPENT ON BUYING ILICIT DRUGS	DRUG INDUSTRY: OUTPUT
								to crime_welfare)						
Pacula et al. (2009)			No consumption: an implausible option				Should be included, though it is difficult to place a value on personal measure as pain and losses. QALY measure should be used	Health(treatment_mortality_intangible cost/productivity(mortality_disability)/Crime/Other direct cost(prevention_harm reduction)						
Rehm et al (2002)	No private cost													

ISSUES	SOCIAL COST COMPOSITION	AVOIDABLE COST CALCULATION	COUNTERFACTUAL	"USE" DEFINITION	PREVALENCE VS. INCIDENCE	RATIONALITY IN DRUG CONSUMPTION	INTANGIBLE COST	MATRIX OF COSTS	PRODUCTIVITY LOSSES APPROACH	LOST EARNINGS COST	STOLEN PROPERTY COST	COST FOR CONTROL OF LAW ENFORCEMENT	COST MGMT: MONEY SPENT ON BUYING ILICIT DRUGS	DRUG INDUSTRY: OUTPUT
Single et al. (2003)			A multitude of alternative (no consumption, reduced consumption, use of other legal/illegal goods). Drugs are not all equal, thus counterfactual should be drug-specific		Incidence: future estimates; Prevalence: a photograph of the current situation. The proposal: they're complementary	Consumer value paradigm à drugs consumers do respect the rational consumer (utility maximizing) paradigm? Not necessarily: addictive consumption may not respect the paradigm, i.e. RATIONAL CONSUMPTION IN DRUGS NOT NECESSARILY RESPECTED	Human capital approach? Undervalues life. Willingness to Pay? Issues in accuracy	Tangible costs/Productivity costs/Law enforcement/Other (property destruction)/Intangible	Human capital or demographic approach: complementary		Not to be included		Not to be included	How to consider jobs, revenues created by drug industry? Considering them positively only under 2 assumptions: a) money used for buying drugs would not have an alternative use b) Resources used in drug production would have no alternative
Xie et al. (1999)					prevalence			Healthcare(treatment_hospitalization_premature death)/Productivity losses	Human capital approach					