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# Best practice in estimating the costs of alcohol – Recommendations for future studies

## **Editors**

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# Best practice in estimating the costs of alcohol – Recommendations for future studies

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## ABSTRACT

This report aims to summarize best practice in estimating the attributable and avoidable costs of alcohol, and to make recommendations for making such estimates in future studies. It discusses the conceptual basis for such cost studies, and then goes through the conceptual and methodological challenges for each type of cost in turn. It recommends (i) changes in the terminology used; (ii) the consistent and explicit consideration of 'external' costs (i.e. costs to others); (iii) more sophisticated modelling of the effect of policy interventions on costs; (iv) more robust attempts to quantify alcohol's causal effect on harms and costs; (v) a demonstration project using new methodologies; (vi) the use of scenarios rather than existing sensitivity analyses; (vii) importing data from other studies rather than simply missing out certain types of cost; (viii) taking account of future health and resource costs; and (ix) not using the 'human capital' method for valuing the labour costs of premature mortality within the main estimates.

### Keywords

ALCOHOL DRINKING – adverse effects  
COST OF ILLNESS  
HEALTH CARE COSTS  
ALCOHOLISM – complications – mortality  
COSTS AND COST ANALYSIS – methods  
GUIDELINES

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## Abbreviations

AAF	alcohol-attributable fraction
CBA	cost–benefit analysis
CGE model	computable general equilibrium model
CHOICE	Choosing Interventions That Are Cost Effective ( <i>a WHO project, also known as WHO-CHOICE</i> )
COI	cost of illness
DALY	disability-adjusted life-year
EU	European Union
GDP	gross domestic product
ICD-10	International Statistical Classification of Diseases and Related Health Problems, tenth revision
LSE	London School of Economics and Political Science
PTSD	post traumatic stress disorder
QALY	quality-adjusted life-year
WHOQOL instrument	WHO quality-of-life instrument
WHOQOL-BREF	WHOQOL instrument, shorter version
WTP	willingness to pay

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## ***Foreword***

*The WHO Regional Office for Europe has supported its 53 Member States in alcohol-related health promotion, disease prevention, evaluation and surveillance activities in line with the regional resolutions on alcohol. As part of this process, WHO and the European Commission jointly developed this volume – bringing together a series of scientific background documents to inform and support national policy-making processes. The studies have followed the direction set out in WHO’s Framework for alcohol policy in the WHO European Region (2005) and the European Commission’s EU strategy to support Member States in reducing alcohol-related harm (2006).*

*Alcohol consumption in the WHO European Region is double the world average. In 2004 alcohol was estimated to be attributable to 618 000 deaths and 17 million life-years lost due to disability and death. In WHO European Member States, alcohol is the second largest risk factor for death and disability and by far the largest risk factor for young people.*

*The effect of harmful use of alcohol extends beyond the direct health-related consequences to drinkers and results in a wide range of costs, including lost productivity in the workplace, criminal damage and violence. A better understanding of which measures or strategies make the best use of resources, and by how much they can reduce the harmful consequences of alcohol use, is essential in an evidence-based approach to alcohol policy and planning.*

*This report summarizes best practice in estimating the attributable and avoidable costs of alcohol, and makes recommendations for making such estimates in future studies, giving special consideration to the varying amount and quality of available data in different countries.*

*The report is designed primarily for those who work in the area of health economics in ministries of health and ministries of finance but also targets stakeholders working in other government sectors on licensing, commercial communication and taxation policies.*

*The WHO Regional Office for Europe looks forward to future collaboration with all partners on alcohol-related diseases, in the hope that a focused alcohol policy can reduce the risks of mortality and disability due to alcohol, to improve the overall health of citizens in the WHO European Region.*

Zsuzsanna Jakab  
WHO Regional Director for Europe



## 1. Introduction

The aim of this report is to summarize best practice in estimating the attributable and avoidable costs of alcohol, and to make recommendations for making such estimates in future studies, giving special consideration to the varying amount and quality of available data in different countries. The present review was commissioned, despite the existence of earlier guidelines for alcohol's attributable costs (Single et al., 2003) and avoidable costs (Collins et al., 2006), to reflect several recent developments, including:

- increasing numbers of cost studies that still use inconsistent and/or puzzling methodologies;
- the need for a robust base on which to build the further economic analyses that are being considered in related European Union (EU) and WHO projects; and
- recent developments by economists in methods for estimating costs.

Nearly all previous attributable and avoidable cost studies for alcohol have been carried out using the cost-of-illness (COI) framework developed in the United States by Dorothy Rice and colleagues. While the present review takes account of best practice in such analyses, it also considers several criticisms levelled at the COI approach and asks whether there are any better methodologies for estimating the costs of alcohol. It does not involve a systematic review on the topic (see instead Anderson & Baumberg, 2006, and Baumberg, 2006), but rather considers a selection of studies that cover the main practical and theoretical issues:<sup>1</sup>

- a COI study in Sweden that was a joint project between the Swedish Ministry for Health and Social Affairs and the WHO Regional Office for Europe, envisaged as a pilot for applying the COI approach to alcohol throughout the WHO European Region (Johansson P et al., 2006);
- *Alcohol in Europe*, a review of previous COI studies on alcohol globally since 1990 by the present author and Dr Peter Anderson (Anderson & Baumberg, 2006; Baumberg, 2006), as well as a separate paper discussing the developments of this review (Baumberg, 2008), the pre-1990 studies having been reviewed elsewhere (Collins & Lapsley, 1991);<sup>2</sup>
- a discussion of social costs by the RAND Corporation that formed part of an “ex ante impact assessment” for the European Commission’s 2006 communication on alcohol (Horlings & Scoggins, 2006);

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<sup>1</sup> The funders of this report (the WHO Regional Office for Europe and the European Commission) specified the first three studies on this list. The other studies were added after discussions with the report’s expert advisory group. This group consisted of Peter Anderson, Dan Chisholm, Pia Johansson, Lars Møller, Jacek Moskalewicz, Esa Österberg, Jürgen Rehm, and Maria Renstrom.

<sup>2</sup> For *Alcohol in Europe*, an initial list of studies was obtained from PubMed, the Alcohol and Alcohol Problems Science Database (ETOH) and the Web of Science. This list was then checked against the WHO Global Status Report on Alcohol 2004 and an Internet search using google.com. The list was also supplemented with the names of studies from four previous reviews as well as names provided by the European Alcohol Policy Network (APN; [www.eurocare.org/eu\\_projects/bridging\\_the\\_gap/alcohol\\_policy\\_network\\_apn](http://www.eurocare.org/eu_projects/bridging_the_gap/alcohol_policy_network_apn)). These studies were selected for the review if they included a new estimate of the social cost of alcohol in at least one cost area. Studies not available in English were included if they were in French, German or Spanish, or if the relevant APN member completed a standardized form providing the necessary data. Due to data limitations, it was not possible to include studies for West Germany or for subnational regions.

- a recent WHO guide to identifying economic costs across all dimensions of health, suggesting substantial changes to the way that such studies are conducted (WHO, 2009), as well as a similar but shorter EU publication written for a wider audience (Suhrcke et al., 2008);
- the two avoidable cost studies that have been conducted on alcohol (Collins & Lapsley, 2008; Rehm et al., 2008a, 2008b); and
- the WHO guidelines for attributable costs (Single et al., 2003) and the Health Canada guidelines for avoidable costs (Collins et al., 2006).

## Outline of the Report

This report consists of six chapters. This introductory chapter considers the general methodological aspects of cost studies, including a description of the broad framework (what cost studies are and what they are used for) and avoidable cost studies in particular. At the end of the report, the concluding chapter looks at the issues that have come up repeatedly in different types of cost studies and makes recommendations about how to address these issues.

In between, the main body of the report considers each type of cost in turn (e.g. health care costs and crime costs). It does this in four chapters, devoted respectively to health and welfare expenditures (health, crime and other types of spending); labour and production losses; non-financial welfare costs; and the benefits of alcohol consumption (both financial and non-financial).

## What Are Cost Studies?

Put simply, an **attributable cost study** compares the costs due to alcohol in a society's current situation with a hypothetical ("counterfactual") situation – usually the slightly unreal situation of "What if alcohol had never existed?" The point here is not that an alcohol-free society is either likely or desirable, but rather that it enables us to ask, "How great is the total social and economic cost of alcohol?" Other reasonable counterfactual situations can also be considered. For example, it would be valid to look at the theoretical minimum cost (Johansson P et al., 2006), i.e. a situation in which everyone drank the amount of alcohol that gave each of them the lowest risk of dying at his or her particular age (White, Altmann & Nanchahal, 2004).

Whatever the counterfactual scenario, costs are usually estimated by looking at the current costs of all past consumption (known as a *prevalence-based approach*),<sup>3</sup> although some studies are inconsistent in doing so (see Chapter 3). The present chapter begins by looking at three key questions that underlie alcohol cost studies. What is a cost? What is the purpose of estimating these costs? And who creates these costs, and who pays them?

### ***What Is a "Cost"?***

Before deciding which costs we are interested in, we need to have a common language to describe different types of costs. Such terminology is surprisingly problematic; while there are conventional terms used in COI studies, in the light of more recent developments it has become clear that they can lead to confusion (WHO, 2009). With guidance from the expert advisory

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<sup>3</sup> The alternative is to look at the future costs of all current consumption, known as an *incidence-based approach*.

group for this report, I have chosen to use the following three terms to describe different dimensions of cost.

1. First, there are **health and crime expenditures**, in which resources are used up due to alcohol-related harms. For example, they include extra spending on health care and police, as well as the damage to cars and property in drink–driving accidents. (They are often called direct costs in COI studies.)
2. Second, there are **labour and productivity costs**, in which alcohol reduces economic output and production (due to anything from lower productivity in the workplace to the impact of workers dying prematurely).<sup>4</sup> These costs suggest that the economy in our counterfactual scenario would be even larger, rather than just being engaged more usefully as is the case with health and crime costs. (COI studies often call them indirect costs, but the RAND terminology (Horlings & Scoggins, 2006) adapted for use here seems to better describe what they refer to.)
3. The third type of cost is **non-financial welfare costs**, which refer to pain, suffering and lost life. These costs are non-financial because they do not have a monetary value, in the sense that you cannot sell or exchange pain. Nevertheless, individuals and society would be prepared to pay something to avoid them, which means they do have a (non-financial) value. (COI studies often refer to them as intangible costs, but that is confusing given that methods do in fact exist that make it possible to estimate them).

In theory it is possible to combine these different types of costs into a single figure, which we can call the **full economic welfare cost** of alcohol use. It is expressed in terms of individual “utility” – the degree that goods and services satisfy human wants, close to what most people would call consumption-related “happiness” (Black RDC, 2008; Black J, Hashimzade & Myles, 2009). Some economists prefer combining all three types of costs in this way, as it produces the “broadest, most relevant” conception of cost (Suhrcke et al., 2008:i).

However, the full economic cost differs from how many policy-makers and much of the public interpret “economic cost”, by which they tend to mean the **total financial cost**, which excludes the non-financial welfare costs.<sup>5</sup> It is therefore crucial to be clear and consistent about what is meant by cost if economic analyses are to contribute to policy debates (WHO, 2009:8; Suhrcke et al., 2008:1). One pragmatic way of enhancing the transparency and relevance of cost studies is to address policy-makers’ questions by talking about financial costs as well as encouraging them to consider the full economic welfare costs. An advantage of this approach is that it allows policy-makers to balance financial resources against other desirables, such as health and pleasure, rather than restricting value considerations to technical debates about assessing non-financial costs.

### *Defining Costs Coherently*

A common problem with COI studies is that they attempt to combine different types of financial costs in ways that do not make sense. For example, they sometimes include non-market production (e.g. unpaid caring) as a share of the gross domestic product (GDP) – even though

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<sup>4</sup> Care is needed in the treatment of unpaid work here, such as volunteer work, housework and caregiving (WHO, 2009:29). Being unpaid, this work occurs outside the market and should be excluded if we are only interested in alcohol’s impact on GDP (other than where a decline in unpaid work would need to be replaced by paid work). However, such work clearly should be considered in the more general category of labour and productivity costs, and it should be included if a wider societal perspective is desired.

<sup>5</sup> The distinction is similar to that between “monetary” and “comprehensive” costs in Levy & Miller (1995:241).

these two concepts are incommensurable.<sup>6</sup> The most common and significant problem lies in trying to combine health and crime costs with labour and productivity costs into a “loss of GDP” figure, but this approach is inconsistent, given that health and crime spending are themselves part of the GDP (WHO, 2009:20, 98). The *WHO guide to identifying the economic consequences of disease and injury* recommends getting around this difficulty by describing the combination as a loss of non-health and non-crime goods and services, i.e. GDP minus health and crime expenditures (WHO, 2009:17).

However, aside from raising some complex conceptual issues,<sup>7</sup> this workaround creates three practical problems. First, the resulting figure of “non-health and non-crime goods and services” is difficult to communicate. Second, it is slightly different from the concept that interests policy-makers; at least one policy-maker from the United Kingdom has talked about how the money spent treating alcohol-attributable diseases could be better spent building new hospitals, suggesting that omitting health spending per se would go too far (a similar argument can be made for police spending). And finally, it may be difficult to estimate GDP minus all the relevant components of health and crime spending (particularly those that are borne by private individuals).

This issue is one in which a demonstration project would be helpful, in determining whether “non-health and non-crime goods and services” can be realistically and productively used for alcohol cost studies.

### ***The Purposes of Cost Studies***

There are three main purposes for undertaking a cost study on alcohol. First, they can help *to show that alcohol is a major social and economic problem*, bringing together all the different areas affected by alcohol use. For example, a World Health Assembly resolution noted that WHO Member States are “concerned about the economic loss to society resulting from harmful alcohol consumption” (WHA 58.26). As a result, “countries that have released costs estimates have achieved greater public visibility and policy maker focus on substance abuse issues” (LeCavalier, 2001).

Second, attributable cost studies can help researchers *to compare the impact of different health and social problems*. In particular, alcohol studies have often been done alongside analyses of the costs of illegal drugs and/or tobacco (Fenoglio, Parel & Kopp, 2003; Kopp & Fenoglio, 2000; Collins & Lapsley, 2002; Single, Robson & Xie, 1996; Easton, 1997). To the extent that the studies show that the cost of alcohol is greater than – or comparable to – that of tobacco or

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<sup>6</sup> See also footnote 4 above.

<sup>7</sup> Conceptually, the reason for splitting health and crime goods and services from the rest of the GDP is that not having to spend this money is preferable to spending it (i.e. being healthy and not paying for health care is better than paying for health care). In the terms of welfare economics, such spending is not seen to enhance “utility”, and is therefore not part of the figure we are interested in. However, many other goods/services likewise include components that are not utility-enhancing, in the sense that people would have greater utility if they did not consume them. For example, many goods and services are in part responses to ill health (e.g. gyms for overweight and obese people), crime (e.g. higher house prices in low-crime areas) or other utility-reducing situations (e.g. many kinds of insurance and much social policy). Indeed, this observation could also be applied to conspicuous consumption (Charles, Hurst & Rousanov, 2007) if one were to assume that society could require a lower degree of spending to maintain status and self-esteem.

For the present case, these observations do not in themselves make it harder to exclude health- and crime-related goods and services; rather, they raise a broader issue (the gap between consumption and utility) that such an exclusion can address only partially.

other drugs, it can increase public support for alcohol control policies. Given that there is a temptation for advocates of any health or social cause to try and “outbid” the advocates of other causes, it is particularly important to produce robust estimates that use comparable methodologies (Single, Robson & Xie 1996; Easton, 1997; Single & Easton, 2001; Warner, 2000).

Finally, cost studies can be designed *to indicate which alcohol policies will reduce costs most*. While attributable cost studies on their own are not very helpful in this effort (although see suggestions in Single et al., 2003), they can serve as a foundation for avoidable cost studies (discussed below) or cost–benefit analyses (CBAs)<sup>8</sup> (Anderson & Baumberg, 2006:59; Suhrcke et al., 2008). They can contribute to such studies in three ways.

1. Cost studies can act as a spur to fill in gaps in the evidence base (Midanik & Room, 2005; Johansson P et al., 2006).
2. They can show which costs need to be included in CBAs (Johansson P et al., 2006). If the full range of alcohol costs are not included, then policies that address competing health/social problems may appear to be more effective simply because more of the policy benefits are captured by the research (Sindelar et al., 2004) – particularly given that non-health savings tend to be far greater than health savings for alcohol interventions (McCollister & French, 2004). That partly explains why analysis performed by the Choosing Interventions That Are Cost Effective (WHO-CHOICE) project found that tobacco policies were more cost-effective than alcohol policies (Chisholm et al., 2006).<sup>9</sup>
3. Attributable cost studies can be developed into avoidable cost studies and CBAs to compare the costs and benefits of a particular policy option (as described below in section 1.2) (McCollister & French, 2004). This function is valuable, as it is difficult to build up an exhaustive CBA from individual project evaluations, given that “clinical trials are rarely powered sufficiently to detect significant economic benefits at the  $p < 0.05$  level” (Fleming et al., 2002:41). Nevertheless, it should be remembered that developing a CBA from an attributable cost study requires a considerable amount of work.

### ***Externalities: Who Creates the Costs, and Who Pays For Them?***

While policy-makers are often interested in the total costs and the efficiency of different policies in reducing them, fairness can also be an important criterion for policies. In particular, it may be seen as unfair that (heavy) drinkers create costs through their drinking that others have to pay for, costs known as **external costs** (Cook P, 2007:170). (See the list in Table 1 below and the discussion in the conclusions.) External costs also violate the assumptions underpinning the view that the market will automatically produce the best outcome when there is no state interference (Godfrey, 2004). Several studies have tried to calculate these external costs (Barker, 2002; Heien

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<sup>8</sup> A cost–benefit analysis (CBA) is a type of economic evaluation in which the costs of a particular policy option or intervention are compared to the benefits, with all costs and benefits being expressed in constant monetary units (e.g. euros).

<sup>9</sup> Because the CHOICE analysis only looks at one type of policy benefit (effectiveness in reducing the burden of disease), and the benefits of alcohol policies are more diffuse than those of tobacco policies, excluding non-health costs gives a false impression of the relative desirability of alcohol and tobacco policies (Baumberg, 2006). For this reason (although speaking in general rather than about the CHOICE analyses), Sindelar et al. suggest that cost–benefit analyses (that look at all outcomes) should be strongly preferred to cost–effectiveness analyses (that look at a single outcome) for alcohol (2004). Note also that the alcohol and tobacco cost–effectiveness estimates differed in the details of the policies compared (e.g. tax rates that are lower for alcohol than tobacco), the effects of similar policies based on the evidence (for advertising bans) and the implementation costs.

& Pittman, 1993; Manning et al., 1989; Cnossen, 2007; Richardson & Crowley, 1994), but they have encountered a number of difficulties.

Table 1. The internal and external costs of alcohol for harms to the drinker

Costs	Primarily external or internal?	Comments
<b>Health and crime costs</b>		
Health care	External	Internal when health care is paid for by the individual
Treatment for alcohol use disorders	External	
Research and prevention	External	
Social security	[External]	A transfer cost, so not included in the total social cost
Drink-driving damage	External	
<b>Labour costs</b>		
Productivity at work	?	Contentious among economists
Absenteeism	?	Contentious among economists
Premature mortality	?	
Unemployment/retirement	External	Depends on the cost being estimated: internal if estimating lost earnings to the drinker
Crime: imprisonment	Internal	
Congestion from accidents	External	
Education	Internal	
<b>Financial benefits</b>		
Financial benefits	External	
Tax paid by drinker	[External]	A transfer cost, so not included in the total social cost
Social capital	?	No evidence, but potentially an external benefit
<b>Non-financial welfare costs</b>		
Health	Internal	
Non-health impacts on drinkers	Internal	
Drinker's relatives: quality of life	External	Considered by some economists to be an internal cost, but seems better to treat as external
Drinker's relatives: informal care	External	Considered by some economists to be an internal cost, but seems better to treat as external
Drinker's relatives: children	External	Considered by some economists to be an internal cost, but seems better to treat as external
<b>Non-financial welfare benefits</b>		
Pleasure	Internal	

*Note:* The costs caused by harms to others are all external, including costs for crime, health care, social services, research, prevention, social security, unemployment and retirement benefits, labour lost by the victims of accidents and crime, and non-financial welfare costs (including fear of crime).

First, it is often difficult to answer the complex question of exactly who bears a particular cost. Estimating who bears each part of an existing social cost has been done in only relatively few social cost studies, but those from Australia and France suggest that governments pay 15–25% of the financial costs (Collins & Lapsley, 2002; Fenoglio, Parel & Kopp, 2003), while the Swedish COI study suggests that half the costs are paid by various levels of government (Johansson P et al., 2006). These figures are likely to vary among countries, with e.g. health costs being socialized in many countries but primarily private in the United States.

However, there are disagreements about who bears certain costs. For example, certain economists have argued that wages adjust to reflect any productivity losses in drinkers, so that this cost is fully internalized (cited in Harwood et al., 1998). The RAND study discusses these arguments in detail for each type of cost, arguing for instance that ultimately, lower amounts of criminal damage will lead to lower insurance premiums (and thereby accrue to everyone who insures their goods), though insurers may capture part of the savings as extra profits (Horlings & Scoggins, 2006).

Second, there is the similarly complex question of who creates a particular cost. Few studies disaggregate the costs by population group, with even the recent Swedish study doing so only for chronic disease health care costs – most of which, perhaps unsurprisingly, were attributed to hazardous and particularly harmful drinkers (Johansson P et al., 2006). It appears that the only other COI study to disaggregate costs was from Germany and reached a similar result, finding as well that people with alcohol use disorders were responsible for only one third of the total financial costs. While the German study examined a greater variety of cost types, they were still able to analyse only two thirds of the total costs (Bergmann & Horch, 2002).

Third, the idea of external costs is broader than simply costs that people inflict on others, in that there are some decisions people make in which they do not take into account costs to themselves (Johansson P et al., 2006). It may be because they lack knowledge of the costs, or because they are addicted to alcohol and therefore lack rationality (Godfrey, 1991; Single et al., 2003).<sup>10</sup> At the same time, other economists define external costs more narrowly by assuming that the costs people inflict on other members of their family are private rather than external, implying for instance that the health and social costs resulting from domestic violence are weighed by the drinker when considering the pleasure of drinking. While researchers are free to choose the assumptions that seem most reasonable to them (Johansson P et al., 2006), it means that the very definitions of external costs are contested. The issue of what an external cost is revisited below in Conclusions and Recommendations.

Finally, external cost studies are usually based on previous social cost studies, and therefore rarely include situations in which money is merely moved from one group to another (e.g. state benefits or alcohol taxes). These movements are called **transfer costs**, and they do not involve a cost to society as a whole. However, when we look at them from an external perspective (or from a government finance perspective), these transfers are likely to make a significant difference to the overall cost estimate in a direction that is unclear a priori. P. Johansson et al. therefore reject the idea that they can estimate the total impact of alcohol on government finances in their attributable cost study (2006).

In conclusion, it would seem sensible to estimate both the social and external costs of alcohol simultaneously, given that the estimates ask different but legitimate questions. (As one external

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<sup>10</sup> It does not include the relatively contentious idea of internalities – costs that a future version of oneself would value more highly than one does now (Whitman, 2006).

cost study noted, public health policies have historically been more concerned about improving people's health than in reducing external costs or improving people's overall expected utility (Richardson & Crowley, 1994:75.) This approach is preferable to doing a post hoc adaptation of a social cost estimate for other purposes, and it should be done in a way that ensures that major cost categories (transfer costs in particular) are not omitted.

### *The remainder of this report*

The next four chapters consider particular cost components, examining both bottom-up and top-down approaches (Johansson P et al., 2006). Top-down approaches use aggregate data and are based on two pieces of information: the total cost of e.g. inpatient care, and the share of this cost that can be attributed to alcohol. Bottom-up approaches are based on individual-level data and also use two pieces of information: the excess harm caused by alcohol users in comparison to others (e.g. excess crime), and the cost per harm (e.g. the cost per violent crime). The main problem with top-down approaches is that it can be hard to estimate the aggregate cost, particularly for costs that are not valued by the market; the main problem with bottom-up approaches is their higher research cost and possible bias caused by the nature of the particular sample.

## **Avoidable Costs**

The notion of avoidable costs has recently been introduced to alcohol studies (Collins et al., 2006:49), with the first two avoidable cost studies being conducted in the past two years (Rehm et al., 2008a; Collins & Lapsley, 2008). This section describes what an avoidable cost is, and then discusses how attributable cost studies can be adapted to provide an estimate of avoidable costs.

### ***What Are Avoidable Costs?***

Avoidable costs are the fraction of total attributable costs that can be potentially averted by reducing exposure to the underlying risk factor – in this case alcohol use – and calculating them enables the estimation of a *feasible minimum cost* (Collins et al., 2006:22). The Health Canada avoidable cost guidelines suggest three ways of calculating a feasible minimum:

1. The feasible minimum can be calculated as a specified change in risk distribution (which Collins et al. call the “epidemiological approach”); for example, the avoidable cost guidelines describe a 10% reduction in smoking consumption, shifting each smoking category to the next-lowest consumption category (Collins et al., 2006:29). Since such a redistribution is entirely arbitrary, however, this method has limited usefulness for policy-makers (Collins et al., 2006:31).
2. The feasible minimum can also refer to the best outcomes or lowest exposures in any comparable country (known as the *Arcadian normal approach*<sup>11</sup>). The major problem here is that the countries being compared may be so culturally distinct that the comparison is not useful.<sup>12</sup> The studies also have difficulties in separating the effects of alcohol from the

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<sup>11</sup> This term was introduced by Armstrong (1990), who named it after the Greek region, which in ancient times was “renowned for the contented pastoral simplicity of its people” (as cited in Collins et al., 2006:31).

<sup>12</sup> It is not altogether clear what reasonably comparable countries would be. Collins et al. suggest they would have “genetically similar populations and ... similar living standards” (2006:32), while the only example of such comparisons being done for alcohol used countries that had  $\pm 10\%$  of the original country's GDP per capita, as adjusted for differences in purchasing power parity (PPP) (Rehm et al., 2008a:Appendix A).



effects of other risk factors that contribute to the same conditions,<sup>13</sup> in dealing with the health benefits of alcohol<sup>14</sup> and in enabling estimates of avoidable crime and labour costs (Collins & Lapsley, 2008:9). As a result Collins & Lapsley find that they are of “limited usefulness”, and Rehm et al. state that the Health Canada guidelines should be revised as a result (2008:175).

3. The final definition of a feasible minimum assumes the introduction of effective interventions. This definition of what is feasible is more realistic than the other two and thus makes an undeniably useful contribution to policy debates. The main challenge with this approach is in making a quantitative estimate of the effect of different policies so that the estimate can be applied to the costs – a practical issue that we consider below. While it is far more valuable than any of the other avoidable cost approaches, there remain a couple practical problems in implementing it.

The two avoidable cost studies conducted to date, in Australia and Canada, have not factored in any lag time between the introduction of policies and the reduction in costs – lag times that could include policy implementation times, delays before policies have an impact on harms, and delays before any impacts on harm translate into economic benefits (Collins et al., 2006:39). It is particularly important to consider lag times because some costs will be unavoidable due to past exposure, as shown in Fig. 1 (see the area marked “unavoidable” after T0). Indeed, early definitions of avoidable costs focused purely on the legacy of past drinking (Single et al., 2003:36). In part this omission reflects the lack of evidence on how quickly exposure reductions result in harm reductions (Rehm et al., 2008a:Appendix C). Both existing studies therefore say that their estimates of avoidable costs would be realized over the course of several years, but they are unsure of exactly how quickly (Collins & Lapsley, 2008; Rehm et al., 2008a:180). Nonetheless, a first attempt to model lags has been undertaken in a modelling exercise in the United Kingdom (Meier et al., 2008), though it is not labelled an avoidable cost study.

Moreover, the two studies did not try combining the effects of different interventions, which is a crucial step to take because of the substantial overlap in the effects of the interventions (Collins & Lapsley, 2008:xi). Such overlap could be potentially accounted for in a modelling exercise that made assumptions addressing the interventions’ combined effect, as has been done in the WHO-CHOICE cost–effectiveness analyses (Chisholm et al., 2004).

In summary, avoidable cost studies should focus on the intervention-based approach. This also has the advantage of making avoidable cost studies more like cost–benefit analyses (CBAs), which require assessing the social costs and benefits of different policy options solely in monetary units. Until now, quantifying the full range of benefits arising from alcohol control

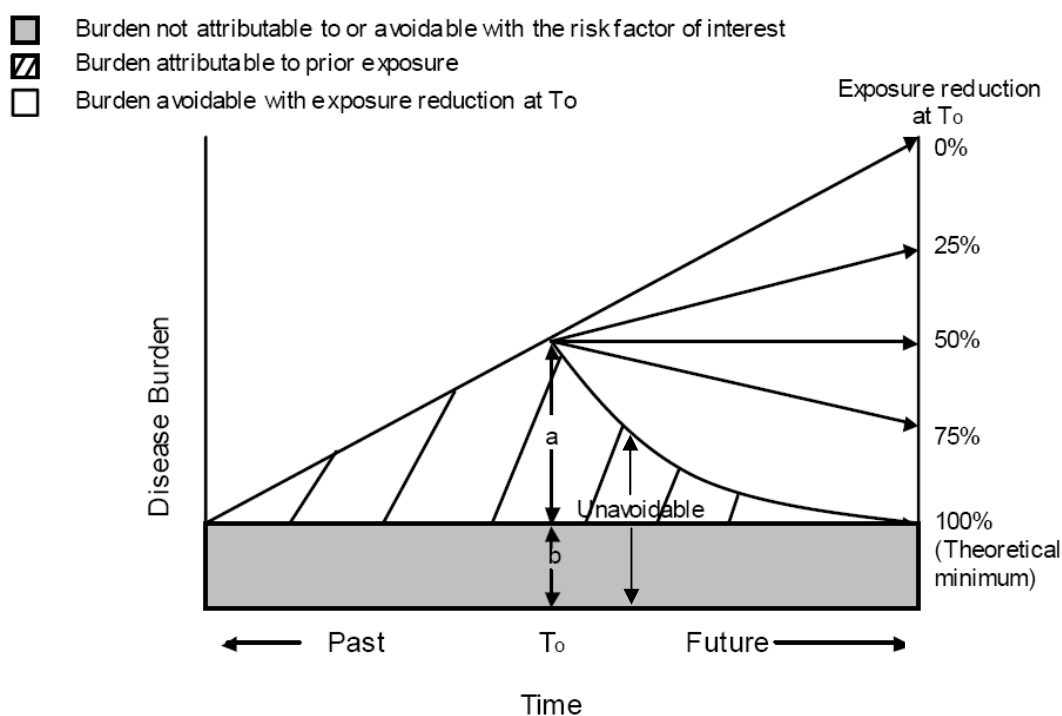
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<sup>13</sup> The *outcome-based Arcadian normal approach* attempts to look only at the alcohol-attributable levels of various outcomes (e.g. death or health costs). These levels are based on alcohol-attributable fractions (AAFs), which are calculated using the WHO global burden of disease study if no other source is available (Rehm et al., 2008a:Appendix A; Collins & Lapsley, 2008:8). However, the avoidable cost guidelines regard the *exposure-based Arcadian normal approach* as far superior in dealing with this problem (Collins et al., 2006:49). This was attempted in an Australian avoidable cost study, which looked at total consumption levels rather than consumption in different groups (Collins & Lapsley, 2008:10). It was also tried in a study from Canada, but proved impractical: the study showed that almost none of the attributable costs were avoidable – a result of comparing countries that have similar average consumption levels and using identical risk functions for harms (Collins et al., 2006:36).

<sup>14</sup> The Australian avoidable cost study says it only used the Arcadian normal approach for conditions in which the AAFs were positive (i.e. conditions in which alcohol harms health): “Where the fractions are negative, it is assumed that policies can be put in place to preserve the benefits of lives saved” (Collins & Lapsley, 2008:8). Without further justification, this assumptions appears unwarranted.

measures has been a major challenge (resulting in a reliance on cost–effectiveness analysis, which only looks at costs in relation to health outcomes). As such, avoidable cost studies provide a potentially useful basis for CBAs in the alcohol field, and indeed, the two approaches may begin to overlap in future.<sup>15</sup>

Fig. 1. Avoidable costs using an epidemiological approach



Source: adapted from Murray et al., 2003, as shown in Collins et al., 2006:25.

### How to Estimate Avoidable Costs

If we define avoidable costs as the costs that would be avoided if effective interventions were introduced, then the first empirical challenge is to find quantitative estimates for the effects of various interventions. The two studies that have made such estimates – from Australia and Canada – approach the problem in roughly the same way, in that they are predominantly based on existing reviews of various policy options.<sup>16</sup> However, the intervention studies which these cost studies have chosen to use from the policy reviews often seem to be selected arbitrarily (e.g. the effects of privatization on consumption in Rehm et al., 2008a:28). The results of the various interventions are then adapted to the whole population as needed, at least in the Canadian study, for instance the effects of brief advice<sup>17</sup> or changing the drinking environment.<sup>18</sup>

<sup>15</sup> While the two methods have different historical lineages, the only remaining difference between avoidable cost studies and CBAs is that avoidable cost studies do not estimate intervention costs, e.g. the cost of providing brief advice in hospitals (Rehm et al., 2008b:27).

<sup>16</sup> The Australian study relies on an EU report (Anderson & Baumberg, 2006, as stated in Collins & Lapsley, 2008:11). The Canadian study uses an earlier WHO report that the EU report was based upon (Babor et al., 2003, as stated in Rehm et al., 2008b:8). However, the detailed nature of the Canadian report seems to suggest that a new review was also conducted for it (Rehm et al., 2008a:18).

<sup>17</sup> Rehm et al. cite a review that shows a 22% decline in consumption among hazardous and harmful drinkers in ideal intervention circumstances (2008a). They suggest that a sensible real-world extension of this would be a policy in which compliance was 70% and reached 50% of the target drinkers, for a real-world reduction of 7.7%. In

In both studies, a single intervention effect is generally modelled as the “main estimate”, with an additional possible intervention effect or two being sometimes (but not consistently) used in a sensitivity analysis. These sensitivity analyses could often be improved; for example, the Australian study simply uses an arbitrary 5% for nearly all interventions (e.g. a partial marketing ban would lead to a 16% consumption decline, so the sensitivity analyses are for 11% and 21% consumption declines (Collins & Lapsley, 2008:19–20)). It would be highly preferable to take into account the degree of uncertainty for the estimates of different interventions, either by looking at the range of valid estimates from high-quality studies identified by a systematic review, or by using confidence intervals from meta-analyses. The main estimates are also presented as “conservative”, a common approach that is critically discussed below in Conclusions and Recommendations.

Taxation requires additional assumptions, in that “it would in principle be possible by the use of tax instruments to achieve almost any level of reduction in per capita alcohol consumption, as long as tax rates were not so high as to encourage large-scale alcohol smuggling or illicit alcohol production” (Collins & Lapsley, 2008:x). The Canadian study uses an arbitrary 25% tax increase, but the Australian study argues that any level of consumption is realizable, and it accordingly uses a version of the exposure-based Arcadian normal approach.<sup>19</sup> The latter approach is less useful to policy-makers, for the reasons the Arcadian normal approach is criticized above.

Both studies decided that it was impossible to estimate the effects of certain policies, either because there was no evidence for the effects, because there were no quantitative estimates of the effects, or because the only quantitative estimates available came from very different sociocultural contexts. The Canadian study does not estimate the effects of interventions addressing hours of sale, the geographical density of sales outlets, or education (Rehm et al., 2008a), while the Australian study omits estimates for drinking environment controls, alcohol interlocks, drinking guidelines and drink labelling (Collins & Lapsley, 2008:30–32).

### *Translating intervention effects to costs*

The intervention effects used in the avoidable cost studies that have been done mainly take the form of the impacts on total alcohol consumption. In this case, the Australian study assumes the same proportional reductions in consumption and costs (e.g. a 5% reduction in consumption leads to a 5% reduction in costs) (Collins & Lapsley, 2008:19–20). The Canadian study takes a more complex approach. Violent crimes are modelled in a simple, sensible way,<sup>20</sup> but for reasons that are not altogether clear, Rehm et al. assume a proportional decrease in other crimes that is

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contrast, the Australian study simply uses the effect size found in another Australian study on brief advice, which found a 28% reduction in consumption and a 56% reduction in alcohol-attributable deaths (Collins & Lapsley, 2008:28–29).

<sup>18</sup> Rehm et al. uses Graham’s evaluation of the Canadian Safer Bars initiative, which found a 34% reduction in violence in bars. Based on Graham’s estimate that 10% of alcohol-attributable crime in Canada is in bars, extending the initiative to all Canadian bars would result in a 3.4% reduction in violence nationwide (2008a:71).

<sup>19</sup> Collins & Lapsley argue that Australia could achieve the same level of alcohol consumption that any comparable country has if it set its taxes high enough. They select Italy, Norway and the United States as comparison countries that have low consumption levels in relation to Australia, and express these countries’ consumption as a percentage of Australian consumption. They then reduce the entire attributable cost by this percentage.

<sup>20</sup> Violent crime AAFs are “modelled on a proportional basis”, which seems to indicate that a 5% consumption decline would be associated with a 5% violence decline (Rehm et al., 2008a:66).

one third of the decrease in consumption.<sup>21</sup> For health and labour costs, they use a more complex adjustment (again, for reasons that are not altogether clear).<sup>22</sup>

While these assumptions are defensible, it is certainly possible to improve on them. Estimating the effect of each intervention on each type of harm is likely to be too data-intensive to be realistic. However, it would be possible to estimate the effect of each policy on consumption in different subgroups – in particular, (long-term) hazardous and harmful drinkers and (short-term) binge-drinkers) – and then to examine the risk for each harm in the different consumption groups. This approach would still require a substantial additional body of evidence, but it would be much less demanding than evaluating the effect of each intervention on each harm. While they are not considered here, two other analyses appear to use variants of this approach (Meier et al., 2008; Chisholm et al., 2004), and these methodologies should be explored further.

Aside from estimating the effects of interventions on costs by their effects on total consumption, both the Australian and Canadian studies also look at the effects of interventions on particular types of harm when these interventions seem to be highly focused on these harms. That means that for policies addressing drink–driving, they apply the reduction in drink–driving accidents to the cost of drink–driving accidents. The Canadian study also investigates the impact of advertising bans on drink–driving and the impact of the Safer Bars intervention on violent crime.

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<sup>21</sup> Baseline AAFs are adjusted by the following factor: % change in consumption \* 1/2 [assuming that a given decrease in consumption leads to half as much decrease in harm] \* 2/3 [it is not clear where this second adjustment comes from] (Rehm et al., 2008a:68). The figures on p. 86 of the study confirm that this formula was the one used.

<sup>22</sup> Rehm et al. state that for calculating avoidable acute-care hospital days, “we applied the estimated percentage changes in the alcohol-attributed fractions caused by the intervention for each alcohol-attributable condition to the baseline figures” (2008a:100). These adjustments appear to be different for each alcohol-related condition, such that a 4.1% decrease in consumption (from a tax increase) translates to an overall 2.3% decline in acute hospital days. Premature mortality costs were calculated in the same way, but morbidity costs were adjusted by the percentage change in the AAF for alcohol dependence.

## 2. Health and Welfare Spending

### Health and Social Care

While they are not usually the largest cost category, in a certain sense health care costs lie at the heart of COI studies. Their centrality partly reflects the widespread use of COI studies for health risks such as alcohol use, and partly the deep reserve of epidemiological literature that these cost estimates are able to draw on. As a result, while most of the cost categories considered in the following sections have been omitted from one study or another, health care costs appear in every alcohol COI study reviewed here.

Before looking at how the total health care costs and alcohol's contribution to them are estimated, it is important to cover certain general issues that are particularly relevant for health care costs.

The section concludes with a short discussion of social care costs.

#### ***General Issues in Health Care Costing***

There is now strong evidence that *alcohol conveys certain health benefits* – particularly when consumed at low levels by older people – despite the large burden of disease it creates overall (Anderson & Baumberg, 2006). This evidence is increasingly being taken into account in cost studies, and the WHO costing guidelines recommend presenting the net costs (which take into account health benefits) alongside the gross cost estimates (Single et al., 2003). In the Swedish cost study (Johansson P et al., 2006), the net costs were about one third lower than the gross costs, which is similar to a parallel estimate from a Swiss study (Jeanrenaud et al., 2003). It should be borne in mind, however, that this net cost is distinct from the cost in a counterfactual situation in which everybody drinks at the lowest risk level.<sup>23</sup>

A greater problem when estimating health costs is what to do with future health costs (Anderson & Baumberg, 2006). More specifically, if people do not die from an alcohol-related cause, then they will ultimately die from a different cause instead – yet nearly all COI studies fail to take the health care costs for other causes into account. It is even possible that reducing the incidence of a disease may raise health care costs, if the disease prevented is fatal in a relatively short time and the diseases that eventually replace it lead to long periods of ill health that are expensive to treat (Bonneux et al., 1998; WHO, 2009:23). Rather than showing what health care costs would be if alcohol never existed, COI studies merely show how much is currently being spent treating alcohol-related diseases and injuries – which answers a different question. Whether to take into account future health costs – particularly “unrelated” health costs – has been a highly controversial topic in the economic literature, but this report will not try and review the entire debate here (see instead Liljas, Karlsson & Stålhammar, 2008; Lundin & Ramsberg, 2008; Drummond et al., 2008; Lee, 2008). We shall instead assume that most users expect that all costs – including future health costs – are considered in the calculation of the figures presented to them.

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<sup>23</sup> See Chapter 1 for a discussion of counterfactuals. In a counterfactual where no one drank at more than a low level, the Swiss study estimated that the net health costs would be only 11% lower than the gross costs in a counterfactual in which no one drank at all. Some people would not consider the latter scenario as the correct one to use in estimating the full gross social cost, since the net health costs in it are higher than the minimum. However, in the interests of having a consistent, workable counterfactual for all types of costs, it probably makes sense to use the counterfactual with no drinking at all in estimating health costs.

It is worth noting that there is a methodology that enables future health costs to be taken into account, known as the **demographic method** and implemented by a team in Australia (Collins & Lapsley, 2002). The demographic method creates a hypothetical population and disease structure that assumes people stopped drinking a long time ago, and then it estimates the health care costs for this new population. This method produces much lower estimates of the health care costs<sup>24</sup> – as we would expect – but these estimates are also more appropriate, given the use that is made of cost estimates. It makes sense for future researchers to use this method if possible, alongside the conventional method, for comparison with other studies on alcohol or on other health risks and conditions. It is worth repeating that the question that conventional cost estimates answer is different than the one answered by the demographic method, but meaningful in its own right; that is, how much does society currently spend treating diseases that are caused by alcohol?

Finally, it is worth noting that these methods do not deal with illicit alcohol and the possibly greater health risks that result from its use (Horlings & Scoggins, 2006).

### ***Estimating Alcohol's Contribution to Health Care Costs***

The most common way of estimating the proportion of hospital treatment caused by alcohol – and the one that was previously recommended (Single et al., 2003) – is to use epidemiological research to calculate the **alcohol-attributable fraction (AAF)** for each condition (i.e. the share of each condition caused by alcohol). This approach combines epidemiological evidence on the risks for particular diseases at different levels of alcohol consumption, with nationally representative data on how common different consumption levels are in that country. The usual data requirements for this method are a national survey of drinking behaviour and treatment statistics broken down by cause and condition (see discussion of alternatives to treatment statistics below). In the Swedish study the AAFs were also calculated for different age- and sex-specific subgroups (Johansson P et al., 2006). The demographic method mentioned above uses similar information but in a different manner, which is explained more fully in the various Australian studies (Collins & Lapsley, 2002, 1991, 1996).

It is possible to try and shortcut these data requirements by looking only at conditions that appear to be fully attributable to alcohol (e.g. alcoholic psychoses and alcoholic cirrhosis), and this shortcut has been adopted by several relatively quick studies with poor data availability (García-Sempere & Portella, 2002; Collicelli, 1996; Sesok, 2003). Yet as the Anderson & Baumberg review makes clear, it leads to substantial underestimates of the total cost of alcohol, as it ignores the whole range of conditions in which a causal role for alcohol has been established (Rehm et al., 2004; Gutjahr & Gmel, 2001). There are better ways of estimating the social cost of alcohol when data are few than to adopt an approach that by its very nature will produce a highly biased result.

With respect to the AAF method, there are two areas of methodological interest to consider in this subsection – estimating the numbers of people in different drinking categories, and estimating the relative risks for each condition at each level of consumption.

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<sup>24</sup> Unexpectedly, Collins & Lapsley also found that the health benefits of alcohol increase the total health care burden. This finding is presumably due to the fact that cardiovascular disease (which light drinking helps prevent) leads more directly to death than long-term disability does, and so preventing cardiovascular disease leads to a long-term increase in health costs.

### *Drinking Categories*

Nearly all cost studies use the results of national alcohol surveys in constructing prevalence figures for different categories of drinking. The Swedish study is interesting in several respects. First, the abstainers in the national survey it uses abstained from alcohol for the previous 30 days or more, rather than for the previous year or more as recommended by the global burden of disease studies (see Johansson et al., 2006:26). The study authors therefore use another Swedish survey as the basis for taking some people out of the abstention group and reallocating them among the three drinking groups. Second, the survey they use does not include people aged 80 and older; the authors therefore assume a constant decline in drinking levels from the 65–72 age group to the 73–79 group to the 80+ group. Both of these workarounds demonstrate the difficulty in obtaining accurate estimates of drinking categories for even a data-rich country like Sweden.

Most interesting of all, a sensitivity analysis in the study by P. Johansson et al. addresses the question of whether the underreporting of alcohol consumption in surveys makes a difference in estimating alcohol's contribution to health costs, using a method introduced by English et al. (1995). The authors take the number of cirrhosis deaths that are described as alcohol-related on death certificates, and they compare it to the number of cirrhosis deaths calculated as alcohol-attributable by the AAF method, finding that the AAF method appears to give a noticeable underestimate. To reconcile the figures, they adjust the prevalence of the consumption groups until the death certificates and the AAF method give the same results, and then they recalculate the costs of alcohol-related cirrhosis. It would be interesting to see the impact of recalculating alcohol consumption levels in this way for the entire study.<sup>25</sup>

While this approach may be valuable to try in sensitivity analyses, there are two main problems with it. First, countries already differ greatly as to when they record a fatal liver condition as being alcohol-related (Norström, 2001), and this recalculation may introduce new, unpredictable biases into the estimates. Second, most epidemiological studies will also suffer from underreporting of alcohol consumption since they are survey-based. If underreporting is solely the result of people in the survey underestimating their alcohol consumption, then the epidemiological studies will automatically take this into account and the adjustment will be invalid (unless the main reason for underreporting is coverage error). Nevertheless, the results of such an adjustment may still be informative when presented in a sensitivity analysis.

### *Relative Risks*

Due to the lack of sufficient epidemiological evidence within any one country, studies employing the AAF method use a review of the international epidemiological evidence on the risks for various medical conditions at different levels of drinking. The benefit of this approach is that these studies have determined how much alcohol consumption actually contributes to these conditions relative to other factors, leading to more accurate results. On the other hand, it seems likely that the relative risks associated with different levels of alcohol consumption vary from country to country, due to both different drinking patterns and different competing risks, as some of the studies note (Johansson P et al., 2006). To these relative risks, studies add the conditions that are considered to be always alcohol-related, i.e. conditions with an AAF of 100% (Leontaridi, 2003; Johansson P et al., 2006).

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<sup>25</sup> The authors only recalculate the costs for early retirement and long-term sick leave (which both use the same data – see below in the main text). They find a relatively small increase of 7% in these costs for their sensitivity analysis, but that may underestimate the change in other areas, given that the primary relevant categories for early retirement in the International Statistical Classification of Diseases and Related Health Problems, tenth revision (ICD-10) are by definition alcohol-related and therefore carry an AAF of 100%.

A more practical problem is that the state of epidemiological knowledge changes over time, which can make it difficult to compare different alcohol cost studies. For example, the Swedish study (Johansson P et al., 2006) uses relative risks that come primarily from a recent study in Canada (Rehm et al., 2006). To these Canadian relative risks they add corrections for heart failure, low birth weight and stroke – in each case for perfectly reasonable reasons, yet nonetheless making comparisons more difficult.<sup>26</sup> For depression, there are no established relative risks in the literature, so P. Johansson et al. use the estimate for the local subregion from the WHO global burden of disease study (Rehm et al., 2004), adjusting it to fit Swedish levels of alcohol dependence (given that alcohol dependence rather than alcohol consumption per se appears to have a causal link to depression). Alternate AAFs are used in the sensitivity analyses, partly due to concerns over errors in the relative risks for older age groups,<sup>27</sup> and partly to consider time-series analyses rather than conventional epidemiological studies.<sup>28</sup>

Epidemiological evidence is widely accepted for health conditions that are seen as primarily “biological”, but the same approach is not considered valid for more “socially” caused health conditions like traffic accidents, other accidents, suicide and homicide. Some studies – including otherwise relatively high-quality studies from France, Norway and Scotland (Kopp & Fenoglio, 2000; Gjelsvik, 2004; Guest & Varney, 2001) – omit at least one of these health conditions as a result, which biases their cost estimates downwards (Baumberg, 2006). Indeed, the Swedish cost study found that these socially caused health conditions accounted for over one third of the total medical care cost (Johansson P et al., 2006).

Other methods therefore have to be used to estimate AAFs for these conditions, methods that form an eclectic group. Their variety is aptly illustrated by considering how the Swedish COI study by P. Johansson et al. approaches them.

- *Motor vehicle accidents* are the most robustly estimated of these groups. The authors use the official Swedish statistics on alcohol-attributable deaths (though the statistics may underreport the true role of alcohol). It is not possible to disaggregate these statistics by age and sex, so the authors have modelled such a separation on the basis of a separate study in Finland. Research also suggests that the role of alcohol in fatal accidents is greater than in non-fatal accidents, so they multiply the mortality AAF by 2/3 to estimate the morbidity AAF (Rehm et al., 2004; Rehm et al., 2006).

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<sup>26</sup> The reasons for the adjustments, according to P. Johansson et al., are:

- low birth weight is excluded because it shows a U-shaped relationship with alcohol consumption, though there is no currently known biological mechanism for any protective effect;
- causality for heart failure was seen as unclear in Rehm et al., 2006, but an aggregate time-series analysis of Swedish data found no relationship; and
- Juergen Rehm changed the relative risks for stroke in a personal communication to the Swedish COI team.

<sup>27</sup> For example, alcohol is estimated to cause 81% of cardiac arrhythmias in the 80+ age group, which seems biologically implausible given the low levels of drinking in that group. P. Johansson et al. say that similar problems also show up for some of the health benefits of alcohol. (For a further discussion about why this might occur, see Johansson P et al., 2006:162–163, 205–206.) Excluding those age 65 and over from the analysis reduces health care costs by 14% but doubles the productivity costs of premature mortality.

<sup>28</sup> Time-series analyses are covered in more detail in the discussion of crime costs in section 2.2 below. However, it is worth noting here that the sensitivity analysis using time-series analyses of the relationship between overall alcohol consumption and particular harms suggests there is no relationship between alcohol and ischaemic heart disease (in contrast to the reduction in ischaemic heart disease associated with light drinking in the epidemiological literature). Assuming there is no relationship increases medical care costs by around 30%.



- *Injury and homicide AAFs* are taken primarily from a Finnish study, although it has substantial problems (it looks for mentions of alcohol diagnoses on forms recording cause of death). Morbidity AAFs were again adjusted downwards in accordance with the studies by Rehm et al., in this case reducing them by 4/9 for non-traffic accidents. The AAF for morbidity due to non-fatal violence was estimated in a completely different way, however, using the figures obtained from the crime costing (see section 2.2 below). It appears that these estimates are not very robust; when an older (1992–1996) Swedish study with broader injury categories was used in place of the more recent Finnish study in a sensitivity analysis, the medical care costs for injuries more than doubled. The sensitivity analyses also include attempts to estimate AAFs through time-series analyses, but as discussed in the next section on crime, they involve assumptions that are likely to be untenable.<sup>29</sup>

P. Johansson et al. also examine the effects of assuming that fewer data are available – a valuable effort to investigate whether the study would be replicable in less data-rich countries. They fill in the missing data by extrapolating from the AAFs for the local region in the WHO global burden of disease study (Rehm et al., 2004).<sup>30</sup> Overall, they find that the injury costs are similar to the ones they calculated for their main estimate, although it is difficult to isolate the effect of this one change given that these additional analyses also vary the other information available (as discussed below).

### ***Estimating Health Costs***

To treat health costs as a single type of cost is actually slightly misleading, as it represents a cluster of different costs within the health system. In many countries these costs includes inpatient care, outpatient hospital care, primary care, pharmaceuticals and ambulance services – and often in both state and private systems. Adapting the AAFs to each of these different types of cost can be a challenge, and it is rarely possible to estimate the costs consistently for every aspect of health care.

Usually, it is *the cost of inpatient care* that researchers spend most effort on estimating. In the Swedish study, the inpatient care cost combines the AAF for each relevant condition, as described above; the number of cases for each diagnosis (using existing national data); and the cost per diagnosis (based on data that were available in two areas of Sweden), excluding the costs of central health administration. P. Johansson et al. note that their cost-per-diagnosis data is unlikely to be nationally representative due to the nature of the areas they use, but there were simply no better data available.

What the Swedish COI study proceeds to demonstrate very well is how important the details of this method are. They do so by examining how their estimates would have turned out if fewer data were available. First, instead of using a cost per diagnosis, they assume that they would only have access to the cost of inpatient care for all diagnoses combined (i.e. instead of having a cost per case of liver cirrhosis and another cost per case of ischaemic stroke, they would simply have a single cost for all cases). They find that this method doubles the total inpatient cost – a remarkably large effect for such a simple and apparently reasonable change. Second, instead of calculating the number of cases and the cost per case, they use the number of days for each

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<sup>29</sup> The time-series analyses for homicide and suicide result in overall costs that are not very different from the main estimate. However, the time-series analyses for accidents produce implausibly high AAFs (90% of all accidents for women, 70% for men), and P. Johansson et al. accordingly exclude them from the sensitivity analyses.

<sup>30</sup> In the “small model”, the injury and homicide AAFs are missing, while for the “medium model”, national data are available on traffic accidents but not on other injuries.

condition and the average cost per day for all diagnoses. This approach yields a somewhat higher estimate (30% more) than the main (cost-per-diagnosis) method, suggesting that the much larger rise in the first alternative method is primarily due to variations in the length of hospital stays for different conditions, rather than to variations in the cost of treating them.

One refinement that has increasingly been included in health care costs is the *impact of alcohol-related comorbidity* – that is, for people who enter hospital for a cause unrelated to alcohol but receive a secondary diagnosis of an alcohol-related condition, the extra cost in comparison to people without such secondary diagnoses. As with the primary inpatient costs, the estimates for these comorbidities are sensitive to whether we look at individual conditions or at all conditions collectively. If we look at the comorbidity cost for each condition individually, taking account of comorbidity only increases inpatient costs by 7%. However, if we have less data and aggregate all conditions, then the comorbidity costs appear to be four times higher.

Besides inpatient costs, it is crucial to estimate *outpatient and primary care costs*. In the Swedish study they amount to 35% of the total health costs related to inpatient care, and the European COI review (using unpublished material available to the study author) similarly suggests that they account for 25–65% of the total health costs in the more comprehensive studies.<sup>31</sup> However, the data available for estimating such costs are usually worse than for inpatient costs. In the Swedish study, even determining the number of cases for the various diagnoses was a problem, and data were only available for a pilot project covering only some cases in a single region (Johansson P et al., 2006). Since no data on costs per diagnosis were available, P. Johansson et al. estimated a weighted<sup>32</sup> standard cost per episode across all diagnoses combined, based on a previous study. It should be noted that this standard cost per episode is the very method that led to such high overestimates for inpatient costs in the sensitivity analyses above.

*Other health care costs* are typically very difficult to estimate since they are not usually attached to any particular condition in the administrative records. For example, for pharmaceutical costs P. Johansson et al. can only include the cost of drugs that are usually used to treat alcohol dependence, and this cost turns out to be relatively small (2006). The Swedish study also looks at the costs of alcohol treatment within employer-based health care, but – perhaps predictably given the Swedish health care system – these costs also turn out to be relatively small.

## ***Treatment, Research and Prevention***

### ***Treatment***

The cost of helping people with alcohol use disorders to recover is often included in COI studies – it is usually easily identifiable and can be entirely attributed to alcohol, or at least a combination of alcohol and drugs. However, due to differences in treatment systems it is often difficult to separate these costs out from other types of cost; some countries include it as part of their health care system (and the cost is therefore covered above), while for others it is separate. As a result, the EU review paper finds it difficult to compare the treatment costs from different studies, noting that they are potentially large but highly variable among different countries (Anderson & Baumberg, 2006).

In Sweden, alcohol treatment is carried out by social services and is relatively easily to price. For adults, the total cost of substance treatment is readily available (although it reflects a slight

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<sup>31</sup> In less comprehensive studies, inpatient costs account for nearly all the health costs (65–99%).

<sup>32</sup> The cost was weighted for different types of resources and medical personnel.

under-coverage), and the AAF used by P. Johansson et al. (2006) comes from a single study that determined the proportion of all clients for whom alcohol was the main substance being abused. They found that in Sweden this cost is relatively large, comprising 13% of the total financial costs of alcohol, and that the cost is even higher if a proportion of the costs for treating people with both alcohol and drug dependence is included.

### *Research and Prevention*

Theoretically, all alcohol research and prevention efforts should be included in attributable cost studies, as in a world without alcohol there would be no expenditure in either area. In a CBA that includes intervention costs, the costs of these efforts would likely rise if effective policies were implemented. In practical terms, it can be extraordinarily difficult to estimate the money spent on alcohol research and prevention, as it is split among so many different organizations. The cost of school-based prevention was estimated in the Swedish study by assuming that 50% of alcohol, drug and tobacco education in schools was devoted to alcohol, while research estimates were based only on the most visible national organizations (Johansson P et al., 2006). The total cost of alcohol research and prevention was small and a likely underestimate – but an underestimate of uncertain magnitude.

### *Social Care*

#### *Social Services*

A small number of studies also estimate the cost to social services of looking after the welfare of children whose parents are alcohol dependent. In the Swedish study, the estimates were derived from a review of small-scale studies in which 10–45% of children's social services were attributed to parental alcohol or drug abuse. P. Johansson et al. use the midpoint of this range in their analysis, reduced by the proportion of substance abusers who mainly abuse drugs (as was done for treatment estimates). They find that the resulting cost is only marginally lower than the cost of treatment, accounting for 9% of the total financial cost. While it is possible that the costs are higher in Sweden than elsewhere, a Scottish study similarly estimates that 7–9% of the total financial cost of alcohol comes from welfare services (Guest & Varney, 2001), suggesting that omitting these costs introduces a significant downward bias (i.e. will lead to underestimates). Other social service costs have also been mentioned as theoretical possibilities for inclusion – such as supported accommodation (Collins and Lapsley 2002), elderly care and orphanages (Johansson P et al., 2006) – but they are not usually estimated in practice.

#### *Social Security*

As mentioned in Chapter 1, social security payments are transfer costs – they move money between different people rather than using up any resources. They therefore should not be included when looking at alcohol costs from a societal perspective, although they should be included in external cost studies, and in practice they have been included in several studies that lie somewhere between societal and external cost studies (Guest & Varney, 2001; Salomaa, 1995; Harwood, 2000). Note that the costs of administering alcohol-attributable social security payments should be included in attributable cost studies; while the Swedish study omitted it, it has occasionally been included in other studies (Harwood, 2000; Salomaa, 1995; Single, Robson & Xie, 1996).

## Crime

Recent studies have started to estimate alcohol-attributable crime costs in some detail, and have shown that they account for a significant cost burden. Compared to estimating health care costs, estimating crime costs is fraught with difficulty due to the complexity of the relationship between alcohol and crime, which also makes it difficult to apply international epidemiological evidence when calculating costs for a particular country.

### *Estimating Crime Costs*

#### *Costs in Response to Crime*

The first thing that comes to mind when thinking of crime costs are the costs of responding to crime – that is, the costs of police, courts and prisons as society’s organized reaction to actual crimes. These costs were estimated by 13 studies included in the European COI review (Baumberg, 2006; Anderson & Baumberg, 2006), and in at least 2 more since (Rehm et al., 2006; Johansson P et al., 2006). Sometimes the cost of administering insurance against crime is also included,<sup>33</sup> although the size of this administrative cost is not usually large (Collicelli, 1996; Johansson P et al., 2006).

In the Swedish costing, the costs of the criminal justice system were calculated from official figures for the costs of the police, the courts and prison (per day of imprisonment), figures that were all available disaggregated for most types of offences (Johansson P et al., 2006). To these costs, the authors added the administrative costs of the insurance industry, an estimate of the cost of breathalysing drivers (based on a previous study, and surprisingly large) and an estimate of the cost of dealing with public drunkenness (based on an English estimate). The latter estimate was necessary since the official Swedish statistics do not include cost breakdowns for the relevant offences.

Yet these costs comprise only one of three types of crime costs, as set out in a series of reports on the cost of crime in the United Kingdom (Brand & Price, 2000; Dubourg, Hamed & Thorns, 2005a). These reports describe why costs in anticipation of crime and costs as a consequence of crime should also be included. Moreover, while the costs in response to crime apply only to recorded crimes, these other costs also relate to the “dark figure” of unrecorded crime.

#### *Costs as a Consequence of Crime*

Costs as a consequence of crime are the costs that result from the crime itself, rather than society’s response to it. The most commonly estimated category of these costs is criminal damage, which – where it has been estimated for alcohol (Leontaridi, 2003; Salomaa, 1995; Muizer, Reinhard & Rood-Bakker, 1996; KPMG, 2001; Harwood et al., 1998) – is lower than the costs in response to crime, yet still sizeable. P. Johansson et al. did not estimate most of this cost in their study, although they did include the cost of arson and clearing up graffiti on school buildings.

Another cost that is often included is part of the value of stolen property. While some have argued that stolen property is simply a transfer between people and does not involve any intrinsic costs (Anderson & Baumberg, 2006), others have included it on the basis that goods resold

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<sup>33</sup> Payments made by insurance companies relating to the cost of criminal damage are covered in the present section under “Costs as a consequence of crime”. However, in external cost studies it is important to consider who pays criminal damage costs, given the redistribution of costs inherent in an insurance system.

through the informal economy are less valuable than goods in the formal economy (Prime Minister's Strategy Unit, 2004; Johansson P et al., 2006). The Swedish study uses the estimate from an Australian study (Collins & Lapsley, 2002) that goods are worth 43% less on average after being stolen. P. Johansson et al. require another assumption to determine the total value of stolen goods, this time an estimate from the United Kingdom of how much of the total value of insurance company payouts are due to theft rather than damage.

Other costs that are a consequence of crime include:

- health care costs for treating the victims of crime;
- support services for the victims of crime;
- labour costs for people who have to take time off work to recover from being a victim of crime;
- labour costs for those who would be working but are instead in prison due to their crimes; and
- labour costs for people who are killed but would otherwise be working.

The costs of health care due to crime are usually estimated as part of general health care costs (see previous section), and we will consider labour costs in Chapter 3. In general, though, all these costs are very difficult to estimate and are frequently omitted even from studies that attempt to estimate the total cost of alcohol-attributable crime. For example, the Swedish study excluded productivity losses for crime victims simply because of the practical difficulty in estimating them.

### *Costs in Anticipation of Crime*

Costs in anticipation of crime are the most-ignored type of crime costs, yet – at least in the first alcohol cost study to include them (Prime Minister's Strategy Unit, 2004; Leontaridi, 2003) – they are almost as great as the costs in response to crime. The category refers to those costs incurred in trying to prevent crimes from happening, in particular the cost of burglar alarms and security guards. P. Johansson et al. find it difficult to estimate these costs – partly because it is hard to know how much is spent on burglar alarms, but also because they find it impossible to estimate how much the security industry is actually focused on crime prevention. As a result, the Swedish study includes only minimal costs in anticipation of crime,<sup>34</sup> thus biasing its overall estimate of crime costs downwards.

### *The Role of Alcohol*

While it is often difficult to estimate the total costs of particular types of crime, the main problem in estimating alcohol-attributable crime costs is in estimating the role of alcohol. The first thing to decide is which crimes to consider as alcohol-related at all. Some studies look at all crimes (Collins & Lapsley, 2002; Salomaa, 1995; Easton, 1997; Gjelsvik, 2004; Guest & Varney, 2001; Leontaridi, 2003). Others by contrast look only at certain crimes that they expect to be alcohol-related, such as violence, property offences and crimes that are intrinsically linked to alcohol like drink-driving and public drunkenness (Johansson P et al., 2006; Collins & Lapsley, 2002; Pernanen et al., 2002).

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<sup>34</sup> P. Johansson et al. ignore security guards completely, looking only at the cost of subscriptions to burglar alarm services (and not the original purchase of alarms) (2006).

The second decision to make is choosing how to estimate how many crimes are committed while the perpetrator (or indeed the victim) is under the influence of alcohol. One subsidiary aspect is deciding how to handle perpetrators who were under the influence of both alcohol and drugs; some studies have excluded them (Anderson & Baumberg, 2006), while other COI studies have partially included them (Collins & Lapsley, 2002; Pernanen et al., 2002). More generally, several approaches have been taken to determine how many crimes to classify as alcohol-related:

- asking the victims of attacks whether they thought their attacker was under the influence of alcohol (Leontaridi, 2003);
- asking attackers, often when they are in prison, if they had drunk alcohol before an attack (Collins & Lapsley, 2002; Johansson P et al., 2006; Rehm et al., 2006; Single, Robson & Xie, 1996; Rice et al., 1990; Harwood et al., 1998);
- breathalysing (or performing other tests) on people who have just been arrested and brought back to a police station (Leontaridi, 2003);
- using police estimates of whether a person is under the influence of alcohol (which may be the approach used for arson in Johansson P et al., 2006); and
- using other, less transparent methods; specifically, two studies from the Netherlands and one from Belgium are based on a single piece of research, unavailable in English, that seems to produce implausible estimates (see Anderson & Baumberg, 2006).

Perhaps most crucial, however, is the final step in estimating the role of alcohol in crime: adjusting these associational figures to indicate the causal role of alcohol. Some studies simply give up on this, explicitly describing crime costs as being “up to” an estimated figure, conceding thereby that it is a maximum rather than an unbiased estimate (Leontaridi, 2003; Guest & Varney, 2001). Others have started to make efforts to generate unbiased (if imprecise) estimates, primarily by asking prisoners and arrestees if they thought the offence they committed was caused by their drinking (Collins & Lapsley, 2002; Pernanen et al., 2000, 2002). Pernanen et al. have found that this approach reduces the associational figures mentioned above by around 20–30%. However, it requires that we assume offender perceptions are accurate – a highly debatable assumption (Cohen, 1999; Room & Rossow, 2001).

The main defence for this approach is simply that there is little in the way of alternatives (Harwood et al., 1998) – or rather, that the alternatives that exist have even greater problems. The Swedish study (Johansson P et al., 2006) uses a time-series analysis by Norström (1998) for assault, which find that 40% of assaults are alcohol-related. However, the process of going from time-series analyses to AAFs is highly problematic, as it means assuming that there is a linear relationship between aggregate alcohol consumption and aggregate harms (e.g. assault) that can be extrapolated from the observed range of alcohol consumption down to no alcohol consumption at all (Rossow, 2001). Such an assumption is highly unlikely to hold, and the AAFs implied by time-series analyses are therefore sometimes entirely implausible,<sup>35</sup> which is why P. Johansson et al. reject elsewhere in their study the sick-leave AAFs implied by time-series analyses.

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<sup>35</sup> Strangely, the Swedish costing (Johansson P et al., 2006) suggests in some places that this method is the same one that was used in the English and Welsh COI study (Leontaridi 2003), and that the two studies’ AAFs can thus be compared (see for example Table 4.1 in P. Johansson et al. 2006). However, in their conclusion P. Johansson et al. correctly note that the latter study produced maximum estimates and did not use the AAF method.

In the end, it may be necessary to use some combination of these methods together with “reasoned judgement”. The WHO guidelines on estimating the cost of substance abuse simply state that any assumptions “should be backed up by a chain of logic and the best data that are available” (Single et al., 2003:42). For example, the Swedish study uses a time-series AAF for assault and then applies it to rape (an extrapolation that is slightly supported by small-scale studies) and graffiti on school buildings. The authors do not consider it valid to apply this AAF to theft, so for that they use figures from Canadian–American research with people who are arrested for theft and arrive at an estimated AAF of 20%. They then decide to halve this figure on the grounds that it applies to the number of offences rather than the value of the offences (on the assumption that alcohol-caused thefts are less likely to be professional and therefore less likely to involve high-value property than other thefts). Finally, they apply the resulting AAF for theft to all costs in anticipation of crime (Johansson P et al., 2006).

### ***Other Related Costs***

#### ***Drink–driving Damage***

COI studies that have been developed in the traffic accident field incorporate a greater range of costs than those typically estimated by alcohol COI studies, as can be seen in the two studies by Miller and others that look solely at alcohol-attributable traffic accidents (Miller & Blewden, 2001; Miller, Lestina & Spicer, 1998). The main non-labour financial cost here is the damage that results from drink–driving accidents – although the value-added from the manufacture and repair of cars due to accidents should be subtracted from the damage cost, on the assumption that the cars will be replaced or repaired (Horlings & Scoggins, 2006).

One of the EU review papers (Baumberg, 2006) reviews the estimates for drink–driving costs from several COI studies. However, few studies evaluate these costs with a transparent methodology – usually they use an AAF calculated for health costs and apply it to a costing of traffic accidents done by other researchers, making comparison difficult. Some studies lack the data necessary to estimate these costs; for example, they are entirely omitted from the Swedish study. Nevertheless, the sums involved can be significant.

#### ***Miscellaneous Other Costs***

There are several other costs that are either ignored in the studies that this report examines in detail, or have not been investigated by any alcohol COI studies. These overlooked costs include:

- the cost of organized crime with respect to the evasion of alcohol taxes (Horlings & Scoggins, 2006);
- the cost of fires caused by people who have been drinking – generally a very small cost, being only 1% of the total financial cost in the four studies that have estimated it (Rehm et al., 2006; Harwood et al., 1998; Salomaa, 1995; KPMG, 2001);
- the cost of alcohol-attributable litter, which a couple studies have estimated (Easton, 1997; Collins & Lapsley, 2002); and
- the cost of damage in workplace accidents that are attributable to alcohol. While workplace accidents impose a considerable cost throughout the EU (Eurostat, 2004), the one study to estimate the role of alcohol in them has found that it only adds 2% to alcohol’s total financial cost (Bergmann & Horch, 2002).

### 3. Labour and Productivity Costs

#### Recent Developments in Estimating Labour and Productivity Costs

The traditional COI methods for estimating labour and productivity costs are covered in the following sections. However, very recent WHO and EU reports have suggested severe problems with COI methods and presented new approaches to be used in their place (WHO, 2009; Suhrcke et al., 2008). This section describes the criticisms of the COI method, presents the new approaches and discusses whether these new methods can be extended beyond health problems to the full range of alcohol-related harms.

##### *Criticisms of COI Studies*

Both the WHO and EU papers are highly critical of COI studies – indeed, Suhrcke et al. do not discuss them at all, relegating their concerns to a footnote that sends readers elsewhere (2005:4n, 29). Several of the criticisms relate to poor-quality (though common) COI methodologies, which are dealt with in the relevant sections elsewhere in this report. For example, given that there are demographic changes that accompany economic changes, changes in GDP do not necessarily imply the same change in GDP per capita (WHO, 2009:38).

More significant is the observation that even well-conducted COI studies try to estimate only the labour costs that arise when an individual worker's productivity is reduced (described as “direct costs” in Weil, 2007). They do not account for more “indirect” effects, or the dynamic ways that effects in one area of the economy can have a ripple effect on the rest of the economy (WHO, 2009:32, 116; Suhrcke et al., 2008:38).

- People with better health may be more likely to invest in education and training, which increases growth (Suhrcke et al., 2008:5; WHO, 2009:38–39).
- People with better health will earn more on average, which can reduce the labour supply if they use their extra income to retire earlier, or increase the labour pool if the higher wages make work more appealing relative to leisure (Suhrcke et al., 2008:5; WHO, 2009:35–36).
- People with better health will need to save more for their (longer) retirement. This increase in saving will ultimately be matched by greater expenditure at older ages, but the short-term increase in saving levels may increase aggregate investment and thereby growth (WHO, 2009:36, 40–41).
- People with better health make a country, particularly a low- or middle-income country, more appealing to foreign investors (WHO, 2009:42).
- Changes in a society's age structures will affect growth (WHO, 2009:36).
- All of these alcohol-related effects – as well as the reduced productivity already estimated in COI methods – will have further impacts on the rest of the economy. For example, to the extent that they reduce demand, they may lead firms to reduce investment, which will in turn further deepen the decline in demand (WHO, 2009:35; see also Suhrcke et al., 2008:5).

Moreover, the health and crime costs described in Chapter 2 may also affect labour and productivity as money is diverted from uses, such as investment, that potentially enhance growth to paying for the costs of alcohol-related harm (WHO, 2009:33). Such diversions also need to be balanced against the value-added created in increased law enforcement, health care, etc.



(Horlings & Scoggins, 2006). For example, economists argue that higher government costs lead to higher taxes, which in turn lead to economic inefficiencies (known as “deadweight losses”) and additional labour and productivity costs. This mechanism has only recently been mentioned in the alcohol literature (Johansson P et al., 2006; Horlings & Scoggins, 2006), and P. Johansson et al. show that it could increase government costs (for health, criminal justice, etc.) by 30–130%. However, incorporating these processes into alcohol costing would require making some broad, crude assumptions, and while it would be possible to undertake more accurate calculations, they would be highly complex (WHO, 2009:21).

All in all, conventional COI studies are not a robust way to estimate labour costs.

### ***Alternative Methodologies***

The WHO paper describes three other kinds of model that can be used to estimate the labour costs caused by alcohol (the EU paper only mentions the first): regression-based growth models, calibration models and computable general equilibrium models. They are briefly described below; those wanting a more detailed discussion should consult the WHO and EU reports.

#### ***Regression-based Growth Models***

Offering the simplest alternative to COI methods, these models involve looking at the impact of health on economic growth in different countries or time periods. Typically they model health in terms of mortality rates or life expectancy, although some studies attempt to use morbidity indicators (Suhrcke et al., 2008:12). As with any other regression model, the better studies of this type introduce a standard set of controls and attempt to deal with biases such as reverse causation and other factors that influence both health and economic growth (WHO, 2009:43).

Regression models suggest that health has a large impact on growth in low- and middle-income countries. However, there are some indications that the impact on growth is much smaller in high-income countries, which may have methodological or institutional causes.<sup>36</sup> The evidence for the impact of particular conditions is also mixed, e.g. with malaria but not maternal health showing a strong impact on growth (WHO, 2009:45).

Despite their advantages – in particular their established methodology and ease of comparability – such studies have several problems. They tend to focus on mortality rather than morbidity; they often ignore methodological problems involving causality; and it is not at all clear which time lags to use, given that there are likely to be multiple causal pathways working at differing speeds (WHO, 2009:46–48). In general, “regression-based methods can produce valid if small estimates of the impact of disease on economic growth and are therefore likely to be of most relevance to measuring large health shocks (where there is sufficient data)” (WHO, 2009:101).

#### ***Calibration Models***

Calibration models begin with individual-level studies of the effects of health on income. These studies are then used in a macroeconomic model alongside national health indicators, which produces estimates of the effect of health changes on economic growth (WHO, 2009:49–51). “Calibration” refers to the use of individual-level studies to “calibrate” the parameter estimates

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<sup>36</sup> Methodologically, there is relatively limited health variation among high-income countries, which makes health appear to be a less important explanation for the variations in growth among them. Institutionally, high-income countries with established pension systems may find that an increasingly healthy workforce still works only until the traditional retirement age, and instead spend longer periods in retirement (Suhrcke et al., 2008:iii, 11–13).

in the structural model. These models are able to overcome the endogeneity problems of regression-based growth models (since they use a structural model), but they capture morbidity less well than mortality. The WHO guide summarizes them as “a tool that is pragmatic and flexible but depends more on assumptions and extrapolated data” compared to the regression-based models (2009:101).

### *Computable General Equilibrium (CGE) Models*

CGE models are a more disaggregated form of modelling than typical calibration models. They do not just focus on one sector of the economy (a partial equilibrium) but model the interlinkages among the different parts of the economy (a general equilibrium), which enables estimates for each part rather than just the economy as a whole. The CGE models are developed from individual agents to form a macroeconomic equilibrium, which requires considerable technical expertise and enormous data demands. As a result, they are unlikely to be feasible for most low-income countries (WHO, 2009:51–55). In general, WHO (2009:101) finds that: “CGE models offer the most complete assessment of market-based disease consequences, but would only be practicable to construct/apply in special cases”. Nevertheless, given its wide-ranging economic effects, alcohol may well be one such special case.

As with the calibration models, the parameters in CGE models need to be calibrated, generally using separate data from individual-level studies. The results of CGE models are highly dependent on these parameters. As a result, the *WHO guide to identifying the economic consequences of disease and injury* (2009:60–61) states:

... studies should take into consideration the several aspects of uncertainty surrounding current models, which relate to theory, measurement and specification. Any assumptions ... should be tested and validated through extensive sensitivity analysis. The results of sensitivity analysis should be documented and reported alongside the main results.

### ***Applying Alternative Methodologies to Alcohol***

The three methods described above were designed to estimate the labour and productivity costs of health, rather than of alcohol use per se. They can nonetheless be extended to alcohol by estimating the impact of alcohol on health using conventional techniques (Rehm et al., 2004), and then estimating the impact of this health on labour costs with these methods. There is however one major difficulty in applying them to alcohol: many harms are attributable to alcohol due to its impact on social rather than health factors. This difference leads to a number of practical problems.

To begin with, the alternate methods have not yet been able to consider the costs of alcohol-attributable crime, which account for a considerable proportion of total COI costs (Anderson & Baumberg, 2006). One possibility would be to model the impact of crime on GDP growth using regression-based growth models, and then use estimates of alcohol’s role in crime using traditional methods. However, it is unclear to what extent international crime statistics are comparable and robust enough to enable regression-based growth models; a demonstration study would be valuable here.

Another problem is that alcohol may affect labour productivity not via health but rather through drunkenness and hangovers (see section 3.2 below). One way of accounting for some of this mechanism would be to directly model the acute impact of alcohol on individual productivity, controlling for health, and then to use these parameter estimates in a calibration or CGE model.

Again, though, this technique has not been tried before, and a demonstration study is needed to determine whether it can be applied robustly.

Given these problems and unresolved research questions, it is difficult to recommend the use of these alternative measurement approaches until they have been successfully applied in practice. Current EU and WHO efforts are starting to apply these methods to alcohol, and it is hoped that they will demonstrate how future studies should be conducted. The following sections consider the traditional ways of estimating labour and productivity costs that can be used in the meantime.

### *Conclusion*

As indicated by the preceding discussion of alternative methods, this report is unable to recommend at this time their wholesale adoption by countries and subnational areas wishing to estimate the economic costs attributable to alcohol. Sections 3.2 through 3.6 therefore describe traditional COI methods for estimating labour costs, just as sections 2.1 and 2.2 cover conventional methods of estimating health and crime costs. Nevertheless, these alternative methods do overcome several key limitations of traditional COI methods, and researchers should try whenever possible to continue developing these new methods and to use them alongside traditional methods.

## **Productivity at Work**

This section is the first in this report to look at traditional methods of estimating labour costs, and thus it introduces a variety of issues that will – in different forms – prove to be important in the next few sections. In most health COI studies, labour costs comprise the largest single element of the total cost (e.g. Petersen et al., 2005). While not true for alcohol studies, because alcohol has much broader social effects than most other health risks, labour costs nevertheless account for a significant part of the total financial costs in many such studies.

### *The Role of Alcohol*

For most people, it seems common sense that alcohol would affect people's productivity when they are at work. People with hangovers are likely to do less work, while those who drink at work are likely to accomplish less and make worse decisions (Horlings & Scoggins, 2006). Whether ones asks drinkers (Jones S, Casswell & Zhang, 1995) or employers (Leontaridi, 2003), people believe that using alcohol in the workplace reduces workers' productivity. A low-quality survey in the United Kingdom suggests that people turn up to work hung over an average of about 2.5 days per year, and on these days they only work at around 75% capacity (reed.co.uk, 2004). Yet if one tries to estimate these figures more scientifically, it is very difficult to estimate the cost of such behaviour accurately.

The initial problem is that it is very difficult to measure productivity, outside occasional exceptions like assembly-line manual work. To get around this, economists usually use wages as a proxy for productivity,<sup>37</sup> on the assumption that the labour market works smoothly enough that productivity is reflected in people's pay. If one does so, though, in addition to finding that heavy drinking is usually bad for people's pay, one also tends to find that abstainers have lower wages than light drinkers (Tekin, 2004; Zarkin et al., 1998; Barrett, 2002; van Ours, 2004).

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<sup>37</sup> As the next section discusses, it has also been suggested that wages are a proxy for absenteeism, since workers who are absent more often are likely to be paid less.

However, it seems very unlikely that light drinking genuinely increases productivity – the beneficial health effects of alcohol are too small to explain this finding in the relevant age ranges. Perhaps better-paid workers are able to drink more, or perhaps the “sick quitters” – people who must stop drinking due to illness – have not been excluded and thus bias the results (Fillmore et al., 2006). Yet more sophisticated analyses are still unable to show the expected relationship between drinking and lower wages; instrumental variable techniques often produce implausibly large estimates (van Ours, 2004; Dave & Kaestner, 2002), while longitudinal analyses that control for unobserved factors in individual people find neither a positive nor a negative effect of any level of consumption on wages (Peters, 2004).

This group of studies creates obvious problems for researchers trying to estimate the productivity cost of alcohol in attributable cost studies (Baumberg, 2006; Johansson P et al., 2006), and some have argued that there is no empirical relationship between alcohol use and productivity (van Ours, 2004). There are two ways to respond to this argument. First, one can look instead at the relationship between alcohol use disorders (rather than alcohol consumption) and productivity, on the assumption that people do not “choose” to have an alcohol abuse disorder the way they choose their drinking level. In a simple model, this approach generally returns the “right” result – i.e. that people with alcohol use disorders have lower wages (Harwood et al., 1998; Johansson P et al., 2006) – yet there are reasons to doubt the validity of these estimates.<sup>38</sup> Other studies with limited data availability have nonetheless imported such findings (from the two studies named or similar, earlier American studies) into their own country (Rehm et al., 2006; Lima & Esquerdo, 2003; Nakamura, Tanaka & Takano, 1993; KPMG, 2001).

Second, it is possible to give up on using wages to look at the relationship between alcohol and productivity (Baumberg, 2006). The assumption that worker productivity is readily visible to an employer and reflected in wages is questionable (Rehm et al., 2006). More importantly, in a culture in which drinking is accepted, or even expected, there may be a workplace penalty for not drinking, as there is among the cantineras in Texas who see drinking as a workplace duty (Fernandez-Esquer, 2003). Yet rather than suggesting a positive effect of drinking on productivity, this observation appears instead to describe a workplace sorting mechanism, where people who went for drinks with colleagues were promoted above non-drinkers without any actual gain in productivity.<sup>39</sup>

Instead of looking at productivity through wages, it is possible to try estimate the effect of alcohol on productivity more directly. The low-quality United Kingdom survey mentioned above used workers’ self-reporting on productivity. If replicated in a higher-quality study, this approach would offer some basis for estimating some of the productivity costs of alcohol.

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<sup>38</sup> Looking more closely at Harwood et al., we see that the study finds a wage penalty for men who have suffered from alcohol dependence at some point, but not for men who have suffered from alcohol abuse, and not for any women at all. Moreover, the only way to find a statistically significant result for men was to avoid controlling for education in the model, on the assumption that one of the pathways by which alcohol dependence affects wages is via education. If this assumption is dropped – not least because the educational cost of alcohol is addressed elsewhere – then the authors find no significant effect of alcohol abuse or dependence on wages for either men or women.

While P. Johansson et al. do not use this approach to estimate a productivity cost for alcohol, they do note that people who have retired prematurely due to alcohol-related diagnoses had a lower wage than others (in unadjusted analyses).

<sup>39</sup> It is however possible that there is a genuine productivity gain in such situations from the increased social interaction among workers, which can make an organization function more effectively. See Chapter 5 on the benefits of alcohol.

However, there are other challenges involved in estimating the effect of alcohol on productivity, and it is therefore no surprise that many studies resort to arbitrary assumptions about productivity in different groups.

- A sensitivity analysis in the study by P. Johansson et al. (2006) finds an enormous productivity cost (about twice the main estimate for the total financial cost) when they use some arbitrary assumptions that have been commonly reported in the Swedish media.<sup>40</sup>
- The RAND study assumes a 25% reduction in productivity on hung over days (as in Easton, 1997), and assumes that each self-reported incidence of drunkenness would lead to a hangover (Horlings & Scoggins, 2006). These assumptions result in estimated productivity costs of around 0.004–0.300% of GDP.

In conclusion, no COI study seems to have produced a defensible estimate of the productivity cost of alcohol<sup>41</sup> – even though most researchers, policy-makers and “people on the street” would expect it be significant. To echo a call made almost 20 years ago (Cook PJ, 1991), it is necessary to conduct better analyses of the relationship between alcohol and productivity, rather than resorting to inconclusive or misleading analysis based on a poor proxy for this relationship.

## **Absenteeism**

Unlike productivity costs in the workplace, the costs of absenteeism have been estimated in several previous COI studies – simply because it is much easier to establish whether someone is absent from work than how productive he or she is when present.

### ***The Role of Alcohol***

When data have been lacking, one way to show the probable magnitude of absenteeism costs due to alcohol has been to use an arbitrary but plausible figure. The RAND study uses this approach, assuming that 5% of reported absenteeism due to “non-work related health problems” was due to alcohol (Horlings & Scoggins, 2006). While the RAND report argues that this estimate generates a very different cost figure than the EU review by Anderson & Baumberg (2006), the discrepancy in fact results from a calculation error by the RAND authors.<sup>42</sup> The EU review assumes that 4–6% of this type of absence is alcohol-related, which by chance is the same level that the RAND study arbitrarily assumes. Once the error is corrected, the figures tally. Besides arbitrary assumptions, there are four main ways in which alcohol’s role in absenteeism has been estimated in the studies covered by the EU review: employee surveys, relative risks and AAFs, time-series analyses and hospitalization/treatment days.

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<sup>40</sup> Apparently, the common estimates are “probably derived from US material” and otherwise unspecified, though they may relate to a study that is somewhat similar to the study by Harwood et al. critiqued above. The figures they use are a 5% annual productivity decline in risky consumers of alcohol, and a 25% decline in high-risk consumers.

<sup>41</sup> Several studies not reviewed in detail here attempt to estimate productivity costs (García-Sempere & Portella, 2002; Jeanrenaud et al., 2003; Jones AS & Richmond, 2006); readers should examine these first to see if any of these use a more defensible methodology.

<sup>42</sup> The RAND report uses data from the European Foundation for the Improvement of Living and Working Conditions. In taking the reported number of days absent from a 2003 report, Horlings & Scoggins assume that they are days absent per person reporting any absence (i.e. 4.2 days per worker among the 19–34% who reported any absence). Closer inspection of the raw Foundation data, however, reveals that the figure represents the average days absent among all workers (i.e. among 100% of respondents). The effect of the RAND error is to reduce the total amount of absence by around two thirds. Further details of this recalculation are available from the author on request.

1. Using a population survey that has data on both absenteeism and alcohol consumption, it is possible to look at the excess days absent among heavier drinkers (Leontaridi, 2003; Gjelsvik, 2004). P. Johansson et al. note that data enabling them to do this are surprisingly rare in Sweden, but they do find one study that includes self-reported absenteeism of either 1–7 days or 8–14 days (2006). In age- and sex-adjusted analyses, they find a linear relationship between drinks per occasion and the number of workers reporting 8–14 days of sick leave; however, they also find an inconsistent relationship between drinking levels and workers reporting 1–7 days' absence that is difficult to interpret. As a result, they only use the figures for 8–14 days' absence in their study and ignore the effect of alcohol on short-term absence.

The Swedish study also uses an older longitudinal (rather than cross-sectional) study from the late 1980s in a sensitivity analysis. Just as with the wage studies mentioned in the previous section, it shows that abstainers have higher risks of absence than drinkers, which they assume is due to the “sick quitter” effect. Even after excluding this effect, the sensitivity analysis still finds only half the level of the costs in the main estimate. Similarly, the English and Welsh cost study (Leontaridi 2003) uses a survey-based method but does not find a direct relationship between alcohol consumption and general absence. However, it does find more absences among people with alcohol dependence, along with an increased risk for absenteeism due to injuries among heavier drinkers.

While the employee survey method is in many ways the method that is most likely to produce accurate estimates, these studies demonstrate the difficulties involved in ensuring that confounding factors do not bias the results.

2. When data on sickness absence are available disaggregated by condition, it is possible to use the AAFs calculated for health costs and apply these to sick leave. While these data are rarely available for short-term absences, they are sometimes available for longer-term absences and disability pensions (Bergmann & Horch, 2002; Johansson P et al., 2006). In the Swedish study, this technique involves applying the AAF for cases of absence (episodes) to the number of days absent, which may introduce a bias similar to the one noted for inpatient costs in section 2.1. An alternative specification in the Swedish study restricts the analysis to the single condition of alcohol dependence and, unsurprisingly, finds a lower cost.
3. As discussed above in the section on crime costs, it is possible to use the relationship between national absence data and national alcohol consumption data to estimate the AAF for crime. This approach is used in one of the sensitivity analyses in the Swedish study, but it implies that 59% of male and 32% of female sickness absence is alcohol-related (Johansson P et al., 2006). These figures are implausibly high, being nearly 20 times higher those generated by the employee survey method, and they only serve to demonstrate the flaws of using time-series analysis in this manner. However, other studies have appeared in the literature more recently that do suggest time-series relationships between alcohol consumption and sickness absence (Norström & Moan, 2009; Johansson E, Böckerman & Uutela, 2009).
4. The fourth main way of estimating alcohol's role in sickness absence at work is to add up the number of days that people spend in hospital (and treatment) due to alcohol, a figure that has usually been determined in calculating the health care costs of alcohol. This method is the easiest to calculate and requires no additional data on health care costs, although one must adjust for the fact that many people who are hospitalized are not in

work. However, by its nature the resulting figure will be an underestimate, since much alcohol-attributable absence occurs when a person is neither in hospital nor in treatment

Although they have never been used in COI studies, there are in theory other ways to estimate the role of alcohol in absenteeism. For example, one small American study followed the same individuals over four weeks, finding that the relative risk of being absent was 10 times greater for individuals on the day after drinking (cited in Hensing & Wahlstrom, 2004). Although this study had other methodological weaknesses,<sup>43</sup> it demonstrates that there are creative possibilities for other approaches beyond the four main ones outlined here.

### ***Estimating Costs***

The cost of a day's work to an employer is conventionally estimated as the wage plus labour taxes,<sup>44</sup> but it should be borne in mind that this figure may be misleading, as the RAND report points out (Horlings & Scoggins, 2006). That is because there are "coping strategies" to compensate for employees who are absent (WHO, 2009:8). Most work tasks do not have to be done at a particular time by a particular worker, so in case of employee absence they can be covered by colleagues doing additional work (particularly in large companies), by the employee themselves when they return from absence or by cancellation in the case of unimportant tasks. Indeed, one study shows that only 25–30% of the costs of missed work remain after accounting for coping mechanisms, although the authors do note that these coping strategies may themselves lead to productivity losses, e.g. by needing to maintain labour reserves to reduce the risk of staff shortages (Jakob-Tacke et al., in a 2005 publication cited by WHO, 2009:123).

Ideally, one would assess the output of workers in different alcohol consumption categories, rather than the input of the time they spend at work. However, such estimates are often difficult (although not impossible) to make accurately, given the problems mentioned above of measuring productivity in many jobs. The new methodologies described in the next section can potentially address the costs of absenteeism due to the health-related impact of alcohol, but not due to alcohol's non-health impact, such as workers who stay home on a Monday morning because of hangovers. Furthermore, it is possible that – at least in the long term – even large companies will be able to reduce the costs of labour if they do not have to maintain labour reserves to cover the risk of staff shortages (WHO, 2009:123).

The best way forward would seem to be to develop the new methodologies to account for the health impact of alcohol on worker output, and to develop better studies of the corresponding non-health impact. While the new methods are being developed, and in the absence of any other methods for estimating the costs of absenteeism due to alcohol, the current convention of using wages plus labour taxes seems better than the alternative of excluding these costs altogether.

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<sup>43</sup> For example, alcohol consumption was reported retrospectively at two-week intervals, and the study did not ask about the quantity of alcohol consumed (or any other features) of the drinking occasion. Such weaknesses were enough for a systematic review to classify the study as "low quality", although it should be noted that only one study worldwide met the review authors' definition of even "medium quality" (Cook RL & Clark, 2005).

<sup>44</sup> As the RAND report makes clear, absence costs are equivalent to the value added by workers at the margin ('at the margin' means the value-added by the additional worker on top of all the other workers, which is generally assumed to be equal to their wages), rather than the average value added per worker (Horlings & Scoggins, 2006).

## Premature Mortality

Of all the labour costs due to alcohol, the premature mortality costs are usually the largest – and at the same time the most contested. This section describes the various assumptions used for premature mortality costs in alcohol COI studies, and suggests which ones are most plausible in most situations.

### *The Role of Alcohol*

The contribution of alcohol to premature mortality costs can be simply estimated using the same AAFs that have been calculated for health care costs, noting the difference in the morbidity and mortality AAFs mentioned in the discussion of those costs in section 2.1. There are no additional issues to address beyond those discussed there.

### *Estimating Costs*

#### *The Human Capital Method*

The conventional way of estimating the cost of an early death – often called the *human capital method* – is to estimate how much economic value a person would have created if he or she had instead lived to an average age. This estimate combines two approaches: a prevalence-based one (current deaths due to past drinking) and an incidence-based one (the future costs of current deaths). This combination can be confusing, and it is inconsistent with the calculation of other costs in an attributable cost study, which generally use a method that is purely prevalence-based (Johansson P et al., 2006; WHO, 2009:23).

The human capital estimate is based on two different figures: first, the value that a person who dies prematurely would have created in a single year, usually estimated as the wages plus labour taxes of an average worker, often an average worker of the same age and sex as the decedent; and second, the number of additional working years that that person could have been expected to live, based on average life expectancy, again for a person of the same age and sex (Johansson P et al., 2006). Often the second figure is based on the official retirement age, which does not take into account the fact that many people retire before reaching that age.

#### *Human Capital versus Friction Costs*

By the late 1990s, it was becoming clear that the human capital method was based on a highly dubious assumption: that a society is characterized by full employment, such that people who die are absolutely irreplaceable in the labour market (Koopmanschap, 1998; Maynard, Godfrey & Hardman, 1994). This assumption is a clear overstatement, as it is more likely that some of the working people who die prematurely are replaced by people who would otherwise have been unemployed. If we go so far as to assume that everyone in the workforce who died prematurely would be replaced, then the only cost is the *friction cost* of replacing workers, which primarily consists of the time it takes to recruit a new worker (Koopmanschap et al., 1995). Several studies have compared the human capital and friction cost methods, finding that the friction cost is often just 1–3% of the human capital estimate<sup>45</sup> (Danish Ministry of Health, 1999; Rehm et al., 2006) and thereby demonstrating just how important such assumptions are.

Yet the friction cost method has been criticized in turn for requiring predictions of macroeconomic variables that are highly inaccurate (Tarricone, 2006), and for making

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<sup>45</sup> Based on a three-month frictional period before the worker is replaced; see the next paragraph.



unwarranted assumptions that cause it to be an underestimate (Johannesson & Karlsson, 1997; Birnbaum, 2005; Godfrey, Parrott & Ghodse, 2005). For example, it is necessary to guess how long the frictional period is; assuming that there will be a 3-month gap instead of a 12-month gap before a worker is replaced leads to a cost estimate that is only a quarter of the size (Johansson P et al., 2006). More importantly, the friction cost ignores the cost of people who cannot be replaced by currently unemployed people, the chains of vacancies that are likely to arise when replacing workers with people employed elsewhere, and the cost of training new workers. The true cost is likely to lie between the two estimates, but it is difficult to be more precise as to exactly where.

### *Future Resource Use*

In the section on health care costs, we saw that there were conflicting views as to whether to take future health costs into account (i.e. the costs of treating people who would not die of alcohol-related diseases in a counterfactual world). A parallel issue arises for premature mortality costs, in that people use resources as well as generate them throughout their life, and it is unclear whether the resource utilization that early death prevents should be taken into account. Indeed, one influential study estimates that American residents older than 55 will use up more resources than they create over the remaining course of their lives (Meltzer, 1997). Such concerns may be particularly important in the current political climate, with its worries about how to fund pensions of an ageing population (Horlings & Scoggins, 2006).

There are two ways to address this issue. One is to use the conventional method, but to create a separate estimate of the annual value of resources used by people of different ages (Jeanrenaud et al., 2003). The other is to adopt the demographic method and create an entire counterfactual population structure, as discussed in section 2.1 above (Collins & Lapsley, 2002). In the two alcohol costing studies that tried one of these methods, the total premature mortality cost was reduced by around 30%, although in a sensitivity analysis of the Swedish costing (Johansson P et al., 2006), it surprisingly appeared that taking future utilization into account raised the total social cost. It is worth pointing out that the actual results are unlikely to have more than a slight impact on pension funding problems; the RAND report notes that alcohol deaths strike only 0.1% of the labour force each year, while the present author's recalculations of figures in Collins & Lapsley's 2002 study suggest that the Australian old-age dependency ratio<sup>46</sup> would only be 0.7% higher in a world where alcohol had never existed.

### *Other Issues in Estimating Costs*

Many additional choices and assumptions can have large effects on the magnitude of premature mortality estimates, including: non-workplace costs, the conditions included, relative risks and disease codes, and discount rates.

- An increasing number of studies attach a value to production outside the workplace, such as housework and voluntary work (Danish Ministry of Health, 1999; Easton, 1997; Kopp & Fenoglio, 2000; Harwood et al., 1998; Rehm et al., 2006; Leontaridi, 2003). Such production can often be difficult to estimate, as an estimate requires national data on

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<sup>46</sup> The old-age dependency ratio is simply the ratio of the economically active population to the economically inactive population (i.e. the ratio of those aged 15–64 to others). While its use as a measure has been strongly critiqued (Calasanti & Bonanno, 1986), it does give us a sufficient idea of the impact of alcohol on the national demographic makeup.

productive activities outside the workplace.<sup>47</sup> In the Swedish study it makes no overall difference to the total cost (Johansson P et al., 2006),<sup>48</sup> but elsewhere the costs involved have been substantial, if not on the scale of the conventional calculations of premature mortality costs.

The main problem with non-workplace costs is that they are non-financial and therefore completely different from the other cost components (Collins & Lapsley, 2002). They should therefore be excluded from the financial cost estimates (as in Anderson & Baumberg, 2006) but incorporated (without double-counting) in the full economic welfare costs.

- Even more than for health care costs, premature mortality costs depend heavily on the inclusion of a full range of alcohol-related conditions, particularly injuries. In the study by P. Johansson et al. there is an overall saving due to premature mortality caused by alcohol-attributable chronic conditions. It is only when alcohol-attributable injuries were considered that premature mortality becomes a cost (2006).
- Estimates based on more limited data in sensitivity analyses in the Swedish COI study show that different relative risks and disease codes can have noticeable effects on premature mortality calculations (Johansson P et al., 2006). Using the subregional AAFs for injuries from the WHO global burden of disease study (Rehm et al., 2004) lowers the premature mortality cost by one third, while using less detailed disease codes raises it by the same amount.
- Unlike the friction cost method or the demographic method, the human capital method requires us to value future costs of current deaths. Because people value €100 today more highly than €100 in 10 years' time, it is therefore necessary to "discount" future costs to create a total value in the present. The parameter determining how much future costs are to be discounted is called the discount rate. WHO guidelines suggest that discount rates of 5% and 10% be used in all studies to facilitate comparison (Single et al., 2003). However, the EU review (Anderson & Baumberg, 2006) found that six studies only look at a single discount rate each (using five different rates overall), and that even studies comparing different discount rates have little overlap and rarely use both of these suggested values. P. Johansson et al. compare rates of 0%, 3% (their preferred rate) and 6%, and find enormous differences in the estimates produced: compared to the 3% main estimate, a 0% rate quadruples the cost while a 6% rate makes it only a twentieth of the cost. In addition, it is necessary to estimate future productivity growth, which will have similar effects on the resulting estimate, alongside the discount.

## Unemployment and Retirement

The issues raised for the cost of people claiming unemployment benefits and disability pensions are similar to those raised in the sections on the costs of premature mortality and absenteeism.

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<sup>47</sup> For example, P. Johansson et al. base their estimate for the time spent doing housework on a Swedish time-use survey. They then value the estimated time spent on domestic work according to how it is valued by the market (the replacement cost principle recommended by Gold et al., 1996, and Single et al., 2003, as cited in Johansson P et al., 2006). In concrete terms, this approach means that they base their main estimate on the lowest union wage for cleaners, while basing a sensitivity analysis on an estimate of how much private cleaners receive.

<sup>48</sup> The lack of any net difference is due to the health benefits among women – i.e. the non-workplace costs from premature deaths attributable to alcohol are balanced by the non-workplace benefits of preventing such deaths from occurring at older ages.

### ***The Role of Alcohol***

Only a limited number of studies have tried to estimate the contribution of alcohol to unemployment. These efforts are based on the finding that heavy drinkers usually have a higher unemployment rate than other people. Assuming that statistics on the association between unemployment and heavy alcohol consumption are available, there are two further issues to address in making these estimates.

First, some studies show that abstainers are more likely to be unemployed than light drinkers (Johansson P et al., 2006). Given the lack of any plausible causal mechanism, such findings are likely to be due to the sick quitter effect (see section on productivity above), but they still cause problems for estimating alcohol's role in unemployment. To get around them, most studies assume that they should only look at people with alcohol use disorders, on the assumption that the effect of alcohol on unemployment occurs primarily through the impact of addiction. The Swiss study by Jeanrenaud et al. (2003) uses the lowest addiction threshold among the various studies, defining addicts as men who drink more than six glasses of alcoholic beverages per day and women who drink more than four. Most other studies look only at people showing signs of clinical alcohol disorders.

Second, excess unemployment among those with alcohol use disorders is not likely to be solely due to alcohol; those with alcohol use disorders are likely to be different from other people in many ways, some of which may also affect unemployment rates (e.g. low levels of education). This clustering of factors is often called *selection bias*, which in this case refers to the types of people who are "selected" for suffering from an alcohol use disorder. In the absence of any further information, some cost studies use the available but naively biased estimates of excess unemployment due to alcohol (Guest & Varney, 2001), while some others make arbitrary assumptions as to the causal extent of the relationship (KPMG, 2001; Easton, 1997).

A common and more robust way of estimating the causal role of alcohol in unemployment is to conduct a properly specified regression analysis that takes potential selection biases into account. Of the few COI studies that have referred to or conducted such regression models, some found a correlation with alcohol consumption or dependence and some did not (Horlings & Scoggins, 2006; Prime Minister's Strategy Unit, 2004). A United States study undertook a new analysis specifically to estimate such costs, but found no effect and therefore estimated a zero cost (Harwood, 2000).

This uncertainty creates a problem for those who want to estimate the role of alcohol in unemployment. Where the data have been sufficient to attempt a determination of what this role is, researchers have found mixed results. If the studies that have found a causal effect are correct, then the true cost in this area is substantial. Further research is needed to elucidate the causal mechanisms with more confidence, particularly for studies in countries that lack the data to enable regression models of their own.

### ***Disability Pensions and Early Retirement***

As with unemployment benefits, abstainers are sometimes more likely to claim a disability pension than light drinkers (Horlings & Scoggins, 2006). However, disability data often include something that unemployment data do not: epidemiological evidence on the association between alcohol consumption and the particular medical causes of disability. In Sweden, where disability claims use the same disease codes as the health care system, P. Johansson et al. have been able to

use the relative risks for morbidity, taking into account the protective effect of alcohol (2006). Although they did not include the possibility of any causal relationships between alcohol and disability beside the effect of alcohol on health, they nevertheless found that the resulting costs were considerable – greater than the health care costs – and not unduly affected by the assumptions they used.<sup>49</sup>

### ***Estimating Costs***

Estimating the alcohol-attributable costs of unemployment and disability pensions is usually done in a way very similar to estimating those for premature mortality. Specifically, one estimates average wages plus labour taxes, and then uses the number of years that the person could have been expected to work were it not for his or her alcohol-attributable condition.<sup>50</sup> Unsurprisingly, the problems of these conventional estimates are the same as the problems we have already seen above.

To begin with, this approach is usually inconsistent with the prevalence-based approach used for most other costs. Second, it assumes a situation of full employment in which these workers are irreplaceable; it would be equally possible to use the friction cost method on the contrary assumption that everyone is replaceable. Third, the estimates are highly sensitive to the assumptions made; for example, changing the discount rate in an incidence-based approach will have a large impact on the estimated cost. Finally – and probably even more likely for these costs than for other labour costs (Horlings & Scoggins, 2006) – these estimates assume that workers with alcohol use disorders would otherwise be (in our counterfactual world) as productive as the average worker. Given the other risk factors associated with alcohol use disorders (e.g. low educational levels and mental health problems), we can expect that this assumption is not valid and leads to overestimating the total cost.

### **Other Labour Costs**

The previous chapters have covered the major types of labour costs due to alcohol: reduced workplace productivity, absenteeism, premature mortality and non-employment. However, there are several other types of potential labour costs to consider, some of which have been included in existing studies, and others that have only been mentioned as possibilities.

#### ***Reduced Time to Work***

In addition to the ways discussed above, there are another two ways in which alcohol is likely to reduce the time available for people to work. First, people imprisoned because they committed alcohol-attributable crimes will not be working (Collins & Lapsley, 2002; Harwood et al., 1998; Salomaa, 1995), thereby incurring costs similar to those of people receiving unemployment and disability pensions due to alcohol. For example, the Swedish study combined the number of people imprisoned for alcohol-attributable offences with an estimate of what an average man

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<sup>49</sup> P. Johansson et al. vary the discount rate and injury AAFs without finding large differences in the estimates produced. See the discussion of premature mortality costs in the previous section for further details on discount rates. They also do a separate analysis that looks only at conditions that are defined as alcohol-related (e.g. alcoholic cirrhosis, alcohol dependence), finding a cost that is similar for reasons that are not altogether clear.

<sup>50</sup> In an externality study, the relevant cost is instead the transfer cost of paying for disability pensions. This is usually a lower cost than the COI estimate, as disability benefits are usually set at a lower level than the average wage. The same is true (albeit often to a lesser extent) for early retirement.

aged 30–49 would produce over the rest of his life (Johansson P et al., 2006). Such estimates need to address the same issues covered in the previous section.

Second, people who are affected by other people's drinking are also more likely to miss work or receive a disability pension. Their situations may involve costs that are very rarely included in COI studies, such as time spent giving evidence (Johansson P et al., 2006) or caring for others disabled due to drinking (Collicelli, 1996). More commonly – and probably also more significantly – alcohol cost studies can estimate the working time lost by victims of drink-driving accidents (Horlings & Scoggins, 2006)<sup>51</sup> or alcohol-attributable violent crime (Rice et al., 1990; Leontaridi, 2003).

### *Inefficiencies at Work*

Alcohol-attributable traffic accidents can lead to congestion and therefore add to the economic cost of transport (Horlings & Scoggins, 2006; Miller, Lestina & Spicer, 1998; Miller & Blewden, 2001). Another potential effect on productivity is through alcohol-attributable workplace accidents. The effect of accidents caused by alcohol has never been estimated, but the effect of workplace accidents more generally has been estimated (Eurostat, 2004).

### *Education*

While the notion is contested and the research evidence for it inconsistent, it is conceivable that alcohol – and in particular, heavy drinking or alcohol use disorders – may adversely affect educational experiences and ultimately educational qualifications, through reduced study, increased truancy and even expulsion (Bray, 2005; Horlings & Scoggins, 2006). Such effects could diminish the skills of the labour force, reduce the human capital available and lead in the end to labour costs.

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<sup>51</sup> Horlings & Scoggins estimate this cost for the EU based on the number of injuries due to alcohol-attributable traffic accidents. They then combine this with GDP per employee and employment rates. Finally, they look at three different plausible estimates of how far victims' productivity is affected in the year after an accident (10%, 25% and 50%). However, without further data these estimates are only imprecise approximations of the true figure.

## 4. Non-Financial Welfare Costs

### Pain, Suffering and Lost Life

Non-financial welfare losses include costs – such as pain, suffering and loss of life – that usually do not have a market price, and their recent inclusion in alcohol cost studies is slightly controversial in three respects. First, there is the issue of whether they should be assigned a monetary value at all. For some people, the idea of putting a price on life is too weighty a responsibility to be treated as a technical matter (Hurlings & Scoggins, 2006; Single et al., 2003). Second, non-financial welfare costs are frequently misinterpreted as financial costs, as described in Chapter 1.

Finally, even among economists themselves, the question of how to accurately measure how much people value life, pain, etc. is also problematic (Johansson P et al., 2006). Economists have developed standard methodologies for estimating non-financial welfare losses, primarily based on people's *willingness to pay (WTP)* to achieve or avoid given outcomes. It can be estimated by examining people's real-life decisions in similar areas (*revealed preference* approaches) or by using population surveys to ask them to make hypothetical decisions that balance risks and consequences (*stated preference* approaches). While these losses are therefore less difficult to estimate than in the past, several practical problems with WTP approaches remain, as this section will discuss.

Despite these problems, economists are increasingly trying to value the non-financial consequences of disease, primarily because economic recommendations otherwise treat such losses as worthless. For example, the human capital method values life in terms of potential productive work rather than as having any intrinsic value (Single et al., 2003). Since economic estimates often receive greater attention from policy-makers and the public than studies of health or crime consequences, areas that are not quantified monetarily may be marginalized in political debate (Johansson P et al., 2006).

As a result, it is recommended that non-financial welfare losses be considered in costing studies, but that they be explicitly separated from financial costs to make it clear that they are a very different type of cost (see Chapter 1). This section considers several different types of non-financial welfare losses that are linked to alcohol. (For discussion of whether these losses are internal or external, see Chapter 6).

### ***Health Impacts***

As with other costs, this calculation requires two pieces of information: the impact of alcohol on health, and a value for this health impact. The health impact of alcohol itself is relatively simple to estimate – and if the premature mortality and health care estimates have been made, it already exists for each health condition. (See Chapter 2 above.) That holds true for both the conventional approach and the demographic approach of Collins & Lapsley (2002).

The health impact then needs to be combined with a valuation for a year of healthy life – a particularly difficult task.

### ***Valuing Healthy Life***

It is possible to value particular health conditions that are related to alcohol. For example, there is one COI study (Pellegrini & Jeanrenaud, 2003; Jeanrenaud et al., 2003) that asks people how

much they value living in good health as opposed to living with certain alcohol-related health conditions. The investigators then combined the resulting valuations for each condition with the risk of suffering from it due to alcohol.

A less demanding and more flexible – and hence much more widespread – approach is to convert the various health impacts into a common health unit, and then apply a fixed monetary value to each unit. (It also enables one to express non-financial welfare impacts in terms of these units rather than in monetary units, as P. Johansson et al. have done (2006).) While the common health unit can be simply deaths, for alcohol it is probably better calculated as years of (healthy) life lost. That is because in some countries, alcohol causes deaths at younger ages and prevents deaths at older ages. If we assume that years of healthy life are valuable, then looking only at mortality leads to a systematic underestimation of non-financial losses (e.g. see Johansson P et al., 2006, in which alcohol causes the loss of 25 000 healthy years but prevents 850 deaths).

The most common unit for measuring healthy life years is the *quality-adjusted life-year* (QALY). A year in which the quality of life is perfect is assigned a base value of 1.0, and years in other states are assigned values relative to the base.<sup>52</sup> For example, if a year living with alcohol dependence is assessed as having a QALY value of 0.6, that means that 6 years of perfect health are worth 10 years of alcohol dependence. Numerous studies in health economics have attempted to produce financial valuations of QALYs, using the WTP techniques mentioned above.

However, both the revealed valuation and the stated preference approaches to measuring QALYs encounter severe problems in practice (WHO, 2009:57–59). For example, the assumption that a QALY has a fixed value that can be applied in different contexts, times and places is questionable; research has suggested that QALY valuations vary according to an individual's wealth, age and family status, as well as baseline levels for a given risk, changes in the risk, moral responsibility for it and whether it is public or private (e.g. the risk associated with wearing seat belts versus that associated with various elements of the road system) (de Blaeij et al., 2000; Dolan et al., 2003; Hammitt, 2002; Bateman et al., 2003).

This variation creates substantial problems in deciding which monetary valuation of a QALY to use in alcohol COI studies. P. Johansson et al. use a Swedish valuation survey that assigns a QALY a value of SEK 340 000 (about €35 000), whereas the Swedish Pharmaceuticals Board seems to use a threshold of SEK 500 000 (€55 000). In the United Kingdom, the National Institute for Clinical Excellence (now the National Institute for Health and Clinical Excellence) used an implicit threshold of £30 000/QALY (€45 000), which is similar to a “back-of-the-envelope” calculation in another study that generated QALY estimates from research on the non-financial value of lost life (Baker et al., 2003). However, the value the Government has adopted in looking at crime (discussed later in this section) is equivalent to what £81 000 was in 1997 (€125 000), based explicitly on research that looks at modest losses of life in a way that is consistent with the use of QALYs.

There is therefore substantial disagreement about the appropriate monetary value of QALYs (WHO 2009). The WHO guide to identifying the economic consequences of disease and injury therefore recommends only using monetary equivalents of QALYs for estimates that are impossible to make by other means (WHO, 2009).

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<sup>52</sup> A key feature of QALYs is that the weighting assigned to different health statuses are derived from public sentiment, rather than the opinion of medical professionals.

### ***Non-health Impacts on Drinkers***

Until recently, there have been no data that would enable us to make robust estimates of how much worse the quality of life is for those who suffer from alcohol use disorders. That changed with an American WTP study asking people how much time they would be willing to trade for time spent under different conditions (Kraemer et al., 2005). The study finds that in their sample, the median person values his or her quality of life as an abstainer or a moderate drinker more highly than as a hazardous or a harmful one. Although the study is small and does not represent the American population, let alone more broadly defined groups, it enabled P. Johansson et al. to apply a weighted combination of its quality-of-life scores to their “hazardous consumption” group to estimate the non-financial welfare losses in drinkers’ quality of life for the first time (2006).

The problem with including these estimates is a twofold problem of double-counting. First, the quality-of-life estimates by Kraemer et al. may include some valuations of health-related quality of life, which has usually been estimated already using the QALY method. Conversely, it is by no means universally accepted that QALYs are a measure of health-related quality of life and nothing more; there are ongoing disagreements among health economists as to whether people take into account the pleasure of consumption when weighing the value of additional periods of life or of good health (Lundin & Ramsberg, 2008; Liljas, Karlsson & Stålhammar, 2008). Both debates are linked to the question of whether to count the future consumption of people who die prematurely as a cost, since it involves future utility that is not realized (Richardson & Crowley, 1994:83).

### ***Impacts on Victims of Crime***

Reduced quality of life in victims of crime is another non-financial cost, in this case due to another person’s drinking. While several recent studies have made estimates in this area (Johansson P et al., 2006; Gjelsvik, 2004; Leontaridi, 2003), they are all based on versions of a continuing strand of research conducted on the general cost of crime in the United Kingdom (Brand & Price, 2000; Dubourg, Hamed & Thorns, 2005b). The earlier (and by the authors’ admission makeshift) version formed the basis of the English and Welsh alcohol COI study (Leontaridi 2003),<sup>53</sup> but the more robust and sophisticated later version that was the basis for the Swedish COI study is considered here.

The approach was developed by Dolan et al. in work commissioned by the United Kingdom Home Office (2003), and it is summarized in a Home Office paper (the later version of the two studies just mentioned – Dubourg, Hamed & Thorns, 2005b). Dolan et al. use various United Kingdom sources to estimate the frequency of the different health impacts of violent crime, including both physical impacts (e.g. broken bones) and psychological impacts (e.g. depression, anxiety).<sup>54</sup> They then use the WHO global burden of disease study (Rehm et al., 2004) to estimate how long such health impacts are likely to last, and how far each one affects the health-

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<sup>53</sup> Brand & Price base their estimates on a study from the United Kingdom on the non-financial welfare consequences of traffic accidents. They apply these impacts to crime impacts by making rough equivalences between them, e.g. that serious violence is similar to a serious road traffic accident. As Brand & Price admit, however, these approximations are likely to be highly inaccurate, and they only intended the substitutions as a temporary solution while the Home Office commissioned more detailed research that would enable more robust estimates.

<sup>54</sup> Other psychological impacts considered include post-traumatic stress disorder (PTSD), drug and alcohol abuse, suicide, acute stress disorder and sexual dysfunction.



related quality of life as measured in *disability-adjusted life-years* (DALYs), units that like QALYs are designed to measure disease burden. Dolan et al. thus only measure the health-related impact of crime on quality of life, ignoring other non-financial welfare impacts.

Their approach is adapted for the Swedish situation by P. Johansson et al., who focus specifically on alcohol by taking the average DALY effect for each crime and multiplying it by the frequency of the various alcohol-attributable violent crimes in Sweden, using the AAFs already determined for the financial costs of crime (2006). They clearly assume in doing so that the health impacts of crime are the same in Sweden as in the United Kingdom. It should also be noted that such estimates will produce different results if adjusted for “hidden” crimes – that is, crime that are not reported to the police. This adjustment was not made in the Swedish study on the grounds that the main crime costs are the financial costs to the criminal justice system, which only occur for recorded crimes, but other studies (Gjelsvik, 2004; Leontaridi, 2003; Dubourg, Hamed & Thorns, 2005b) include the adjustment on the grounds that the non-financial impacts of hidden and recorded crimes will be similar.

Finally, as with many other non-financial welfare losses, estimating the impact of crime on crime victims runs a high risk of double-counting. To the extent that the health impacts of crime have already been incorporated in QALY or DALY estimates, the non-financial health costs have already been accounted for.

### ***Impacts on Drinkers' Relatives***

Similarly, the impact of alcohol on a drinker's relations has only recently begun to be investigated in alcohol cost studies. The Swedish study made a major effort to ensure that these losses were included, designing a new telephone survey that measured general quality of life – including the respondent's physical health, mental health, social relationships and environment – using a validated questionnaire, the short version of the WHO quality-of-life (WHOQOL) instrument, the WHOQOL-BREF (Johansson P et al., 2006). Each person who responded also answered a question about whether they shared a household with someone who had a drinking problem, or whether someone close to them outside their household had a drinking problem. (Respondents were left to define “drinking problem” for themselves.) From the responses, P. Johansson et al. established that people who share a household with someone who has a drinking problem have a significantly lower quality of life than people who do not, and that there is also a slight effect among people who know (but do not share a household with) someone with a drinking problem. Finally, they combined the quality-of-life results from different domains (physical health, mental health, social relationships and environment) into a single score that they treated as a QALY score,<sup>55</sup> and by multiplying the QALY cost of living with someone with a drinking problem by the prevalence of this situation,<sup>56</sup> they were able to calculate the total QALY attributable cost.

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<sup>55</sup> To convert the results into QALYs – and in the absence of any guidance on the WHOQOL-BREF – they averaged the four (standardized) life domains and assumed that 1.0 indicates perfect quality of life for both measures. However, as P. Johansson et al. note in their conclusion, this approach is problematic for two reasons: first, WHOQOL-BREF covers social aspects of quality of life, while QALYs are only designed to measure health-related quality of life; and second, the weights assigned to the different domains are arbitrary rather than preference-weighted (i.e. they are not based on how people say they would weight them).

<sup>56</sup> While 2% reported that they lived in a household with someone who had a drinking problem, 24% said that they did not live with a problem drinker but were close to one.

This effort represents a notable and welcome addition to the literature, but it also suffered from several pronounced problems. First, the number of people who shared a household with someone who had a drinking problem was small (n=60), making the results imprecise. Second, the study was cross-sectional and therefore likely to suffer from selection biases; while P. Johansson et al. do note this possibility, their suggestion of halving the estimates as a “conservative rule of thumb” is difficult to justify. Third, more than half of the total non-financial impact came from the group of people who knew but did not live in the same households with problem drinkers (a much larger group than those who lived with problem drinkers). To claim that there was a significant difference between this group’s quality of life and the rest of the population’s is highly debatable, even based on the survey’s results.<sup>57</sup>

Although the study by P. Johansson et al. claims to be the first to estimate the non-financial losses caused by another person’s drinking (2006), there does exist an earlier study, available primarily in French, that estimates these losses in a different way (Jeanrenaud et al., 2003; Pellegrini & Jeanrenaud, 2003). This Swiss COI study asks people how much they would be willing to pay to avoid living with a person who was dependent on alcohol. This method goes directly to a valuation in monetary terms (one that averages around €3500 per year) without creating an estimate in some standardized non-financial unit.

### ***Other Non-financial Impacts***

One study has also quantified the pain and suffering caused by the death of others (Collins & Lapsley, 2002), but this impact was not considered in any of the reports reviewed in detail here. In addition, there are several other areas where alcohol causes a non-financial welfare impact that has never been quantified:

- the loss of leisure time for people who are employed in the counterfactual scenario, to replace those not working due to their drinking;<sup>58</sup>
- the loss of leisure time for the unpaid carers of people disabled due to the health effects of their drinking;
- general fear of crime;
- the non-health impact of crime on its victims; and
- the impact of people’s alcohol dependence or abuse on their children.

It is therefore unsurprising that there have been several calls for further research into social harms – particularly the external costs of harms to others – caused by alcohol (Room, 2000; Anderson & Baumberg, 2006; Johansson P et al., 2006).

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<sup>57</sup> In comparing the total quality-of-life scores, there emerged only a slight, non-significant difference between the two groups. However, P. Johansson et al. justify their estimates by saying that one of the quality-of-life sub-scales (the environment sub-scale, particularly the parts addressing financial resources, recreation and leisure, and transport) showed a significant difference. Yet it is far from certain that there exists any genuine difference between the two groups, even in this cross-sectional analysis.

<sup>58</sup> Although this impact is mentioned in WHO guidelines (2009:60), it may be counterbalanced by evidence that people are in better mental health – i.e. that they are happier and more satisfied with life – if they are working (Waddell & Burton, 2006).

## 5. Benefits of Alcohol

### Financial Benefits

Other than accounting for the health benefits of alcohol in producing net health and mortality costs, alcohol COI studies tend not to include any other financial benefits of alcohol. However, the RAND report (Horlings & Scoggins, 2006) does consider other such benefits, particularly the economic benefits of the alcohol trade. This section briefly considers such costs in the context of attributable cost studies, drawing on a previous paper by the present author for WHO (Baumberg, 2008).

#### *Should Benefits Be Included?*

Before looking at particular methodologies, it is important to be clear on whether, in the context of the aims set out in Chapter 1, such benefits should be included in alcohol cost studies.

If the main aim of these studies is to show that alcohol is a major social and economic problem, then it can be argued that benefits should be excluded because we are interested in the total cost of alcohol. For example, P. Johansson et al. argue that “cost-of-illness studies are concerned with adverse effects of a disease, condition or set of events, and the methodology cannot appropriately be applied to possible benefits from drinking in general” (2006:7). Nevertheless, they do include the health benefits of drinking on the basis that it is a “mitigation or reduction in health harm due to drinking, rather than a benefit of drinking”. It is unclear in what sense other economic benefits cannot also be seen as a mitigation of economic harm rather than as a benefit, or why the methodology is more problematic for benefits than costs.

If the main aim of these studies is to provide the foundation for further economic analyses that can contribute to the policy-making process – something that has rarely been the case in the past but which may become more important in future – then it would seem even more useful to include financial benefits. That is because alcohol cost studies should ideally include all of the areas that would be relevant for understanding the economic impacts of a particular policy – and simply excluding the broader benefits of alcohol does not make sense.

From this brief discussion, there appears to be no reason why the financial benefits of alcohol should not be included in alcohol cost studies. The question thus becomes how the benefits of alcohol should be valued – and the rest of this chapter will suggest that their omission is unlikely to influence the results to any great extent.

#### ***Benefits of the Alcohol Trade***

The RAND report describes how the alcohol industry makes a “modest contribution to the total economy of the EU25 [the 25 EU Member States at the time of the study]”, with the sums and jobs involved being “substantial” (Horlings & Scoggins, 2006). The sums and jobs the report mentions include:

- €25 billion of value added in the production of beer, wine and spirits; nearly €20 billion of value added in supplying industries for the production of beer, wine and spirits; and an unquantified additional amount of value added from other forward and backward linkages within the economy;
- €10 billion added to the EU’s overall balance of trade; and

- around 600 000 workers producing beer, spirits and wine (including viticulture), together with another 600 000 workers supplying the beer and spirit production industries and 2.6 million in the retail of beer alone.

It should be noted that many of these figures come either directly from the alcohol industry or via commissioned research that is designed to demonstrate the importance of the alcohol industry – and that some of these figures may therefore be overestimates. For example, the RAND report points out that the 2.6 million retail jobs for beer include many part-time jobs and are dependent on much more than just alcohol. In the tobacco field, it has been estimated that the full-time equivalent number of jobs involved is around one third of the total calculated in industry-commissioned research (Jacobs et al., 2000). Nevertheless, the basic assertion that the alcohol industry has a noticeable economic role is not questioned.

The more important point to make is that such figures simply cannot be taken as estimates of the economic benefit of the alcohol industry (Anderson & Baumberg, 2006; Baumberg, 2008). If people reduced their spending on alcohol, they would spend their money in other areas instead (or save it). The alcohol-related jobs that would be lost would therefore be counterbalanced by jobs created in other areas. While no studies have investigated the consequences of this scenario for alcohol, several studies in the tobacco field suggest that the net result could be either positive or negative, depending on particular spending patterns, especially on whether the replacement spending is more likely to be of domestic products than the original tobacco expenditure (see Jacobs et al., 2000).

It is still possible that drinking may help economic development by increasing employment, tax revenues and technology transfers (Claeson et al., 2000), even compared to replacement spending. This view has been challenged (Curry, 1993; 1987), however, and it seems likely that the main financial cost of alcohol control policies will be in the transition costs required to move from producing alcohol to producing replacement goods and services. While such an analysis may be complex to perform for individual policies, it is straightforward for the present counterfactual, in which alcohol has never existed. In this case there would be by definition no transition and thus no transition costs, so the economic benefit implied in this analysis by the existence of the alcohol industry would be limited to the long-term costs, which as we have just seen are likely to be much smaller than suggested by the overall economic role of the alcohol industry today.

That said, ignoring these costs clearly does not help any study to provide a basis for further economic analyses of particular policies, such as CBAs. To the extent that that is a major purpose of attributable cost studies – and particularly intervention-based avoidable cost studies – attempting to model the impact of reduced spending on alcohol is essential. As well as making the overall estimates more accurate, it not only is a first step in modelling the economic impact of particular policies on the alcohol industry, but it should also remind those who use such studies as a basis for analysis that they should consider this cost category in their work.

## ***Other Benefits***

### *Taxation*

As mentioned in Chapter 1, taxation is a transfer of money from one group to another and therefore does not constitute a social benefit. However, if we are looking at external costs (or the costs to a particular actor such as government) then taxation does become an external benefit; if drinkers are causing additional costs but are also paying for them through alcohol-specific taxes,

then the net external cost may be zero. Relatively few external cost studies have been performed, and those that exist are usually adapted from COI studies and therefore omit major external cost categories. Nevertheless, they tend to show that taxes on alcohol are currently lower than the external costs (Cnossen, 2007; Manning et al., 1989).

### *Other Benefits*

It is possible – although by no means certain – that the spending that would replace spending on alcohol, as described earlier in this section, would create social costs of its own (Anderson & Baumberg, 2006; Levy & Miller, 1995). If so, it could be considered a financial benefit of alcohol, because insofar as people drink, they are not consuming other goods and services that create social costs.

Conversely, it is also possible that the replacement spending would create additional social gains, especially given claims that in low- and middle-income countries, spending on alcohol diverts money from investment in economic development (Marshall, 1999) and impoverishes households (Saxena, 1999; Lightwood et al., 2000). The tobacco estimates reviewed in Baumberg (2008) consider various ways of estimating what such replacement spending would be (e.g. average spending, recent quitters), and it may be possible to use such methods to start to answer these questions for alcohol.

## **Non-financial Welfare Benefits**

The pleasure of drinking alcohol has sometimes been acknowledged in the public health literature (Anderson & Baumberg, 2006), but it has never been included in an attributable cost study on alcohol. There are at least two reasons for this omission – one theoretical, the other practical – and it is important to review them both, as they have entirely different implications for future research.

### *Theoretical Problems with Valuing Pleasure*

The theoretical argument against valuing pleasure is made by P. Johansson et al., who explicitly reject the idea of valuing it in their study (2006). Put simply, they argue that pleasure is an internal cost, and that their study only evaluates external costs. To the extent that their study focuses on external costs, this position is entirely justifiable.

The problem is that P. Johansson et al. also value several other non-financial welfare costs that may be thought of as internal, such as life lost by people who did not suffer from an alcohol use disorder, and the suggestion that such a cost is external is implausible. Indeed, P. Johansson et al. concede in their conclusion that they have included some private costs in their study.

There is therefore some inconsistency in the inclusion of non-financial welfare costs by P. Johansson et al. To be consistent, the study should either include the non-financial benefits of alcohol (making the overall perspective of the study societal), or it should exclude the internal benefits and costs of alcohol (keeping the overall perspective external). The matter is not just academic. While Kleiman suggests that the reduced consumer surplus from population-wide interventions is likely to be “too small to worry about” (2008), a model of heart disease finds that including a very small QALY loss – equivalent to half the inconvenience of having to take an aspirin every day – and applying it to the entire population makes a large difference in the final results of their CBA (Zulman et al., 2008). (See below for a definition of consumer surplus.) This matter is considered again in the next chapter.

### *Practical Problems with Valuing Pleasure*

Anderson & Baumberg note that while pleasure would ideally be included alongside the non-financial (and primarily internal) costs of lost life that they quantify, there are several problems in estimating non-financial benefits (2006). From a review perspective, the complete absence of research on valuing the pleasure related to alcohol is an insurmountable problem. This absence reflects some of the practical difficulties in conducting such a study.

The main way to measure the internal benefits of a good economically is through the idea of the *consumer surplus* – how much more people would have been willing to pay for the good than the actual price they paid (Aslam et al., 2003; Leontaridi, 2003). (It is akin to the WTP concept described in the previous chapter, only applied to the price of goods instead of the relative value of different states.) In an ideal world, the consumer surplus already accounts for the internal costs of drinking, because fully informed, rational drinkers “would be willing to pay more for alcohol products if there were no significant negative side effects associated with alcohol consumption” (Centre for Economics and Business Research, 2009:46). It means that the non-financial welfare value of the pleasure from drinking is higher than the consumer surplus.

The problem is that how much people would be willing to pay is unknown, and one must make strong assumptions about it before one can estimate the consumer surplus. In studies that have estimated the consumer surplus (Aslam et al., 2003; Richardson & Crowley, 1994),<sup>59</sup> it is based on a “linear demand function”. Being linear, this function assumes that a 1-unit increase in price will lead to a constant decrease in consumption<sup>60</sup> at every level of price and consumption. One can then use data on the observed relationship between price and consumption and extend it to the unobserved parts of the demand function. As derived from Aslam et al. (2003:Appendix A), the actual formula for calculating the consumer surplus (CS) based on elasticity ( $\eta_1$ ) at a certain level of price and consumption ( $P_1, Q_1$ ) is:<sup>61</sup>

$$CS = -Q_1P_1/2\eta_1$$

Table 2 provides an example of the formula in practice, taken from estimates for London from Aslam et al. (2003).

There are three substantial problems with the results of this approach. First, the assumption of a linear demand curve is far-fetched; even Aslam et al. accept that “we know that the demand curve of a product like alcohol is not linear” (2003). That is because a person drinking 4 units a week is likely to value them more highly than another drinker values the 4 units that comprise the difference between 46 and 50 units a week. Put another way, as consumption decreases, it is

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<sup>59</sup> A report commissioned by the brewer SAB Miller estimates that the lost consumer surplus from reducing consumption in moderate drinkers by 5% in the United Kingdom would be £590 million per year, but it provides far too little detail to enable the reader to understand how this figure was constructed (Centre for Economics and Business Research, 2009:50). It is likely to use a methodology similar to that described here.

<sup>60</sup> The function is expressed in terms of unit changes (i.e. a 1-unit change in price leads to an X-unit change in consumption). It differs from a function with a constant elasticity, which is expressed in terms of proportional changes (i.e. a 10% change in price leads to a Y% change in consumption, where Y is a constant). A constant elasticity is not defined for a quantity of zero, which would entail an infinite consumer surplus.

<sup>61</sup> This formula can also be easily derived from first principles: the elasticity of demand  $\eta$  is equal to the per cent change in quantity divided by the per cent change in price. One can use this relationship to find the slope of the demand curve at  $P_1$  and  $Q_1$ , and then use the slope of the demand curve to estimate the area.

likely that people are willing to pay a higher price per unit than they previously were, which suggests that these estimates of the consumer surplus are likely underestimates.

Table 2. An estimate of the consumer surplus from drinking in London

	Beer	Cider	Wine	Spirits
<b>Q<sub>1</sub> * P<sub>1</sub>: expenditure</b> (billions of £)	2.26	0.20	1.23	0.94
<b>Q<sub>1</sub>: volume of consumption</b> (millions of litres)	730.25	77.31	165.34	11.94
<b>P<sub>1</sub>: price per litre</b> (£, derived from 1 <sup>st</sup> two rows)	3.09	2.59	7.44	78.73
<b>η<sub>1</sub>: elasticity</b>	-0.95	-0.80	-1.32	-0.93
<b>Consumer surplus</b> (£ billions)	<b>1.19</b>	<b>0.12</b>	<b>0.47</b>	<b>0.51</b>

Source: based on Aslam et al., 2003.

Second, the consumer loss will be an overestimate to the extent that it excludes any consumer surplus from the spending that replaces drinking. One can assume that this consumer surplus is lower than it would be for alcohol – otherwise people would simply spend their money differently – but it is also highly improbable that such a consumer surplus is non-existent. For example, if alcohol had never existed – or more plausibly, if people reduced their drinking following an effective intervention – then people would save money that they would otherwise have spent on alcohol and instead use it to hear live music, go out with friends for a meal, etc. These alternate expenditures would be more valuable to people than the money they spent on it.

Finally, and most critically, such estimates assume that consumers are both fully informed and rational. That assumption becomes difficult to maintain once one realizes that some drinkers, who account for a sizeable proportion of total consumption (Baumberg, 2009), are heavy and hazardous drinkers, and some of them are addicted to alcohol and unable to make rational, informed purchase decisions (Collins & Lapsley, 2002; Kleiman, 2008). As a result, even those studies estimating the value of the consumer surplus sometimes recognize that it should not be applied to hazardous and harmful drinkers (Centre for Economics and Business Research, 2009:46). It can also be argued that non-addicted drinkers are subject to some irrational decision-making (Sutherland, 2007), particularly while they are drinking (George, Rogers & Duka, 2005). It has therefore been argued that the consumer surplus should be ignored entirely for interventions that focus on reducing drunkenness (Levy & Miller, 1995:241). There are also problems with information (Dantzer et al., 2006).

Some studies have accordingly included the money spent on alcohol by people with alcohol use disorders as an attributable cost, on the assumption that they derive little or no pleasure from it (Easton, 1997; Collins & Lapsley, 2002). The argument is reasonable, but various assumptions about rationality and addiction may be considered sensible, given the absence of empirical evidence, and such spending should only be included as an attributable cost if the consumer loss is included alongside. For avoidable cost studies that model different tax policies, the increased amount of money spent on a constant level of alcohol should also be considered (Centre for Economics and Business Research, 2009).

### *Other Benefits*

There may also be other non-financial benefits of alcohol consumption that have not hitherto been considered by research, such as a link between drinking and social networks at work, or between drinking and social capital more generally (Horlings & Scoggins, 2006).

## 6. Conclusions and Recommendations

Rather than trying just to summarize each individual chapter of this report, this chapter focuses on issues that future economic studies need to address.

### Terminology and Presentation of Results

Chapter 1 begins by proposing a new terminology for alcohol cost studies. The terms “health and crime spending”, “labour and productivity costs” and “non-financial welfare losses” are suggested as replacements for the common but misleading COI terms “direct costs”, “indirect costs” and “intangible costs”. The chapter also emphasizes that policy-makers often talk about economic costs as if they were all financial costs, which is misleading if their estimates include non-financial welfare costs. It is therefore recommended that researchers present two separate figures, the *total financial cost* and the *full economic welfare cost*, and make sure that they do not present either as the “total cost” without further clarification.

**Recommendation 1. Alcohol cost studies should consider three types of cost: health and crime spending, labour and productivity costs, and non-financial welfare losses. The terms that COI studies previously used for these types of cost should be avoided.**

**Recommendation 2. Alcohol cost studies should present estimates for the “total financial cost” and the “full economic welfare cost” separately, and make sure the differences between the two of them are clear.**

### External Costs

Chapter 1 also explains how external cost studies are particularly valuable for policy-makers because external costs are considered unfair and inefficient. Despite this, current external cost estimates are marred by confusion about what counts as an external cost (particularly for non-financial welfare costs). For example, the Swedish study by P. Johansson et al. describes itself as an external cost study, yet most of the non-financial costs they examine are internal (2006). To help clarify the situation, Table 1 in Chapter 1 sets out which costs should be counted as external and which internal (see also Leontaridi, 2003:11).

A further problem is that while external cost studies are often adapted from social cost studies, social cost studies omit transfer costs that may well be significant in external cost studies. Social cost and external cost studies should therefore be conducted alongside each other to facilitate a complete estimation of both relevant quantities.

**Recommendation 3. Cost studies should estimate both the external costs and total social costs at the same time, remembering to exclude internal (private) costs from the former and transfer costs from the latter.**

**Recommendation 4. Alcohol cost studies should discuss which costs are external and which are internal and apply these terms consistently, justifying any departures from the classification in Table 1 (see Chapter 1).**



## Avoidable Costs

Chapter 2 discusses avoidable cost studies, suggesting that – if done in the right way – such studies can be invaluable to policy-making. However, care needs to be taken to ensure they realize their potential value. First, the intervention-based approach should be used, as the other approaches reviewed do not generate a credible estimate of the “feasible minimum”. Second, the effects of individual interventions should be considered more carefully, employing better justifications for selecting particular values as the main estimates and much better sensitivity analyses (see also below).

Further research is also needed to improve avoidable cost studies. Ideally, such studies would model interventions primarily via their effect on different consumption groups (and the risk of different harms at different levels of consumption), but there is not enough research (or at least reviews) focusing on this approach. More work also needs to be done on lag times (such as that between introducing an intervention and changes in consumption, and between changes in consumption and reduction of harms) and on modelling multiple interventions simultaneously.

**Recommendation 5. Avoidable cost studies should use an intervention-based approach, taking care over the estimates of the intervention’s effect.**

**Recommendation 6. Further research should be conducted to enable more sophisticated avoidable cost studies, particularly research on lag times, modelling several simultaneous interventions and modelling the effects of interventions on different groups.**

## Causality

This report gives numerous examples of difficulties in attributing particular causal impacts to alcohol. Some studies have used simplistic methods that make them little better than guesstimates (Maynard, 2004). Often these overestimate the causal role of alcohol because many factors can influence heavy drinking, alcohol disorders and associated harms, and, if they are not all accounted for, the role of alcohol will be overestimated.<sup>62</sup> In particular, better evidence is needed for the relationship between alcohol and (i) productivity at work (using measures based on output rather than input or wages), (ii) unemployment and (iii) non-financial welfare costs such as the impact on drinkers’ families.

In addition, there are several areas where alcohol has a likely economic impact, usually positive, for which there is almost no evidence at all, even of low quality. These areas include (i) the benefits of the alcohol trade, (ii) pleasure and the consumer surplus and (iii) possible work-related benefits from improved social networking. Another area that calls for further research is the spending on goods and services that would substitute for spending on alcohol if consumption were reduced or eliminated. Whether such replacement expenditures lead to further costs or further benefits, this topic is strangely omitted from most discussions of counterfactual scenarios.

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<sup>62</sup> For example, an American COI study uses an estimate of productivity losses that does not control for the links between education and either alcohol use disorders or wages (Harwood et al., 1998). If these linkages are taken into account, then the cost disappears. Confronted with uncertain attributions to alcohol for Swedish crime, P. Johansson et al. say that they raise “the question of whether it is reasonable to include theft offences in the analysis at all” (2006). Similar problems are particularly apparent in looking at the role of alcohol in crime, absenteeism, unemployment and several non-financial welfare areas.

**Recommendation 7. Future research should attempt to quantify more robustly any causal links between alcohol and various harms, particularly unemployment, decreases in workplace productivity and non-financial welfare costs.**

**Recommendation 8. Similarly, future research should try to quantify any causal links between alcohol and various benefits, including the economic benefits of the alcohol trade, the labour benefits of social networking, and pleasure. It should also begin to analyse the costs and benefits of the goods and services that substitute for alcohol in counterfactual scenarios.**

## **New Methodologies**

Chapter 3 discusses a number of methodological developments that have the potential to produce more meaningful results than the usual COI methods, but it is unclear how applicable they are in the case of alcohol. There is therefore a need for a demonstration project to apply these methods to alcohol, focusing particularly on whether it is possible to:

- conduct regression-based growth estimates for the effect of crime on GDP;
- use parameter estimates for the non-health impact of alcohol on productivity and absenteeism in a calibration or CGE model;
- investigate health and crime costs with these methods by defining the quantity of interest as non-health, non-crime goods and services; and
- combine traditional methods with new methods to estimate costs for which new methods alone are not practical.

**Recommendation 9. A demonstration project should be conducted to test the applicability of new alcohol costing methodologies. It should focus on areas where alcohol differs from the normal health risk factors that the methods were designed for.**

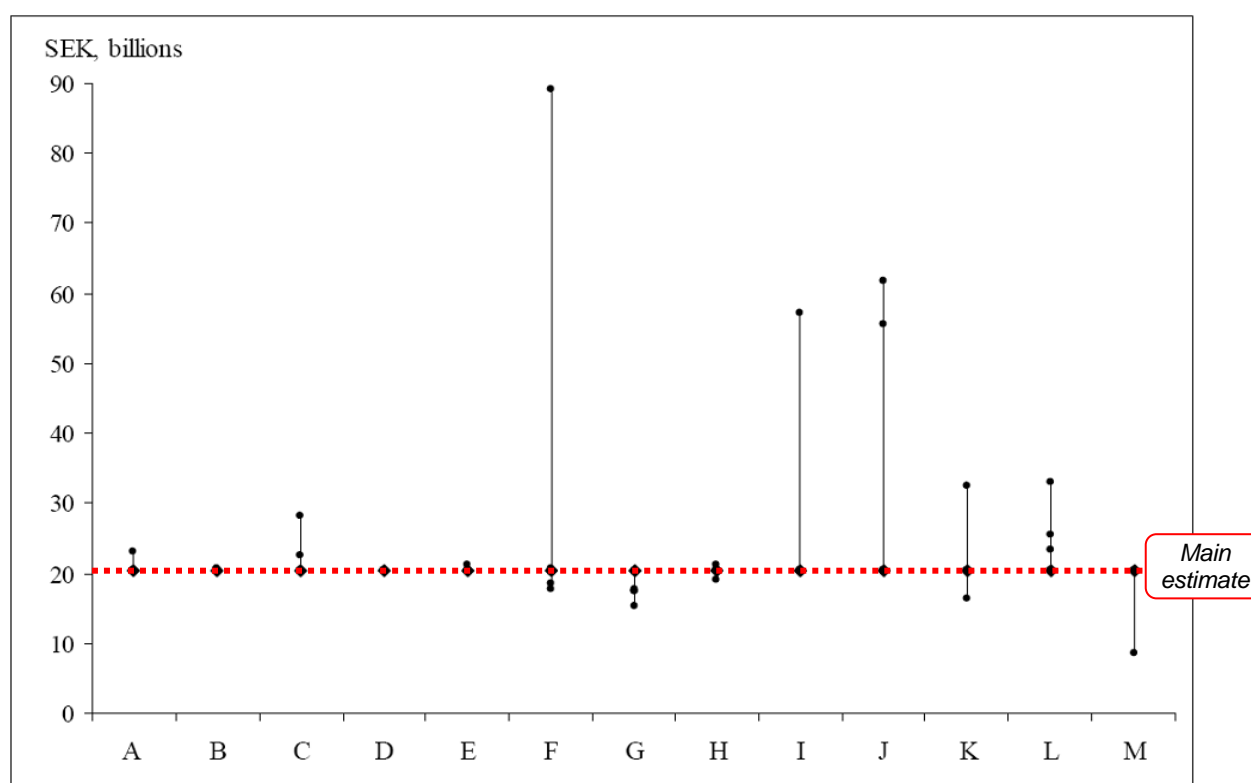
## **Assumptions and Sensitivity Analyses**

It is doubtless true that there has been a much greater degree of consistency in alcohol COI studies in recent years since the WHO guidelines were published (as noted by Jarl, 2005). Yet there is still an enormous variation in methods among studies, due partly to differences in the data available (Harwood et al., 1998) and partly to different assumptions and methodological approaches (Single & Easton, 2001). This report shows that using a different data source or methodological assumption – e.g. a different discount rate, the human capital instead of the friction cost method, or a different approach to estimating the contribution of alcohol to a given outcome – can lead to radically different results.

Although the EU review tried to make valid comparisons by only looking at studies with broadly similar methodologies, it found variations among studies at too fine a level of detail to fully capture (Anderson and Baumberg, 2006). To make matters worse, cost findings reflect not only alcohol-related problems and methodological approaches but also investments in health, social welfare, etc., making it enormously difficult to compare the results of cost studies not just for different countries but even within a single country over time (Johansson P et al., 2006).

Yet the problem is not just one of comparison. *If cost studies reflect arbitrary assumptions more than meaningful differences in alcohol-attributable costs, then their value for the purposes outlined in Chapter 1 is questionable.* For instance, although making consistently conservative estimates (as in Johansson P et al., 2006; Rehm et al., 2008b:22; and many others) may help demonstrate that alcohol causes genuinely large costs, it is unhelpful in producing useful, unbiased comparisons of different policies. Instead, the way round this problem is to show the sensitivity of the estimates to different assumptions – something that the Swedish study begins to address in its series of sensitivity analyses (Johansson P et al., 2006). Fig. 2 summarizes the results of its sensitivity analyses, showing large variations around the main estimate in both directions.

Fig. 2. Effect of sensitivity analyses on the estimates in P. Johansson et al., 2006



SEK: Swedish kronor. For the sensitivity analyses, A: age groups, 0–64 years; B: size of consumption groups; C: disease and injury risks, aggregate data; D: health care costs, data; E: health care costs, valuation; F: productivity costs, data; G: productivity costs, valuation; H: social services, data; I: employer costs, data; J: quality-added life years (QALYs), valuation; K: discount rates; L: deadweight losses; M: most conservative assumptions.

Source: Johansson P et al., 2006.

P. Johansson et al. are to be commended for performing this lengthy series of sensitivity analyses, an effort that goes beyond even the most sophisticated of the previous analyses, and it is very helpful for comparing the Swedish results to previous studies. At the same time, they still fall short of generating these analyses in an ideal form for policy-making, as they do not distinguish between reasonable and unreasonable analyses. Some of the sensitivity analyses in Fig. 2 can be ignored; they use poor data sources and generate implausible estimates (e.g. Analysis F). Yet other analyses represent choices between equally defensible options; for example, they represent arbitrary choices between different data sources or assumptions (such as

some of the crime AAFs in Analysis C) or methodological choices (such as the discount rates in Analysis K). Furthermore, the analyses only address certain assumptions, and there are many more assumptions in the study whose impact remains unclear.

What policy-makers – or indeed, anyone trying to make use of the figures – need is an analysis that tries to differentiate between the raw data and the assumptions of the researcher. It is probably impossible to model every assumption; there are simply too many minor assumptions that need to be made. Instead, such a study should model any assumption that seems likely to have a moderate effect on the results. To make the results more comprehensible, it should group them in three different scenarios: “most likely”, “plausible but conservative”, and “plausible”. Because of the variety of assumptions involved in any scenario, even the most likely scenario will produce a range rather than a single figure (as shown in Leontaridi, 2003), and the plausible scenario is likely to produce a much larger range. Any assumptions that are seen as implausible should be discarded completely, as they will only serve to confuse the sensitivity analysis.

**Recommendation 10. All attributable and avoidable cost studies should present results grouped into three scenarios: “most likely”, “plausible but conservative” and “plausible”. For each scenario, estimates should be made using combinations of all the assumptions that may have potentially moderate effects on the results. This approach should replace the current practice of generating a single main estimate followed by sensitivity analyses.**

## When Data Are Unavailable

This report shows that to produce overall cost estimates, even data-rich countries like Sweden must make a large number of assumptions (e.g. alcohol’s role in violent crimes, the non-financial impact of violent crimes, alcohol’s role in certain acute conditions, etc.). To make such estimates in countries with less of a tradition of alcohol research – in other words, outside a handful of countries – one must decide what to do when data are limited.

When data are unavailable for a given cost component, the usual response is simply to omit that component.<sup>63</sup> As with the practice of making deliberately conservative estimates (see discussion leading to recommendation 10), such omissions may be understandable when the aim is to show the significant economic losses caused by alcohol, but they are unhelpful when we want to make unbiased comparisons among different policies in a CBA (Kleiman, 1999) or among the costs of different substances (e.g. alcohol and tobacco). Omitting cost components generates downward-biased estimates, and the bias is potentially quite considerable.<sup>64</sup>

A better alternative is to import data from studies conducted in similar countries. These data can be AAFs (Chapter 2); for example, the Swedish low-data sensitivity analysis uses AAFs from

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<sup>63</sup> For example, lowered productivity in the workplace was left out of an English and Welsh study (Leontaridi, 2003), while the Swedish study omitted some non-state health care, ambulance and local (country) health prevention costs, and in their low-data scenarios certain health care costs (comorbidity and pharmaceutical costs) and costs anticipating or responding to crime (Johansson P et al., 2006).

<sup>64</sup> The argument by P. Johansson et al. that “one might guess that filling in the missing data would not add more than SEK 5 billion [roughly 25%] to our estimate” for crime costs (2006:93) is unconvincing, whether one assesses it based on the low-data scenario comparisons in the own study (where the authors admit the largest differences are due to coverage rather than data availability) or on the EU review (Anderson & Baumberg, 2006).

WHO (Rehm et al., 2004).<sup>65</sup> Because there are WHO data for nearly every country in the world, it is always possible to estimate AAFs crudely. Data can also be imported for the costs themselves, as was done for some crime costs in the low-data Swedish scenario<sup>66</sup> and has also been done for other occasional estimates (e.g. Richardson & Crowley, 1994), using results for particular cost components from a review of social cost studies (Anderson & Baumberg, 2006; Baumberg, 2006). Such data can be scaled by a relevant economic measure, e.g. as a percentage of health care spending, or even as a cost per alcohol-dependent person (Andlin-Sobocki & Rehm, 2005).<sup>67</sup>

Clearly, such imported estimates must be separated from more robust estimates in the main presentation of results; they are more likely to be inaccurate, as they are not based on data from the same country, and they should be treated differently. In accordance with the discussion for the previous recommendation, they should also be subject to a range of sensitivity analyses to avoid presenting a spurious level of accuracy (for example, minimum and maximum levels from comparable countries should be used in the “plausible” scenario). Nevertheless, importing estimates is a useful way of avoiding systematically underestimating costs in alcohol cost studies, and it also serves to remind those interested in undertaking further economic analyses of the variety of cost components that need to be considered in producing a valid CBA. As Richardson & Crowley note, “the second best solution to ideal measurement is not to ignore quantitatively important issues. It is to use the best evidence available” (1994:86).

**Recommendation 11. When it is impossible to estimate a cost component, a cost study should import data or a cost estimate from studies in comparable countries. Omitting cost components should be avoided, as it will bias the results downwards. Imported costs or cost data should be presented separately within each scenario to make clear that they are not based on primary data from the country being studied.**

## Other Recommendations

Finally, two important points do not fit neatly under any other heading. First, health care costs are commonly presented as if they could all be saved in the absence of alcohol. However, such a presentation neglects the future health care costs that would be spent treating people for diseases that arise after they would have otherwise died from alcohol-related causes. To be consistent with the rest of the cost methodology, such future health costs should be included in calculating the net health care costs, which should be presented as the main health care estimate. The conventional gross estimates can be calculated as long as they are accurately described as the total amount currently spent treating alcohol-attributable conditions. Similarly, if premature mortality costs are calculated, then future resource use should be considered.

**Recommendation 12. Future health and resource costs should be included in alcohol cost studies.**

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<sup>65</sup> More precisely, they take average subregional AAFs and adapt them based on other data from the same study by Rehm et al.

<sup>66</sup> The Swedish low-data scenarios import crime AAFs from the English and Welsh COI study in the absence of any alternatives. (They find these AAFs have only a small impact on the resulting estimate – at least in this case.)

<sup>67</sup> The latter approach is not to be recommended for most costs. In Germany, people with alcohol use disorders have been estimated to account for only 20% of the costs that could be disaggregated among drinkers (Bergmann & Horch, 2002).

Second, many studies have used the human capital method to value premature mortality losses, but mainstream economists now view this approach sceptically (Gold et al., 1996; Swedish Pharmaceuticals Board, 2003; both as cited in Johansson P et al., 2006). As P. Johansson et al. suggest, this method should therefore not be employed in the main analysis, though it may be useful to conduct such an analysis separately to enable comparability with earlier studies.

**Recommendation 13. The labour costs of premature mortality should not be included in the main estimate, though they may be included separately within a cost study to enable comparability with earlier studies.**

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