



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

Systematic Review of Existing Publications on Social Costs of Illegal drugs, Alcohol and Tobacco

Workstream 1

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Note on terminology: Throughout the text, we have used the term “illegal” instead of illicit, since “illicit” means “Forbidden by law, rules or custom” (<http://www.oxforddictionaries.com/definition/english/illicit>). In so doing, we have tried to avoid the vagueness or subjectivity of what might be forbidden by custom. Illicit has been used in the systematic searches in order to maximize the reach of the search. We hope this will serve to lead to better practice and clearer communication in this field.



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Abstract

Background: Addiction accounts for one of the main disease groups in Europe, with relevant consequences to both individuals and society. There is therefore an increasing need to evaluate the economic consequences of addiction in order to develop appropriate policies. In this deliverable, we aim at evaluating the social costs of illegal drugs, alcohol and tobacco in the European Union, based on currently available publications.

Methods: A systematic search of relevant databases was conducted. Grey literature and previous systematic reviews were also searched. Studies reporting on social costs of illegal drugs, alcohol and tobacco were included. The methodology and the cost components, as well as cost estimates, were extracted from individual studies. To compare across studies, final costs were transformed to 2014 Euros.

Results: 42 studies reported in 40 papers met the inclusion criteria (8 for illegal drugs, 26 for alcohol and 8 for tobacco). There was a predominance of prevalence estimates and the human capital approach for the estimation of indirect costs. While there was a constant inclusion of direct costs related to treatment of substance use and comorbidities, there was a high variability for the rest of cost components. Intangibles were only included in two alcohol studies. Total costs showed also a great variability between studies for the three substances. Price per capita for the year 2014 ranged from 0.38€ to 78€ for illegal drugs, from 26€ to 1,500€ for alcohol and from 10.55 to 391€ for tobacco. A rough estimate for the total cost of addiction to the EU zone revealed it ranges between 1.2% and 3.9% of the total gross domestic product (GDP).

Conclusions: Addiction imposes a heavy economic burden to Europe. Given the high methodological heterogeneity that exists in the field, and in order to better assess this burden and to effectively develop adequate policies, methodological guidance is urgently needed.

1. Introduction

Illegal drug, alcohol and tobacco use are major components to global burden of disease worldwide (Degenhardt et al., 2013). Their use does not only affect individuals alone but also society as a whole, its consequences ranging from health deterioration to social and economic decline. Similarly, alcohol and tobacco are well-known threats to the well-being of both individuals and society (*The European health report 2012: Charting the way to well-being*, 2013).

Increasing efforts have been made in recent years to accurately estimate the costs that illegal drug, alcohol and tobacco use impose on society (the so-called social costs). Reviews on social costs of illegal drugs, alcohol and tobacco in the European Union (EU) suggest these costs are high, consuming an important share of nations' gross domestic product (GDP). Although the concept seems clear enough at first glance, this task has proven difficult due to methodological issues inherent to the complex phenomenon of drug use and its social consequences, where variables and causal relationships might be multiple, deferred in time and sometimes not clearly identifiable, measurable or retrievable. In many instances, for example, it might not even be straightforward whether a substance should be labelled as legal or illegal (such as cannabis). Some substances might even be used both in a legal and illegal manner (diverted prescription drugs for example, or even alcohol if consumed by underage people, according to many state's laws). Complicating things further, there is the fast evolving situation of novel psychoactive substances or "legal highs". But not only definitions and classifications are intrinsically difficult. As stated, causal connections emerge also as a highly complex web of relationships, in which a precise and sharp delineation of the exact causal responsibility of a substance for a particular phenomenon becomes troublesome. Taking crime offenses to illustrate the point, it is easy to see the inherent difficulties in exactly determining what share of the costs of a particular offense should be attributed to any given substance involved. This complexity has led in some cases to even question the utility of social costs estimation (Rice, 1994)(Byford, Torgerson, & Raftery, 2000).

Multiple definitions and guidance documents exist regarding the proper methods to undertake such cost analyses, and none of them are totally consistent with each other. Therefore, an important methodological heterogeneity exists in the field.

Notwithstanding, this is an unavoidable task from the policy-maker and cost-effectiveness perspectives, where informed decisions must be taken and limited resources allocated in an efficient manner. In this scenario, a clear need for methodological guidance protrudes as a first-order priority in the field.

In this scenario, the LEADER project aims to advance understanding in the field of social costs estimates of illegal drug use by conducting a systematic review on social costs of illegal drugs. Moreover, the last available review regarding social costs of illegal drugs dates back to 2004 (Andlin-Sobocki, 2004). It is time therefore to undertake a new review to systematically assess the social costs of illegal drugs in the EU. Despite some obvious differences with alcohol and tobacco (mainly their legal nature), we believe their inclusion in this systematic review will add useful information, both in the form of differences and similarities, and will allow a better insight on the social costs of illegal drugs. Therefore, they will also be included in the review.

2. Methods

2.1. Search Strategy and inclusion criteria

This systematic review on social costs of illegal drugs, alcohol and tobacco was made following the principles of the PRISMA statement (Moher, Liberati, Tetzlaff, & Altman, 2009) and was conducted including studies published between 1990 to March 2015. The electronic databases PubMed and Scopus were searched with the search strategy displayed in appendix A. Briefly, terms referring to illegal drugs (such as drugs, illicit drugs, illegal drugs, marihuana, opioids, cocaine, heroin, amphetamine, methamphetamine, street drugs), alcohol (such as drinking, drinker, alcohol dependence, alcohol abuse, risky or hazardous drinking) and tobacco (such as smoker, smoking, tobacco, cigarette), were combined with terms referring to social costs (such as social costs, economic costs, cost of illness, burden of disease, economic evaluation, traffic crashes, property damage, productivity losses or premature mortality). Previous systematic reviews, bibliographies and expert communications were also searched for potential studies. Studies were first screened based on title and abstract by two independent reviewers. If deemed appropriate, the full text of the study was retrieved to check against inclusion and exclusion criteria, which are outlined in table 1. Disagreements between reviewers were resolved by consultation with an expert on the field.

Table 1: Inclusion and exclusion criteria

INCLUSION CRITERIA	EXCLUSION CRITERIA
<ul style="list-style-type: none"> • Studies that consider the social costs of drugs, alcohol or tobacco 	<ul style="list-style-type: none"> • Non-English language summary available
<ul style="list-style-type: none"> • English language or English summary available 	<ul style="list-style-type: none"> • Conference abstract
<ul style="list-style-type: none"> • Study conducted beyond 1990 	<ul style="list-style-type: none"> • No costs quoted in the result section
	<ul style="list-style-type: none"> • Conducted in specific population sub-groups such as pregnant women or adolescents
	<ul style="list-style-type: none"> • Not an original research article (i.e. review articles, systematic review articles, and editorials)
	<ul style="list-style-type: none"> • Further publications of single studies

2.2. Data extraction

Standardized extraction forms were used to extract the following information for each study:

- 1) Methodological characteristics.
- 2) Cost components included in the analysis, as well as its magnitude.
- 3) Total estimated cost of illegal drugs, alcohol and tobacco.

One of the authors extracted all information from the included studies, and another reviewed all extracted information to check for errors and solve them.

2.2.1. Methodological characteristics

Methodological characteristics extracted from the identified literature were related to:

- 1) The approaches used in the cost estimates, i.e. prevalence or incidence approach. Prevalence-based estimates generally measure the costs of substance use in the

present and the past in a given year, while incidence-based studies generally estimate the present and future costs of substance use in a given year.

2) The methods used for estimating the cost of premature mortality (i.e. human capital or demographic approach). In the human capital approach, the lost value of a deceased worker's production is estimated by present earnings plus a discounted rate of future earnings. The demographic approach compares the actual population size and structure to that of an "otherwise healthy" population, i.e. an alternative population in which there were no drug-related deaths.

3) The inclusion of the positive effects of alcohol drinking (i.e. using gross cost or net cost; not applicable to either drugs or tobacco studies).

4) The discount rate used for adjusting future monetary values. The use of a discount rate acknowledges the fact that any amount of money received any given year is worth more than the same amount received next year (even if there is no inflation) because this year's resources become available for investment purposes a year earlier and so produce interest receipts or profits a year earlier. Then, it adjusts for the difference between present and future values.

2.2.2. Cost components included in the analysis

Although a high variability exists between included costs in different studies, we tried to broadly include all possible costs reported in the literature.

A common initial approach is to divide costs into tangible and intangible costs. Tangible costs can be further divided into direct costs (costs measuring direct consumption of societal resources) and indirect costs (costs arising from lost or impaired productivity, where no actual payment is made).

Intangible costs try to value life beyond its contribution to material production. Hence, they represent pain, suffering, and the deterioration of quality of life. This type of cost, when reduced or eliminated, does not yield resources that can be made available for other uses, and is less likely to be included in cost estimations.

In an effort to display all cost components, we followed the international guidelines of Single et al. (Single et al., 2003) where costs are finally classified according to the following major types of costs:

- 1) Consequences to health and welfare system
- 2) Productivity costs (i.e., consequences to the workplace)
- 3) Law enforcement and criminal justice costs
- 4) Other costs (e.g., property destruction, fire loss, fire prevention)
- 5) Intangible costs

2.2.3. Total estimated cost of illegal drugs, alcohol and tobacco

For each included study, the total estimated cost in monetary value was presented as originally reported by the study.

In order to facilitate comparisons across studies (which means comparing across different countries and different years), we calculated for each study the percentage of GDP and the price per capita that the total costs represented in 2014. To achieve this, costs from Eurozone

countries that were published before the introduction of the Euro were inflated to 2002 using Eurostat and inflation.eu, converted into Euros using the average exchange rate in 2002 on OANDA and then inflated to 2014. Costs published in Euros were simply inflated to 2014 values. Costs in British pounds were inflated to 2014 and converted into Euros. This operation resulted in the final price in millions of Euros for 2014, which can be seen in the second column of tables 9, 11 and 13. Dividing this number by the 2014 GDP values found in Eurostat, we obtained the percentage of GDP, which can be seen in the last column of the mentioned tables.

To obtain price per capita, we applied purchasing power parity (PPP) to the 2014 total cost using the 2013 PPP rates from Eurostat. The result is observed in the third column of tables 9, 11 and 13. This transformation allows to minimize biases introduced by international comparisons of market exchanges. Then we divided this amount by the total 2014 population in each country, resulting in the final price per capita for the year 2014, which can be observed in the fourth column of the mentioned tables.

2.3. Quality assessment

As part of the LEADER project, in parallel to this study a review of existing guidance documents for estimating social costs was conducted (see Agència de Qualitat i Avaluació Sanitàries de Catalunya et al., forthcoming at <http://www.alicerap.eu/social-costs-of-addiction/171-social-costs-of-addiction.html>). The authors concluded with the establishment of two frameworks: the first could be considered as a minimum standard which researchers should refer to for conducting social costs' estimation studies. The second framework would represent the ideal approach, allowing for a more comprehensive estimation. Their structure and components can be seen in Appendix B. Therefore, for each included study in our review, we assessed whether they conformed to the optimal, minimum or neither of the frameworks.

2.4. Total EU cost

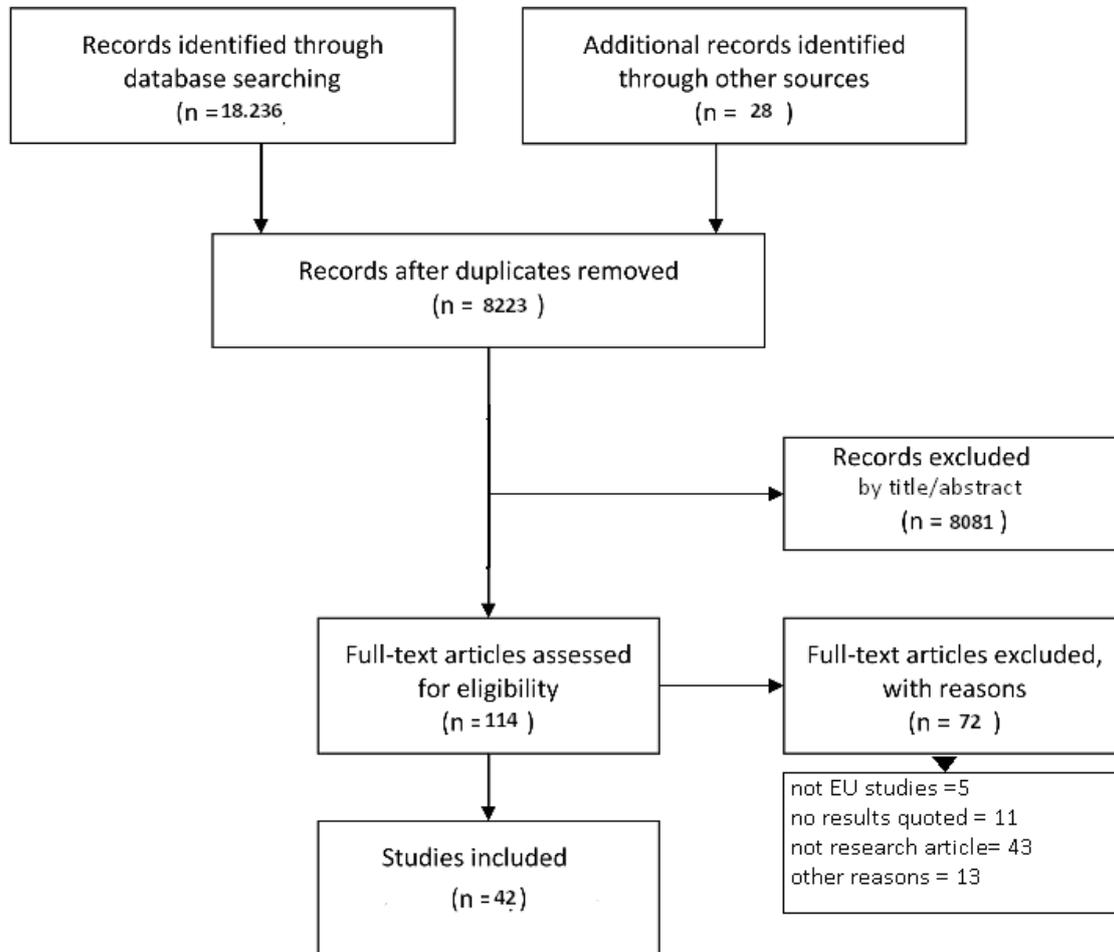
Given that the focus of this review is the EU zone, a global estimate for the whole EU was intended. As previously stated, high heterogeneity between studies precludes a direct and fully valid comparison. Therefore, following the suggestions provided by the internal review of methodological guidance documents in the LEADER project we tried to give a rough estimate of what those costs would be for illegal drugs, alcohol and tobacco. The estimation was based on price per capita in 2014 of the most representative or methodologically optimal studies. Applying this price to the whole population of the EU would give us the estimate for 2014.

3. Results

3.1. Literature search

The electronic search strategy resulted in approximately 18000 hits. After assessing title and abstract, 86 studies were selected for full review. The assessment of previous systematic reviews and other data sources yielded 28 more studies for full review. After exclusion criteria were applied, a total of 42 studies, reported in 40 publications, were finally included in this review (8 for drugs, 26 for alcohol and 8 for tobacco). Flow diagram is shown in figure 1.

Figure 1. Study flow diagram



3.2. Methodological characteristics

Tables 2 to 4 outline the general methodological characteristics of the included studies. Most of the studies included in the three categories (illegal drugs, alcohol and tobacco) were prevalence-based studies (6 out of 8 studies for drugs, 21 out of 26 for alcohol, 6 out of 8 for tobacco). The remaining either used a bottom-up approach (which instead of a societal perspective follows a cohort of users over time and measures the costs they incur in) or did not report the methodology employed.

For premature death estimates, there was a clear predominance of the human capital approach. In the illegal drug studies, 2 followed this approach (6 did not report any method). For alcohol, 15 studies were based on it (9 did not report on any method, 1 used the demographic approach, and 2 used willingness to pay approach). For tobacco, 7 out of 8 used the human capital approach, with 1 study not reporting on any methods regarding premature mortality estimates.

Regarding the inclusion of beneficial effects of consumption, which only makes sense in the alcohol category, most of studies used gross costs (i.e., did not take into account the beneficial effects of consumption). Out of 26, only 5 used a net cost perspective, whereas 1 study did not report on this item.

The discount rate applied in the drugs studies turned out to be 6%, belonging to a single study, with the other 7 studies not reporting on this item. Alcohol studies ranged from 0% to 10% (the number of studies not reporting on this item was 18), and tobacco studies ranged from 3 to 6%, with 3 studies not reporting on this item.

Table 2. Drugs studies' methodology

Country & Year	Costing methodology			Discount rate	Gross or Net costs
	Cost estimates (prevalence vs. incidence)	Premature death estimates (human capital vs. WTP)	Intangible costs		
UK 1995 (Healey et al., 1998)	Bottom up				
France 1997 (Fenoglio et al., 2003)	Prevalence	HCA	Not included	6%	NA
Spain 1997 (García-Altés, Ollé, Antoñanzas, & Colom, 2002)	Prevalence	HCA	Not included	N.I.	NA
Sweden 2002 (Ramstedt, 2006)	Prevalence	N.I.	Not included	N.I.	N.I.
Netherlands 2003 (Rigter, 2006)	Prevalence	N.I.	Not included	N.I.	N.I.
Germany 2006 (Mostardt, Flöter, Neumann, Wasem, & Pfeiffer-Gerschel, 2010)	Prevalence	N.I.	Not included	N.I.	N.I.
Belgium 2008 (Van malderen, vander laenen, & de ruyver, 2007)	Prevalence	N.I.-	Not included	N.I.	N.I.
Portugal 2010 (Gonçalves, Lourenço, & Silva, 2014)					

HCA: human capital approach

DA: demographic approach

WTP: willingness to pay approach

N.I.: not applicable or not reported

Table 3. Alcohol studies' methodology

Country & Year	Costing methodology			Discount rate	Gross or Net costs
	Cost estimates	Premature death estimates	Intangible costs		
Finland 1990 (Lehto, 1997)	Prevalence	N.I.	Included	N.I.	Gross
Slovak Republic 1994 (Koziva, 1995)	N.I.	N.I.	Not included	N.I.	Gross
Germany 1995 (Bergmann & Horch, 2002)	N.I.	N.I.	Not included	N.I.	Gross
Portugal 1995 (Lima & Esquerdo, 2003)	Prevalence	HCA	Not included	5%	Gross
France 1996 (Reynaud, Gaudin-Colombel, & Le Pen, 2001)	Prevalence	N.I.	Not included	N.I.	N.I.
France 1997 (Fenoglio, Parel, & Kopp, 2003)	Prevalence	HCA	Not included	6%	Gross
Spain 1998 (García-Sempere & Portella, 2002)	N.I.	N.I.	Not included	NA	Gross
Sweden 1998 (Johnson, 2000)	Prevalence	DA	Not included	N.I.	Gross
Switzerland 1998 (Jeanreanud, Priez, Pellegrini, Chevrou-Severac, & Vitale, 2003)	Prevalence	HCA	Included (WTP)	0-2-6%	Net

Country & Year	Costing methodology			Discount	Gross or
Belgium 1999 (Pacolet, Degreeef, & Bouten, 2004)	N.I.	N.I.	Not included	N.I.	Net
Ireland 1999 (Byrne, 2000)	N.I.	N.I.	Not included	N.I.	Gross
England & Wales 2001 (Leonardi, 2003)	Prevalence	HCA	Not included	N.I.	Gross
Norway 2001 (Gjelsvik, 2004)	Prevalence	HCA	Not included	3, 5%	Gross
Scotland 2001-2 (Guest & Varney, 2001)	Prevalence	HCA & WTP	Not included	6%	Gross
Germany 2002 (Konnopka & König, 2007)	Prevalence	HCA	Not included	5%	Net
Slovenia 2002 (Sesok, 2003)	Prevalence	HCA	Not included	N.I.	Gross
Sweden 2002 (Jarl et al., 2008)	Prevalence	HCA	Included, no cost associated	3%	Net
Austria 2004 (Wancata, Sobocki, & Katschnig, 2007)	Prevalence	HCA	Not included	N.I.	Gross
Italy 2004 (Pugliatti et al., 2008)	Prevalence	HCA	Not included	N.I.	Gross
Portugal 2005 (Cortez-Pinto et al., 2010)	Prevalence	N.I.	Not included	N.I.	Gross
UK 2005 (Balakrishnan, Allender, Scarborough, Webster, & Rayner, 2009)	Prevalence	N.I.	Not included	N.I.	Gross
Estonia 2006 (Saar, 2009)	Prevalence	HCA	Not included	2-10%	Net
España 2007 (Scandurra, Garca-Altés, & Nebot, 2011)	Prevalence	HCA	Not included	N.I.	Gross
Ireland 2007 (Byrne, 2010)	Prevalence	WTP	Not included	N.I.	Gross
Scotland 2007 (York Health Economics Consortium, 2007)	Prevalence	HCA	Not included	N.I.	Gross
Scotland 2009-10 (Johnston, Ludbrook, & Jaffray, 2012)	Prevalence	HCA	Included, WTP approach	N.I.	Gross

HCA: human capital approach

DA: demographic approach

WTP: willingness to pay approach

NI: not indicated

Table 4. Tobacco studies' methodology

Country & Year	Costing methodology			Discount rate	Gross or Net costs?
	Cost estimates (prevalence vs incidence)	Premature death estimates (human capital vs WTP)	Intangible costs		
Germany 1993 (Welte, König, & Leidl, 2000)	Prevalence	HCA	Not included	3%	NA
Denmark 1995 (Rasmussen & Søggaard, 2000)	Incidence	HCA	Not included	N.I.	NA
Germany 1996 (Ruff, Volmer, Nowak, & Meyer, 2000)	Prevalence	HCA	Not included	4%	NA
France 1997 (Fenoglio et al., 2003)	Prevalence	HCA	Not included	6%	NA
Sweden 2001 (Bolin & Lindgren, 2007)	Prevalence	HCA	Not included	5%	NA
Germany 2003 (Neubauer et al., 2006)	Prevalence	HCA	Not included	3%	NA

Country & Year	Costing methodology			Discount	Gross
UK 2005 (Allender, Balakrishnan, Scarborough, Webster, & Rayner, 2009)	Prevalence	N.I.	Not included	N.I.	NA
Germany 2008 (Wacker et al., 2013)	Bottom-up	HCA	Not included	N.I.	NA

HCA: human capital approach

DA: demographic approach

WTP: willingness to pay approach

N.I.: not indicated

3.3. Cost components included in the studies

Tables 5 to 7 outline cost components included in the different studies, according to the classification suggested by Single in the second edition of his international guidelines (Single et al., 2003).

At first glance it becomes clear that alcohol studies tend to include more cost components than drugs or tobacco studies. While there is a clear and constant inclusion of direct costs related to treatment of substance abuse and its comorbidities for all three categories, it is difficult to find a consistent pattern for the rest of the items.

Most of the studies in the drugs section include costs related to law enforcement and criminal justice (6 studies), with research and prevention costs being also frequently included (5 studies). Regarding costs due to premature mortality or lost productivity, they are only taken into account in 2 studies.

Table 5. Cost components included: Drugs studies

COSTS	Study number*							
	1	2	3	4	5	6	7	8
(A) Tangible costs								
1. Consequences to health and welfare system	x	x	x	x	x	x	x	x
Treatment of substance abuse and comorbidities	x	x	x	x	x	x	x	x
Prevention and research		x	x	x	x		x	
Welfare and social services			x	x		x		
2. Productivity costs								
Premature mortality		x	x					
Lost employment or productivity		x	x					
3. Law enforcement and criminal justice costs	x	x	x	x	x	x		
4. Other costs								
Property destruction								
Accident property damage								
(B) Intangible costs								

*Study number is assigned following the ordering of studies as in table 2.

Table 6. Cost components included: alcohol studies

COSTS	Study number*																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
(A) Tangible costs																											
1. Consequences to health and welfare system	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Treatment of substance abuse and comorbidities	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Prevention and research	x		x			x		x						x			x										
Welfare and social services	x	x						x			x			x			x								x	x	x
2. Productivity costs																											
Premature mortality	x	x	x	x		x		x	x	x		x	x	x	x	x	x						x	x	x	x	x
Lost employment or productivity	x	x	x	x				x	x	x	x	x	x	x	x	x	x					x	x	x	x	x	x
3. Law enforcement and criminal justice costs	x	x		x		x		x			x	x	x	x			x					x		x	x	x	x
4. Other costs																											
Property destruction	x		x	x				x															x				
Accident property damage			x			x	x		x		x	x	x												x		
(B) Intangible costs	x								x																		x

*Study number is assigned following the ordering of studies as in table 3.

Table 7. Cost components included, tobacco studies

COSTS	Study number*							
	1	2	3	4	5	6	7	8
(A) Tangible costs								
1. Consequences to health and welfare system	x	x	x	x	x	x	x	x
Treatment of substance abuse and comorbidities	x	x	x	x	x	x	x	x
Prevention and research				x				
Welfare and social services								
2. Productivity costs								
Premature mortality	x		x		x	x		
Lost employment or productivity	x			x	x	x		x
3. Law enforcement and criminal justice costs								
4. Other costs								
Property destruction								
Accident property damage								
(B) Intangible costs								

*Study number is assigned following the ordering of studies as in table 4.

Alcohol studies tend to be the most inclusive. Besides healthcare costs, included in all of them, 6 studies evaluate research and prevention costs, 9 studies focus also on welfare and social services related expenses, while 13 studies do also include other costs, such as property damage or accidents. A great majority of studies include indirect costs, with 19 studies referring to premature mortality and 19 studies as well focusing on lost employment or productivity. Regarding criminal justice and law enforcement costs, there are 15 studies assessing these components.

Regarding tobacco studies, all of them assess costs related to healthcare, while only one includes expenses in research and prevention. Indirect costs are measured in the majority of them; premature mortality is included in 4 studies and lost productivity in 5 studies.

Finally, intangible costs are rarely included in social cost studies. For the whole sample of studies, only 3 in the alcohol section include them.

3.4. Cost estimates

Tables 8 to 13 display cost estimates. For each of the main components of the review (drugs, alcohol and tobacco), there are two tables. The first outlines total cost estimate in the year of the study, as well as the share of direct, indirect and intangible costs. If reported by the study, the percentage of GDP is also displayed. The second table enables study comparison, outlining total cost in 2014, % of GDP in 2014 and price per capita in 2014, following the operations as explained in section 2.2.3.

In the illegal drugs section, a wide range of results is observed. For example, price per capita in 2014 ranged from 0,37€ in the UK to 78€ in Germany. The same happened with % of GDP, which goes from 0.001% in the UK to 0.4% in the Netherlands. Although only 2 studies included indirect costs, results between them were also quite heterogeneous, with one estimating their share in the total costs estimated as 24.4 (Spain) and the other as 45.7 (France). The share of direct costs represented from 54.3% (France) to 100% (this number

belonging to studies not taking into account any indirect cost). As none of the studies on illegal drugs incorporated intangibles to its estimations, no numbers can be given for this item.

Similarly to illegal drugs, alcohol estimates presented a wide range of estimations, with price per capita ranging from 26€ (Portugal) to 1,500€ (Sweden). The percentage of GDP ranged from 0.11% (Italy) to 3.47% (Sweden). The share of indirect costs represented from 13.5 % (Scotland) to 87.2 % (Spain). For direct costs, the share went from 5.7% (Scotland) to 80% (Belgium). Although only included in 2 studies, when present, intangibles accounted for the majority of the costs (66% and 81%, for Switzerland and Scotland respectively). Similarly, it is also worth mentioning that usually indirect costs were higher than direct costs for alcohol studies (in 14 of 26 studies).

Finally, tobacco studies showed a high degree of variability in its results too. Price per capita went from 10,55€ (Sweden) to 391€ (Germany). Percentage of GDP ranged from 0.28% (Sweden) to 1.17% (Germany). The share of indirect costs represented from 12.2% (Denmark) to 74% (Sweden). For direct costs, the share ranged from 26% (Sweden) to 87.8% (Denmark). None of the studies estimated intangible costs. In half of the studies indirect costs were larger than direct costs, while 1 remaining study did not assess any indirect costs (UK).

Table 8. Drugs cost estimates reported by studies

Country & Year	Total tangible cost in study year and local currency	% GDP (tangibles only)	% direct	% indirect
UK 1995	12,2 £M		100%	-
France 1997	13350,3 FF M 88889-	0.16%	54.3%	45.7%
Spain 1997	134321 PTA M	0.07%	75.60%	24.40%
Sweden 2002 (D)	500-1400 €M		100%	-
Netherlands 2003	2185 €M		100%	-
Germany 2006	5143,7-6023,7 €M		100%	-
Belgium 2008	296,3 €M	0.09%	100%	-
Portugal 2010			100%	-

£M: millions of UK pounds; FF M: millions of French francs; PTA M: millions of Spanish pesetas; €M: millions of euros; GDP: gross domestic product.

Table 9. Comparison of drug cost estimates

Country & Year	Final price millions of euros 2014	Final price 2014 with PPP applied	Price per capita 2014 in euros	% of GDP in 2014
UK 1995	21,55	23,3	0,37	9,70E-0.4%
France 1997	2666,49	2357,5	36,5	0.12%
Spain 1997	1047,51-1582,90	1163,1-1757,6	24,7-37,3	0.1%-0.15%
Sweden 2002	592,53-1659,09	50,8-142,2	5,3-14,8	0.14%-0.39%
Netherlands 2003	2611,11	2379,2	141,6	0.40%
Germany 2006	5824,63-6821,12	5540,7-6488,6	67-78,5	0.2%-0.23%
Belgium 2008	326,27	289,8	26	0.08%
Portugal 2010			24,5	

PPP: purchasing power parity.

Table 10. Alcohol cost estimates reported by studies

Country & Year	Total Tangible Cost in study year and local currency	% GDP (tangibles only)	% Direct	% Indirect	% Intangibles
Finland 1990	8041,1 Fmk M	1.60%	19.00%	27.50%	53.50%
Slovak Republic 1994	16571 SKK M	1.25%	27.83%	72.17%	-
Germany 1995	39572 DM M	1.10%	39.00%	61.00%	-
Portugal 1995	433,6 €M	0.60%	25.00%	75.00%	-
	2300-3300 US\$M				
	11611,9 FF M-				
France 1996	16659,4 FFM	1.04%	NA	NA	-
France 1997	115420,9 FF M	1.42%	51.20%	49.80%	-
Spain 1998	637718 Psts M		35.80%	64.20%	-
Sweden 1998	109 SEK Billion	5.50%	44.00%	56.00%	-
Switzerland 1998	2191,7 SF M	0.60%	11.00%	23.00%	66%
Belgium 1999	179230 BEF M	2.40%	80.50%	19.50%	-
Ireland 1999	1863 £ M	1.70%	46.3%	43.70%	-
England & Wales 2001	18517,1 £M- 20044,0 £M	1.5-1.7%	72%	28.00%	-
	13379-15061				
Norway 2001	NOK M	1.2-2.1%	66.40%	33.60%	-
Scotland 2001-2	1070,6 £ M	0.70%	42%	58%	-
Germany 2002	24398 €M (C)	1.16%	34.6%	65.4%	-
Slovenia 2002	16,5 SIT Billion	0.30%	15.6%	86.4%	-
Sweden 2002	20330 SEK M	0.89%	51.6%	48.4%	-
Austria 2004 (Alcohol + drugs)	1444 € M		27.8%	72.2%	-
Italy 2004 (alcohol + drugs)	1456 € million	0.11%	72.5%	27.5%	-
Portugal 2005	191 €M	0.13%	100		-
UK 2005	2985,9 £M		NA	NA	-
Estonia 2006	204.6–303.3 €M	1.57–2.32%	22%	78%	-
Spain 2007	2760 €M	0.26%	12.8%	87.2%	-
Ireland 2007	3719 €M	1.90%	78.40%	21.60%	-
Scotland 2007	2250 £M		63.2%	36.8%	-
Scotland 2009-10	1375 £M		5.7%	13.3%	81%

Fmk M: millions of Finnish marks; SKK M: millions of Slovak koruna; DM M: millions of German marks; €M: millions of euros; US\$ M: millions of US dollars; FF M: millions of French francs; Psts M: millions of Spanish pesetas; SEK: Swedish crowns; SF M: millions of Swiss francs; BEF M: millions of Belgian francs; £ M: millions of UK pounds; NOK M: millions of Norwegian crowns, SIT: Slovenian tolar; GDP: gross domestic product.

Table 11. Comparison of Alcohol cost estimates

Country & Year	Final price in millions of euros 2014	Final price 2014 with PPP applied	Price per capita 2014 in euros	% of GDP in 2014
Finland 1990	2141,2	1735,7	318,9	1.05%
Slovak Republic 1994	1030,3	1516,3	278	1.37%
Germany 1995	26796	25489,9	308,4	0.92%
Portugal 1995	658,7	844,7	79,6	0.38%
France 1996	2347,6-3368,1	2075,6-2977,8	32,1-46,1	0.15%
France 1997	23060,7	20388,7	315,4	1.07%
Spain 1998	5668,8	6294,3	133,7	0.54%
Sweden 1998	14,9	1,3	1548,4	3.47%
Switzerland 1998	1628,1	891,3	109,3	0.32%
Belgium 1999	5991,4	5321,4	477,5	1.49%
Ireland 1999	2699,1	2449	523,6	1.46%
England & Wales 2001	30086,4-32567,3	32522,1-35203,9	512,3-554,5	1.46%-1.47%
Norway 2001	2123,8-2390,8	174,2-196,1	34,2-38,5	0.56%-0.63%
Scotland 2001-2	1710,6	1849,1	347,1	1.06%
Germany 2002	29556,4	28115,7	340,2	1.02%
Slovenia 2002	0,104	0,13	0,062	0.28%
Sweden 2002	2721,1	233,3	24,2	0.63%
Austria 2004 (Alcohol + drugs)	1767,3	1581,4	185,5	0.54%
Italy 2004 (alcohol + drugs)	1750	1735	28	0.11%
Portugal 2005	211	271	26	0.12%
UK 2005	4549	4917	77	0.20%
Estonia 2006	275,1-387,3	377,3-531,2	293,9-413,8	1.41%-2.72%
Spain 2007	3038,6	3373,9	71,7	0.29%
Ireland 2007	3781,7	3431,4	733,6	2.04%
Scotland 2007	3259,6	3523,5	661,4	2.03%
Scotland 2009-10	1811,2	1957,8	367,5	1.13%

ppp: purchasing power parity; GDP: gross domestic product.

Table 12. Tobacco cost estimates reported by studies

Country & Year	Total tangible cost in study year and local currency	% GDP (tangibles only)	%direct	%indirect	% intangibles
Germany 1993	33786 DEM M		27.40%	72.60%	-
Denmark 1995	4100 DKK M		87.80%	12.20%	-
Germany 1996	16600 €M		51.00%	49.00%	-
France 1997	89256,9 FFM	1.10%	63.5%	56.5%	-
Sweden 2001	804 US\$M		26%	74%	-
Germany 2003	21025 €M		35.60%	64.40%	-
UK 2005	5170,5 £M		100%		-
Germany 2008	31300 €M		57.20%	42.80%	-

DEM M: millions of German marcs; DKK M: millions of Danish marks; €M: millions of euros; FF M: millions of French francs; US\$ M: millions of US dollars; £M: millions of UK pounds; GDP: gross domestic product.

Table 13. Comparison of Tobacco cost estimates

Country & Year	Final price in millions of euros 2014	Final price 2014 with PPP applied	Price per capita 2014 in euros	% of GDP in 2014
Germany 1993	23848,3	22685,8	274,5	0.82%
Denmark 1995	777,6	76,5	13,6	0.30%
Germany 1996	21691,6	20634,3	249,7	0.75%
France 1997	17827,6	15761,9	243,8	0.83%
Sweden 2001	1185,5	101,6	10,6	0.28%
Germany 2003	25210,6	23981,8	290,2	0.87%
UK 2005	10717,7	11585,4	182,5	0.48%
Germany 2008	33987,1	32330,5	391,2	1.17%

ppp: purchasing power parity; GDP: gross domestic product.

3.5. Quality assessment

Overall, only a few studies in each category were deemed as conforming to the standards of the minimum desirable framework recommended by AQuAS et al (forthcoming). Specifically, 2 studies in the illegal drugs section, 3 in the tobacco, and 8 in the alcohol section. No study was classified as conforming to the optimal framework. Therefore, the rest of the studies were considered as out of both frameworks. The classifications can be seen in Appendix C.

3.6. Total EU cost

As previously reported, methodologies, cost components and estimations suffered from great variation between studies. Even in studies conducted in the same country, where one could expect more similarities, heterogeneity was high. Therefore, a total EU zone cost estimate remains difficult. However, following our quality assessment, we tried to select those studies that could be considered the nearest to the “gold standard” of social cost estimation for each of the substances included in this review. Extrapolating its price per capita to the total EU population would give us a rough estimate of the total costs in the EU.

For illegal drugs, there were only two studies including indirect costs due to premature mortality or lost productivity (France 1997 and Spain 1997). Therefore we used them as a basis for a total EU estimate. Given that the Spain study uses a range of costs, and that the cost of the France study is very close to the upper end of the Spain study, we simply used the lower and upper end of the Spain study to calculate the total costs for the EU. Assuming a population slightly above 500 million people, the estimate would range between 12.500 and 19.000 million €.

For alcohol, the following can be considered the studies more thoroughly assessing social costs : Finland 1990, England & Wales 2001, Scotland 2001, Estonia 2006, Ireland 2007, Scotland 2007 and Scotland 2009. It looks like their price per capita is situated in two big layers, one around 300 €, and the other around 600 €. Taking the lowest (Estonia 2006 with 293,93€) and

the highest (Ireland 2007 with 733,62 €) price per capita, the total cost for the EU is estimated between 149.000 and 372.000 million €.

For tobacco, the most inclusive studies, also the only ones assessing premature mortality and lost productivity are those of Germany 1993, Sweden 2001 and Germany 2003. While the results for the Germany studies are highly consistent, there is a huge variation between them and the Sweden study, therefore, a range of results is presented with the lowest and highest price per capita obtained from these studies (Sweden 2001 providing the lowest of 10,55 € and Germany 2003 providing the highest with 290,15 €). The total cost for the EU then ranges from 5.300 to 147.000 € million. All these results are summarized in table 14.

Table 14. Estimated EU total social cost in millions of Euro

	Low estimate	High estimate
Illegal drugs	12.500	19.000
Alcohol	149.000	372.000
Tobacco	5.300	147.000

4. Discussion

This review aimed at evaluating the social costs of illegal drugs, alcohol and tobacco in the EU. Despite methodological shortcomings, the results suggest that these costs are high, imposing an important economic burden on society. The most frequent included costs were those related to healthcare, crime and law enforcement and lost productivity as well as premature mortality. A great methodological variability between studies was noted.

We covered the whole spectrum of substance use, hence we included studies assessing illegal drugs, alcohol and tobacco related costs. However, some important differences must be pointed out.

The first is the almost universally illegal status of drugs, which makes data availability much more difficult and therefore alcohol and tobacco studies tend to be more inclusive than drug studies, in respect to parameter and types of costs included. Globally, lack of primary data is one of the biggest weaknesses of social costs' estimations. When this cannot be directly addressed, it is suggested that authors use other sources or proxies, such as existing data from similar countries. Although this method obviously adds an important degree of imprecision, it would prevent the omission of essential cost components, such as mortality or lost productivity.

Another important observation is how costs are distributed between direct and indirect costs. While there is a clear predominance of indirect costs in terms of total share for alcohol studies, and in the tobacco section there seems to be a tendency to equality, in the drugs studies there is a clear preponderance of direct costs (only 2 out of 8 studies evaluated indirect costs), with none of the studies finding superiority for indirect costs in terms of its contribution to the total cost.

Regarding the methodology of the studies, the great majority were conducted under the framework of Cost of Illness studies, which takes a top-down approach in order to assess costs. While some studies did not mention their theoretical approach, one study in the tobacco and

one in the drugs section employed a bottom-up approach, consisting in the follow-up of a cohort of patients and the concomitant evaluation of the costs they incurred in.

Besides different theoretical frameworks, other relevant aspects of the studies' methodologies are highly heterogeneous. For example, most of the studies are based on a prevalence approach, although some employ a demographic approach. Regarding premature death cost estimates, most of the studies use the human capital approach, but some rely on the demographic approach and others in the "willingness-to-pay" approach. Another huge difference is observed in the discount rates applied, which vary greatly (with some studies not even applying it). The assumptions these different approaches are based on do not necessarily have to be contradictory, but rather complementary. What becomes worrisome is that the validity of comparisons between countries becomes compromised. Do the differences in costs reflect real differences or are they just a by-product of the different methodologies applied? This relevant question will remain unanswered until uniform guidelines for the estimation of social costs are adopted in the EU. This is indeed one of the founding arguments of LEADER (www.leader-project.net), a European research project, co-financed by the European Commission since January 2015, which aims to enhance the economic analyses of illegal drugs through 2 core objectives: the development of methodologies and guidance for estimating the comprehensive social costs of illicit drug use and the review of the impact of economic crises on drug use and implications for drug policies and preventive practice. Hence, we expect the LEADER project to help in the overcoming of major gaps in health economic research in the field of substance use.

Focusing on major gaps regarding economic research, it becomes evident that the alcohol field is ahead of the tobacco and drugs fields. Not only there exists a larger number of alcohol studies, but they are also more inclusive and thorough in their investigations, with more components and parameters included in their estimates. It should, therefore, constitute a reference point for countries and policy makers undertaking social cost estimations of tobacco, and especially illegal drugs, where, as previously stated, the state of affairs might be more behindhand.

The time frame covered by this review is between 1990 and March 2015. It means that some studies can be considered as recently done, while others might date back as far as 25 years. Treatment practices change over time, as do the illicit drug markets, with new drugs becoming available. Also, new treatments become available for substance use. Taken together, all these suggest that caution should be the norm when extrapolating cost results from the past to the present.

Despite all these difficulties, an attempt to conduct a comparison between studies (i.e., comparing across different countries and different times) was done by using economic indices such as inflation and purchasing power parity (PPP). An important heterogeneity was observed, but in general costs can be considered high. It means that an important share of national economies is consumed by substance use, either directly or indirectly. For drug studies, most of their estimations ranged between 0.1% and 0.4% of GDP. Considering the scarcity of data availability in this field, it would not be unwise to consider real costs even higher. For tobacco, studies ranged from 0.3% to 1.2% of GDP, and for alcohol figures were even higher despite a huge variability, with the majority of studies exceeding the 1% of GDP and some of them between 2% and 3.5% of GDP.

A rough estimate for the total EU zone gave us, adding all three categories, a range between 166.800 and 538.000 € million. These figures would suppose a percentage of the total EU GDP

of 1.2%-3.9% for the year 2014. Nonetheless, as previously pointed out by experts in the field (Mielecka-Kubien et al. forthcoming) it should be strongly stressed that, in aggregating these data, one should take into account that there is a probable overlap between substances (i.e., patients who simultaneously smoke, drink and/or use drugs). It means that they might be counted twice or even three times, and, unfortunately, current methods do not allow taking this fact into account. Therefore, these data should be treated with caution. But even so, taken together, all these numbers clearly indicate the deleterious effect that substance use has on society at large.

5. Limitations

Several limitations must be taken into account when interpreting the findings of this review.

First, the general limitations of social costs studies must be acknowledged. Whatever their theoretical framework, social costs studies heavily rely on many assumptions that might not be accurate enough at all times. Therefore, they must be considered a rough approximation rather than an exact estimation of reality. In this sense, their quality is highly dependent on the capacity for data extraction in many areas (e.g., criminal justice system, insurance companies, healthcare system, etc). This capacity might be very different across countries, with some of them having a relative tradition of data storage, management and extraction, whereas others might be rather new in this task.

Another relevant caveat in the field of social cost estimations is the existence of a broad methodological heterogeneity. This means that for a given reality, different estimations can be obtained. The problematic consequence of this fact is that it makes direct comparisons between countries difficult, and jeopardizes the investigation of one of the aims of social cost estimation, i.e., the assessment of cost-effectiveness policies.

Specifically for the field of substance use, one must add the intrinsically complex causal relationships network. For example, when estimating the premature mortality of alcohol patients, one should take into account other relevant factors, such as smoking, and the relevant interactions alcohol and tobacco might produce. Illegal drugs, in its turn, suffer specially from such interactions, since comorbidities with alcohol and tobacco are extremely frequent. Should we consider one as causing the others, or should we consider them as comorbidities without causal hierarchy? Although some methods exist for incorporating this complexity into the studies, such as attributional fractions, they are far from perfect.

As previously stated, data availability is a huge limitation for the conducting of social cost estimates. Specifically for drugs, the problem is even larger. Given that they are almost universally confined to illegality, with maybe the exception of “legal highs”, it is even more difficult to obtain reliable data related to its use or its consequences. There is no doubt that illegal drugs constitute a huge market on their own, but in the present state of affairs, researchers are hardly able to evaluate it.

For the methodological limitations of the present review, some aspects are worth mentioning. First, although we have tried to be as systematic as possible, there remains the possibility of having missed relevant studies, especially those not available in English. Our main focus of study was the EU zone. While this might have granted the review a higher internal validity, it imposes several limitations when trying to extrapolate our results out of the EU.

6. Conclusions

Despite the limitations that have been noted in the field of social costs evaluations, there seems to exist a clear impact of substance use on society from an economic perspective. Illegal drugs, alcohol and tobacco keep consuming nations' resources in many ways, such as increasing costs of healthcare delivery, law and crime enforcement or lost productivity. All together, they add up to become a significant share of nations' GDP, even exceeding 3% in some cases. Hence, from a public health and policy maker perspective, there is a strong need to address these issues. Given our results, it seems that in order to unambiguously progress in this task, there is an urgent need for methodological guidance, a need to standardize and homogenize the methodologies employed for social costs evaluations.

7. References

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8. Appendix

Appendix A. Search strategy

SEARCH QUERY	SEARCH TERMS	SEARCH AIM
#1	Search "alcohol-related disorders " [MeSH]	
#2	Search "alcoholism "[MeSH]	
#3	Search "alcohol drinking"[Mesh]	
#4	Search "alcohol depend*[tiab] "	
#5	Search "alcohol misuse[tiab] "	
#6	Search "alcohol addict*[tiab] "	
#7	Search "alcohol abuse[tiab] "	
#8	Search "problem drink[tiab] *"	
#9	Search "alcohol consumption[tiab] "	
#10	Search "harmful alcohol*[tiab] "	
#11	Search "hazardous alcohol*[tiab] "	
#12	Search "risky alcohol*[tiab] "	
#13	Search "harmful drink*[tiab] "	
#14	Search "hazardous drink*[tiab] "	
#15	Search "risky drink*[tiab] "	
#16	Search "((drinking[tiab] OR drinker[tiab] OR drinkers[tiab] AND alcohol[tiab]))"	
#17	Search (#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16)	Alcohol disorders
#18	Search "tobacco[tiab]"	
#19	Search "smoker[tiab] OR smokers[tiab] "	
#20	Search "smoking[tiab]"	
#21	Search "cigarette[tiab] OR cigarettes[tiab] "	
#22	Search (#18 or #19 or #20 or #21)	Tobacco disorders
#23	Search "illicit drug[tiab] OR illicit drugs[tiab] "	
#24	Search "illegal drug[tiab] OR illegal drugs[tiab]"	
#25	Search "non legal drug[tiab] OR non legal drugs[tiab]"	
#26	Search "street drug [tiab] OR street drugs[tiab]"	
#27	Search "cocaine[tiab]"	
#28	Search "heroin[tiab] OR opioids[tiab]"	
#29	Search "amphetamine[tiab]"	
#30	Search "methamphetamine[tiab]"	
#31	Search "drug consumption[tiab] OR drugs consumption[tiab]"	
#32	Search "marihuana[tiab] OR cannabis[tiab] OR hash[tiab]"	
#33	Search (#23 or #24 or #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32)	Illicit drug disorders
#34	Search (#17 OR #22 OR #33)	All disorders together
#35	Search "cost of illness[tiab]"	
#36	Search "social cost[tiab] OR social costs[tiab]"	
#37	Search "societal cost[tiab] OR societal costs[tiab]"	
#38	Search "economic cost [tiab] OR economic costs[tiab] "	
#39	Search "burden of disease[tiab] "	
#40	Search "(cost [tiab] OR costs[tiab]) AND (assessment [tiab] OR evaluation[tiab])"	
#41	Search "traffic accidents[tiab] OR crashes[tiab] OR crime[tiab] OR fetal alcohol syndrome[tiab] OR fetal alcohol spectrum disorder[tiab] "	
#42	Search "premature mortality[tiab] "	

SEARCH QUERY	SEARCH TERMS	SEARCH AIM
#43	Search “productivity losses[tiab] ”	
#44	Search (#35 or #36 or #37 or #38 or #39 or #40 or #41 or #42 or #43)	Social costs
#45	Search #34 AND #44	Final construction

Appendix B. Proposed estimation frameworks

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

Appendix C. Quality assessment

C.1 Quality assessment of drug studies

Study	Out of frameworks	Minimum framework	Optimal framework
UK 1995 (Healey et al., 1998)	√		
France 1997 (Fenoglio et al., 2003)		√	
Spain 1997 (García-Altés, Ollé, Antoñanzas, & Colom, 2002)		√	
Sweden 2002 (Ramstedt, 2006)	√		
Netherlands 2003 (Rigter, 2006)	√		
Germany 2006 (Mostardt, Flöter, Neumann, Wasem, & Pfeiffer-Gerschel, 2010)	√		
Belgium 2008 (Van malderen, vander laenen, & de ruyver, 2007)	√		
Portugal 2010 (Gonçalves, Lourenço, & Silva, 2014)	√		

C.2 Quality assessment of alcohol studies

Study	Out of frameworks	Minimum framework	Optimal framework
Finland 1990 (Lehto, 1997)		√	
Slovak Republic 1994 (Koziva, 1995)		√	
Germany 1995 (Bergmann & Horch, 2002)	√		
Portugal 1995 (Lima & Esquerdo, 2003)	√		
France 1996 (Reynaud, Gaudin-Colombel, & Le Pen, 2001)	√		
France 1997 (Fenoglio, Parel, & Kopp, 2003)		√	
Spain 1998 (García-Sempere & Portella, 2002)	√		
Sweden 1998 (Johnson, 2000)		√	
Switzerland 1998 (Jeanreanud, Priez, Pellegrini, Chevrou-Severac, & Vitale, 2003)	√		
Belgium 1999 (Pacolet, Degreef, & Bouten, 2004)	√		
Ireland 1999 (Byrne, 2000)	√		
England & Wales 2001 (Leonardi, 2003)	√		
Norway 2001 (Gjelsvik, 2004)	√		
Scotland 2001-2 (Guest & Varney, 2001)		√	
Germany 2002 (Konnopka & König, 2007)	√		
Slovenia 2002 (Sesok, 2003)	√		
Sweden 2002 (Jarl et al., 2008)		√	
Austria 2004 (Wancata, Sobocki, & Katschnig, 2007)	√		
Italy 2004 (Pugliatti et al., 2008)	√		
Portugal 2005 (Cortez-Pinto et al., 2010)	√		
UK 20005 (Balakrishnan, Allender, Scarborough, Webster, & Rayner, 2009)	√		
Estonia 2006 (Saar, 2009)	√		
Spain 2007 (Scandurra, Garca-Altés, & Nebot, 2011)	√		
Ireland 2007 (Byrne, 2010)	√		
Scotland 2007 (York Health Economics Consortium, 2007)		√	
Scotland 2009-10 (Johnston, Ludbrook, & Jaffray, 2012)		√	

C.3 Quality assessment of tobacco studies

Study	Out of frameworks	Minimum framework	Optimal framework
Germany 1993 (Welte, König, & Leidl, 2000)		√	
Denmark 1995 (Rasmussen & Sjøgaard, 2000)	√		
Germany 1996 (Ruff, Volmer, Nowak, & Meyer, 2000)	√		
France 1997 (Fenoglio et al., 2003)	√		
Sweden 2001 (Bolin & Lindgren, 2007)		√	
Germany 2003 (Neubauer et al., 2006)		√	
UK 2005 (Allender, Balakrishnan, Scarborough, Webster, & Rayner, 2009)	√		
Germany 2008 (Wacker et al., 2013)	√		