Building Capacity project:
Economic and Health Impact assessment

(work package 6)

Manual for assessing the health impact and economic costs of alcohol policy measures in Europe

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Building Capacity…in the economic analysis of alcohol policy measures

The objective of WP6 is to determine the health and economic impacts of different alcohol policy measures to reduce the harm done by alcohol at both the European level and in all partner countries. In order to realize this objective, two key analytical platforms are required:

1. Construction of a country-specific database containing detailed information on demography and mortality structures, epidemiology of alcohol use, intervention coverage and efficacy, plus resource and price estimates relating to intervention implementation.

2. Development of an analytical framework capable of illustrating the health impact and economic costs of different policy instruments at the level of EU member states.

Building on an existing analytical framework and an earlier analysis undertaken at the aggregate level of WHO regions of the world, the key contribution of work package 6 of the *Building Capacity* project is to make available to member states a user-friendly analytical tool which can usefully inform alcohol policy at the level of individual members states, and which makes full use of existing data at the same time as remaining flexible enough to reflect the ever-changing landscape of alcohol policy and research. This manual forms part of this output, in the sense that it provides a step-by-step set of instructions on the use and application of the analytical tool.

1. Construction of a country-specific database

As already alluded to above, quantitative analysis of the health and economic impact of alcohol policy measures requires a substantial amount of data across a number of information domains, including:

- the demographic and mortality structure of populations;
- the epidemiology of alcohol use in member states;
- the estimated effectiveness of various policy measures at the population level; and
- estimates of the human and other resources (plus their associated costs) needed to implement and maintain these effective interventions.

Some of this information is already systematically collected and available at the national level, specifically the population and mortality estimates broken down by sex and (one-year) age groups that are produced by UN or its specialized agencies (WHO).

Concerning the epidemiology of alcohol use, considerable advances in the generation of research evidence have been made over the last decade, culminating in the production of alcohol consumption estimates for different regions of the world, stratified into discrete categories reflecting differential levels of expected harm (i.e. abstainer, moderate drinker, hazardous drinker, harmful drinker; the latter two categories are taken to represent heavy alcohol use as a risk factor for disease; Rehm et al, 2004). Together with meta-analytic estimates of the mortality risks and disability associated with these differential levels of consumption (or exposure), as well as observed patterns of drinking, these prevalence estimates have allowed a detailed analysis of the contribution of alcohol use to the global burden of disease, again undertaken at the level of WHO (or World Bank) regions (Rehm et al, 2004, 2006). For the purposes of the *Building Capacity* project, however, we ideally required such estimates to be generated at the level of individual member states, so to this end we ran disease models for all member states with country-specific data that allow us to do so (a total of 22 out of 27 EU member states). For those countries where data do not permit this, existing estimates for the relevant sub-region of the WHO's European region can be used.

In relation to the expected health impact of alcohol policy measures, the last decade has again seen considerable advances at the international level in our understanding and knowledge of what works (e.g. Babor et al, 2003; Anderson and Baumberg, 2006). However, uncertainty remains about the extent to

which international estimates of effect - in relation to the impact of breath-testing on alcohol-impaired driving or the introduction of comprehensive advertising bans, for example - are transferable or generalizable across countries or sociocultural contexts. Consequently there is an ongoing effort to try and generate more precise information on the expected impact of different alcohol policy measures at the level of individual member states (both of the EU and the WHO). The primary mechanism being used for this is the *WHO's Global Survey on Alcohol and Health*, and relevant country-specific information derived from this survey can be used to revise the input parameters of our health impact model (described below).

Finally in relation to resource use and costs, notable developments in the assessment of the resources needed to initiate and maintain health interventions at the population level have been made (Johns et al, 2003), including their assessment in the context of alcohol policy measures (Chisholm et al, 2004). Such estimates can be reassessed and revised as necessary in the context of information gleaned from the *WHO's Global Survey on Alcohol and Health* (for example, the level and extent of programme management at central, provincial and district levels). Country-specific information on the prices of resource inputs is also now available (www.who.int/choice), thereby allowing comprehensive cost analysis of different policy measures to be assessed.

An accessible country database (in Microsoft Excel format) covering all core information domains required for the economic analysis has now been completed, and is available as a downloadable file from http:// ??????????. **PETER** - WHO FTP site no longer available due to hacking problems - use the IAS website?

2. Development of an analytical framework: CHOICE

Cross-country modelling of the population-level costs and health effects of alcohol policy measures is still at a relatively early stage of development. In this project, we have made use of an existing analytical model that enables us to link estimates of the exposure of different populations to the health risks associated with heavy or harmful use of alcohol to the expected impact of effective policy measures. In so doing, we are seeking to move on from the concept of attributable burden of (heavy) alcohol use to the question of avoidable burden.

The analytical framework that we use (and build on) is one developed at the WHO some years ago, called WHO-CHOICE (CHOosing Interventions that are Cost-Effective). It was developed with the objective of providing policy makers with comparable evidence for deciding on the interventions and programmes which maximize health for the available resources, and has been applied to all major disease or risk factor contributors to the global burden of disease, including alcohol (www.who.int/choice). The initial focus of the work programme was on the development of standard analytical tools and the reporting of the costs and effects of a wide range of health interventions at the aggregate level of whole sub-regions of the world. With that now nearing completion, the focus has now moved to the application of the approach at the country level (Hutubessy et al, 2003).

In the context of the *Building Capacity* project, the objective is to build on earlier methodological work and regional analysis and produce a refined CHOICE tool for alcohol policy analysis that is both quick and easy to use, and specific to the drinking and countermeasure context of individual member states.

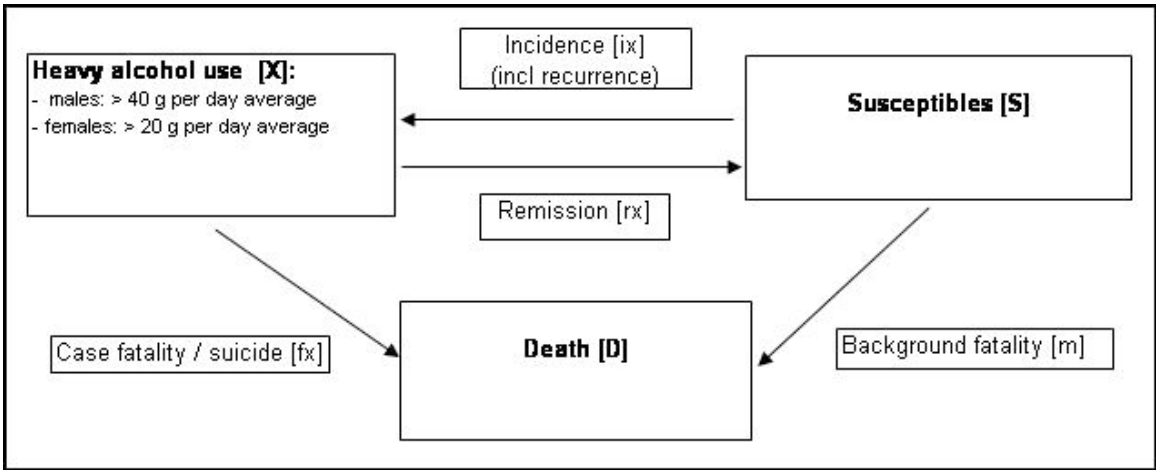
WHO-CHOICE employs an epidemiological approach to the estimation of the population-level effectiveness or health gain of different health interventions. Specifically, the effect of a given intervention on the health of a population is derived with reference to two epidemiological situations, one with the intervention in place, the other without the intervention (a counterfactual situation referred to as a 'null' scenario). The difference between these two situations represents the net effect of the intervention. It is therefore imperative that the best available epidemiological estimates are employed in the analysis.

These epidemiological scenarios are estimated via a multi-state population model (PopMod; Lauer et al, 2003), which traces the development of a population taking into account births, deaths and the disease in question. Susceptibles (e.g. persons not currently drinking hazardous quantities of alcohol) become cases at an instantaneous transition rate ***i*** [incidence]; persons with the index disease or risk factor go back to being susceptible at remission rate ***r***; cases are subject to the instantaneous case-fatality rate ***f***; and both susceptibles and cases are subject to a general mortality rate ***m***. The model can also accommodate the inclusion of a co-morbid health state / condition. Accordingly, the key parameters of interest are the incidence and prevalence of a particular index disease or risk factor (plus co-morbid states, if specified), together with rates of remission and case fatality. Data for each of these model parameters are needed at the level of sex-specific one-year age groups, and need to be expressed as

instantaneous rates (or hazards). A further requirement is that the epidemiological parameters are internally consistent (e.g. there are not more deaths occurring than there are incident cases emerging).

For the alcohol model, state X refers to heavy or hazardous alcohol use - defined as more than an average of 20g alcohol per day for women, and 40g for men - and S refers to people who do not meet this threshold but who nonetheless are 'at risk' of doing so at some point in the future (see Figure 1).

Figure 1 Model for considering the health impact of alcohol policy measures



Until now, PopMod has been supplied as a compiled program that relies on a combination of graphical user interfaces and standard spreadsheet tools for reading input data and selecting computational options (analysts wishing to use PopMod were expected to be familiar with spreadsheets and quantitative analysis as well as basic epidemiological and demographic concepts). We have now significantly streamlined the analytical processing procedure by writing a dynamic link library (DLL), which is called upon to generate and run the files that are needed by PopMod. In essence, it is now a 'one click' routine. Specifically, users can simply select their country and the data input template will be automatically populated with default country data. Users can override the default data with their own information as desired (e.g. if more recent epidemiological or effectiveness estimates are available). Once any data adjustments have been made, users simply click on an 'execute' button to start the calculations and produce country-specific model output (healthy years of life that can be obtained by implementation of current or new intervention strategies, relative to a situation of 'no intervention').

A specific set of instructions for running the Alcohol-CHOICE model is given at Appendix 1.

3. Results for the cost, effectiveness and cost-effectiveness of alcohol policy measures in EU member states

The Alcohol-CHOICE model has now been run for 22 out of 27 EU member states, with results complied into a policy briefing note that was presented and distributed at the Expert Meeting on Alcohol and Health (held in Stockholm under the auspices of the 2009 Swedish EU-Presidency). This briefing note is available from the following website of the Institute of Alcohol Studies: http://www.ias.org.uk/buildingcapacity/resources/briefing-notes/index.html . Here, we use one example of a country briefing (***Czech Republic***) in order to describe the model outputs and its implications for policy. Interested readers are requested to obtain the profile of other countries form the aforementioned website. In these country-specific analyses, we modeled the following:

- the impact of *excise taxes on alcoholic beverages*, both current rates and also increases of 25% and 50%, adjusted for the observed or expected level of unrecorded use due to illicit production and smuggling (taken as a close proxy measure for untaxed consumption); taxes increase the final price of alcohol to consumers, and numerous published studies have demonstrated that such changes in price lead to a fall in demand;
- *reduced access to and availability of alcohol* through estimating what would happen if alcohol could not be purchased for a 24-hour period at the week-end, assuming a reduction of 1.5-3.0% in the incidence of hazardous drinking and 1.5-4.0% in alcohol-related traffic fatalities if fully implemented (here, coverage in the population was set at 50%);
- the impact of *advertising controls*, based on a 2-4% reduction in the incidence of hazardous alcohol use, derived from international time-series analyses of the impact of a comprehensive advertising ban (TV, radio, billboards, etc.);
- two independent effects on *alcohol-related traffic injuries*: drink-driving laws, estimated to reduce traffic fatalities by 7% if widely implemented in a country; and enforcement via random breath testing (RBT), which at 80% coverage can reduce fatalities by a further 12-14.4%; and
- *brief interventions* involving a small number of education sessions and psychosocial counselling, with an effect of shifting the entire distribution of hazardous drinking downwards if applied to the total population at risk (a reduction in overall prevalence of 35-50%, equivalent to a 14-18% improvement in the rate of recovery over no treatment at all), adjusted for treatment adherence (80%) and target coverage in the population (30% of hazardous drinkers).

Explanation of the table

The table provides a number of policy options for the prevention and control of heavy alcohol use in the Czech Republic. These cover both single and combined intervention strategies, and are listed in Column 1. Column 2 estimates their impact in terms of the number of healthy years gained for every one million people in the population. Column 3 provides the annual cost of implementing the policy (in Euros for the year 2005), both for the population as a whole and per person. Column 4 gives the cost effectiveness ratio (CER), which is the total cost of implementing the policy or action (compared to doing nothing), divided by the number of healthy years gained, again relative to no intervention. Thus, if we consider a comprehensive advertising ban, this is estimated to gain 932 healthy years of life per one million of the population (9,536 years for the whole population of the country). Implementing and monitoring an advertising ban is estimated to cost the country €5.1 million, equivalent to 50 cents per person. Thus, the cost-effectiveness ratio is €534 per healthy year of life gained (€5,100,000 / 9,536).

Column 1		Column 2	Column 3		Column 4
Country	Czech Republic	Annual healthy life years gained per 1 million population	Annual cost (Euros, 2005)		Cost per healthy year of life gained (Euros, 2005)
Population	10,235,800		Total	Per person	
Gross national income per person (Euros, 2005)	9,746				
Euro exchange rate (2005)	0.033				
Current taxation		1,918	€ 3,382,352	€ 0.33	€ 172
Increased taxation (Current + 25%)		2,174	€ 3,810,920	€ 0.37	€ 171
Increased taxation (Current + 50%)		2,386	€ 3,810,920	€ 0.37	€ 156
Reduced access to retail outlets (50% coverage)		219	€ 3,458,173	€ 0.34	€ 1,540
Comprehensive advertising ban (80% coverage)		932	€ 5,096,905	€ 0.50	€ 534
Brief advice in primary care (30% coverage)		1,241	€ 16,956,481	€ 1.66	€ 1,335
Roadside breath-testing (RBT; 80% coverage)		116	€ 7,552,154	€ 0.74	€ 6,343
Current Scenario - combination of interventions		2,396	€ 14,776,451	€ 1.44	€ 602
Combination 1: Increased tax and RBT		2,452	€ 10,794,921	€ 1.05	€ 430
Combination 2: Increased tax and Advertising Ban		3,251	€ 8,462,434	€ 0.83	€ 254
Combination 3: Increased tax and Brief advice		3,554	€ 20,207,677	€ 1.97	€ 555
Combination 4: Increased tax + Ad Ban + Brief advice		4,421	€ 24,606,749	€ 2.40	€ 544
Combination 5: Increased tax + Brief Advice + Ad ban + Reduced access		4,539	€ 27,892,013	€ 2.72	€ 600
Combination 6: Increased tax + Brief Advice + Ad ban + Reduced access + RBT		4,649	€ 35,066,559	€ 3.43	€ 737

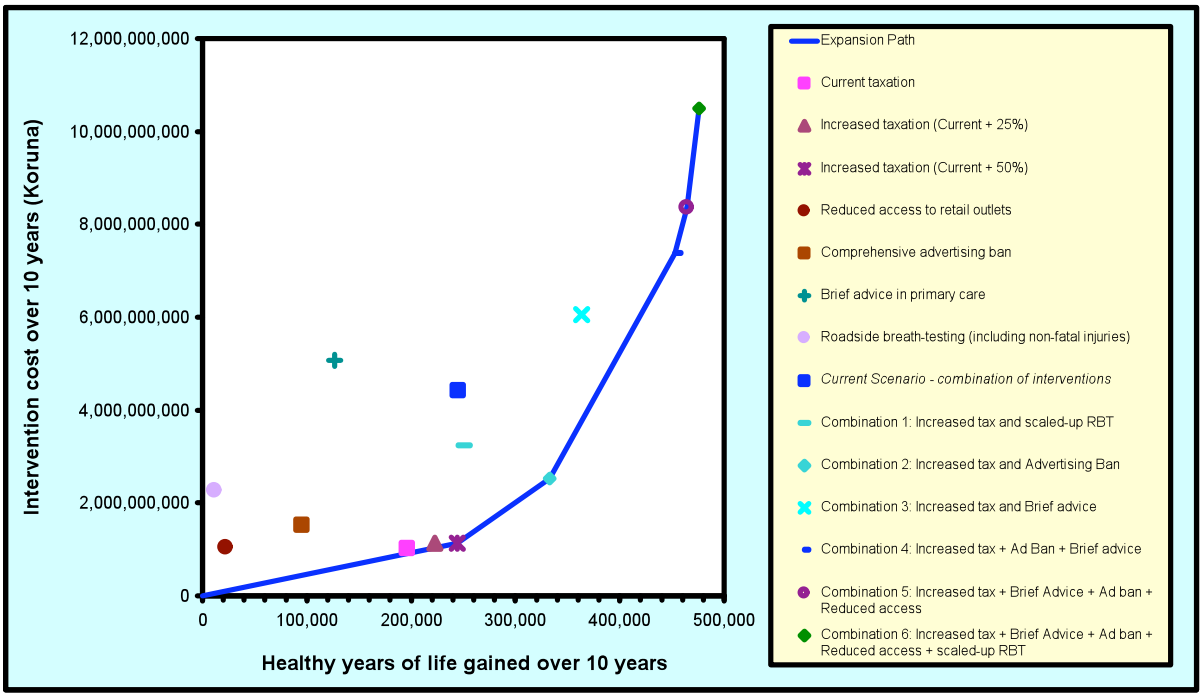
What the table means

In preventing alcohol-related ill-health, available resources can be put to best use via enhanced taxation policies, since these have a large health impact, are relatively cheap to implement, and thus have the lowest cost per healthy year of life gained. A comprehensive advertising ban is also projected to be a

highly cost-effective measure. Road-side breath testing and reduced access to retail outlets are estimated to generate less health gains, but are still very cost-effective. Brief interventions, by comparison, can have a big impact but are relatively costly to implement, so they are also not as cost-effective as taxation and advertising ban measures. However, all interventions - whether implemented alone or in combination - produce a favourable return for the cost incurred (that is, each extra year of healthy life can be secured for considerably less than the average annual income of persons living in the country).

Explanation of the figure

This figure plots the total costs and effects of each single and combined intervention for a 10-year period. The blue line plots the increasing cost of gaining an extra year of healthy life in the population as interventions become less cost-effective (as the gradient becomes steeper, so the cost per unit of effect increases). It shows the most efficient way of combining different strategies. Interventions to the left of this line are less effective and/or more costly than other, more efficient interventions. The most cost-effective single and then combined options are those that occur on the points of the blue line when it changes direction.



What the figure means

The first point where the blue line changes direction is increased taxation (current + 50% increase), and thus this is the most cost-effective policy option. The second point where the blue line changes direction is increased tax plus a comprehensive advertising ban, and thus this is the best combination of two policy options from a cost-effectiveness point of view. The third point where the blue line changes direction is increased tax plus an advertising plan, plus brief interventions for hazardous drinkers, and thus this is the next best combination of policy options. The final point is a combination of increased tax, an advertising ban, brief advice programmes, reduced access and random breath-testing campaigns, which represents the combined effect and cost of all studied interventions. It should be noted that the current intervention mix (■) does not appear on the expansion path, indicating room for improvement from a cost-effectiveness point of view and that more health gains could be achieved by re-allocating existing resources.

Summary of key findings (country case study: Czech Republic)

Adding a cost component to health impact assessment allows the opportunity to identify alcohol prevention and control strategies that offer greatest (or worst) value for money. In the Czech Republic, all of the population-based interventions (increased taxation, reduced access to alcohol, and an advertising ban) represent a cost-effective use of resources (against the international yardstick of per capita income), and compare favourably to treatment strategies for disease and injury that may in fact result from harmful alcohol use (e.g. cirrhosis of the liver, depression, trauma care for people injured by alcohol-impaired drivers). Brief interventions for the treatment of individual high-risk drinkers also compare favourably to such treatment strategies, but are harder to scale-up because of their associated training and manpower needs.

To illustrate the working and output of the Alcohol-CHOICE model, Table 1 provides results for the cost, effectiveness and cost-effectiveness of a range of alcohol policy measures in selected EU member states (Hungary, Slovenia, Spain and Sweden). Since not all of the input parameters are finalized (or taken solely from national-level data sources), these results are only illustrative, and as such it is premature to go into a detailed interpretation and discussion of the results. It is nevertheless apparent from these intial runs of the model that:

Summary of key findings (comparative analysis across 22 EU member states)

Ultimately, national policy makers need economic evidence that is specific to their own country's policy context, and that has been the primary aim of the *Building Capacity* project. Nevertheless, analysis across member states of the EU can also provide interesting insights and indicate which intervention strategies work best at this more aggregate policy level. Some of the key conclusions from this multi-country analysis can be summarised as follows:

Prevalence: Since the Alcohol-CHOICE model assesses the health impact of different policy measures at the level of the population (as opposed to the clinical or individual level), the underlying incidence and prevalence of hazardous or harmful drinking is a core determinant of intervention impact. Using latest available information on the epidemiology of alcohol use, the analyses show a startlingly high prevalence of hazardous drinking in certain countries and age groups - as much as 50% or even more. Accordingly, any measure that is able to significantly change such high levels of drinking is likely to have a sizeable impact on population health.

Impact: In most EU member states, taxation offers the single most effective response to the current burden of heavy alcohol use. Consumers of alcohol do clearly respond to changes in price, and this can be effectively raised through higher levels of excise or other taxes on alcoholic beverages. However, it is not the case that taxation is *always* the most effective strategy; specifically in the EU context, the overall impact of taxation as a countermeasure can be significantly diminished in member states who exercise the right to apply a zero per cent level of tax on wine (the minimum level permissible under EU law). In Italy, for example, where wine is the predominantly consumed alcoholic beverage, current or even increased rates of excise tax generate less health gains than other interventions that are targeted at reduced availability (including a comprehensive advertising ban) or at high-risk groups (such as brief interventions for heavy drinkers or breath-testing for alcohol-impaired driving).

Cost: Implementation of these interventions is not expensive, relative to the harms that they cause (particular when one includes the non-health consequences of harmful drinking, such as property damage, crime and violence, which are not incorporated into the model). The lowest cost strategy is again taxation - in most case less than one Euro per person per year to implement and enforce) - but even the combination of this with other more expensive / less cost-effective strategies such as random breath-testing and brief interventions produces an overall annual cost in the range of Euros 5-10 per

capita, which is a small investment to make when set against a total estimated social cost of Euros 2125 billion in the EU. More expensive to implement are more targeted strategies such as random breath-testing of drivers or brief interventions for individual heavy drinkers.

Cost-effectiveness: The most cost-effective measure in most of the 22 EU member states is increased taxation, due to the large impact that it has on average consumption levels as well as the low cost of its implementation. The least cost-effective option in virtually all member states is random breath-testing, due to quite high costs of enforcement, plus relatively low health effects. With very few exceptions, all interventions - whether implemented alone or in combination - produce a very favorable health return for the cost incurred, in the sense that each extra year of healthy life can be secured for considerably less than the average annual income of persons living in the country (which in the year 2005 ranged from Euros 8,764 in Hungary to over 30,000 in Sweden). This threshold is used by CHOICE as an international yardstick for considering a health intervention to be a highly worthwhile use of resources.

Together with escalating social costs and persisting market failures (information deficits, spillover effects), there are strong grounds for enhanced action, both on health grounds (i.e. large population-level health improvements) and also on health economic grounds (cost-effective use of resources).

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Appendix 1 Running the Alcohol-CHOICE Model

General instructions

1. Download the zipped folder titled "Alcohol-CHOICE" (from the WHO FTP site).

2. Copy the file '4SPopmod.dll' to the following directory on your PC: C:\Windows

3. Open the files ALC_Template.xls and ALC_Data.xls

4. On the worksheet tab titled "Readme", enter your country from the dropdown menu (cell F15). The corresponding WHO sub-region will be automatically populated.

5. Throughout the Excel workbook, the pale yellow cells with blue font show data that differ between countries and are stored in a separate workbook (called ALC_Data.xls); examples include population and mortality statistics, the prevalence of hazardous alcohol use, and the rates of excise taxation currently in force. These values can be overwritten by the user if better / more recent data are available. Values in red are those that do not differ between countries but which are nevertheless modifiable by the user (such as the disability weights for hazardous and harmful alcohol use, desired levels of tax increase, or adherence to brief interventions). Other (un-highlighted) cells are formulae and should not be modified (to ensure the running of the model).

6. Once all data revisions have been completed (see below), return to the 'Readme' worksheet and press the yellow PopMod button to start the calculation process. PopMod will run and produce several output files.

7. Upon completion of the PopMod calculations, open the files ALC_Template.xls and ALC_Results.xls. In ALC_Results.xls, go to Tools, Macro, and then run the "SummaryResults" macro, which will automatically populate the file with the following information for each intervention:

- Intervention name/definition and modelled level of coverage
- Costs broken down into patient, programme and training categories (in local currency units over a period of 10 years)
- Effectiveness - Disability Adjusted Life Years (DALYs) averted over a 10-year period of implementation (with and without discounting and/or age-weighting)
- Cost per DALY saved - the Average cost-effectiveness ratio (ACER) and the Incremental cost-effectiveness ratio (ICER)
- Standardized costs and effects: Cost per capita per year (in Euros), and DALYs averted per one million population per year.
- Graphical displays showing the average and incremental cost-effectiveness of interventions that fall on the cost-effectiveness 'frontier' (i.e. those that dominate other possible interventions in terms of their relative cost to effect)

Sheet-by-sheet instructions

1. "Demography": you can enter revised population and mortality rate data if available (default data are taken from the UN Statistics Division for the year 2005).

2. "Current Epidemiology": you can enter revised estimates of the incidence, prevalence, remission and case mortality rates heavy alcohol use if available (default data are taken from the WHO Global Burden of Disease study for the year 2002).

3. "Health State Valuations": you can change the disability weight for hazardous and/or harmful alcohol use (default data are taken from the Dutch Disability Weight study). The disability weights for those 'at risk' (i.e. without the risk factor of heavy alcohol use) are taken from the WHO Global Burden of Disease study for the year 2002).

4. "Effectiveness Summary" provides an overview of interventions that can be assessed by the model, together with their rationale and primary sources of evidence of effect. No modifications to this sheet are needed.

5. "Brief interventions": Based on efficacy reviews of brief interventions, the default estimate for the net reduction in consumption among heavy drinkers is 22%, which - depending on the extent of

heavy drinking in the population - would reduce overall prevalence by 35-50% (equivalent to a 14-18% improvement in the rate of recovery over no treatment at all). Users can change the rate of patient or provider adherence to be modeled, as well as the current and target levels of treatment coverage in the population (the default is 30% of heavy drinkers).

6. "Tax": A number of data inputs are needed in order to calculate the expected impact of (current or increased) excise taxes on the consumption (and associated harm) of alcohol, including current levels of recorded and unrecorded consumption and taxation (by beverage type), and estimates of the price elasticity of demand for alcohol (the extent to which an increase in price is associated with a change in consumption). enter the increased excise tax of your choice. Country-specific default data are taken from the WHO Regional Office for Europe's Health for All database, updated where applicable with information from the WHO Global Survey on Alcohol and Health. Default data or model parameters (such as what percentage increase in excise tax to model) can be overwritten by the user.

7. "RBT, Ad Ban, Access": This worksheet documents the efficacy of the remaining population-based strategies (random breath testing, a comprehensive ban on advertising of alcoholic beverages, and reduced access to retail outlets). The user can modify the (current or target) coverage of these interventions, or their estimated efficacy. Default data for the proportion of total mortality and morbidity attributable to road traffic injuries are sub-regional estimates taken from the WHO Global Burden of Disease study for the year 2004, while data on the proportion of traffic fatalities due to alcohol are taken from the Comparative Risk Assessment; Rehm et al, 2004).

8. "Null scenario": This sheet provides a table from which the effectiveness of currently implemented interventions can be calculated. Space is provided for efficacy measures, effect modifiers and the effectiveness of interventions. No modifications need to be made (data are updated automatically).

9. "Intervention scenarios": This sheet is similar to the Null scenario table, but is used to determine the effectiveness of interventions to be analysed. In other words, here we are using target coverage of interventions rather than current coverage. Again, no modifications need to be made (data are updated automatically).

10. "Options": This sheet contains a number of analytical options that could be modified. However, for the present exercise, default options should be left unchanged.

11. "Codes": This final worksheet contains the code number for each WHO member state. It should not be altered / modified in any way.