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ASSESSING THE IMPACTS OF ALCOHOL POLICIES: A MICROSIMULATION APPROACH

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SUMMARY

Alcohol policies have significant potential to curb alcohol-related harms, improve health, increase productivity, reduce crime and violence, and cut government expenditure. The WHO Global Strategy to reduce the harmful use of alcohol provides a menu of policy options based on international consensus, which the OECD has used as a starting point in identifying a set of policies to be assessed in an economic analysis based on a computer simulation approach. This working paper provides a comprehensive illustration of the modelling approach, input data and underlying assumptions that have been used to carry out the analyses. The policies assessed in three country settings – Canada, the Czech Republic and Germany – include price policies, regulation and enforcement policies, education programmes and health care interventions. The results of the OECD analyses show that brief interventions in primary care, typically targeting high-risk drinkers, and tax increases, which affect all drinkers, have the potential to generate large health gains. The impacts of regulation and enforcement policies as well as other health care interventions are more dependent on the setting and mode of implementation, while school-based programmes show less promise. Alcohol policies have the potential to prevent alcohol-related disabilities and injuries in hundreds of thousands of working-age people in the countries examined, with major potential gains in their productivity. Most alcohol policies are estimated to cut health care expenditures to the extent that their implementation costs would be more than offset. Health care interventions and enforcement of drinking-and-driving restrictions are more expensive policies, but they still have very favourable cost-effectiveness profiles.

RÉSUMÉ

Les politiques de l'alcool peuvent jouer un rôle majeur dans la réduction des méfaits de l'alcool, l'amélioration de la santé, l'accroissement de la productivité, la réduction des délits et de la violence, et la diminution des dépenses publiques. La Stratégie mondiale de l'OMS visant à réduire l'usage nocif de l'alcool propose une liste d'options découlant d'un consensus international, que l'OCDE a utilisée comme point de départ pour mettre en lumière un ensemble d'actions à évaluer dans le cadre d'une analyse économique s'appuyant sur un modèle de micro-simulation. Ce document de travail offre une description complète du modèle, des données et des hypothèses sous-jacentes utilisées pour mener les analyses. Les actions évaluées dans trois pays – le Canada, la République tchèque et l'Allemagne – incluent des politiques de prix, des mesures de réglementation et d'application de la législation, des programmes d'éducation et des interventions sanitaires. Les résultats de l'analyse de l'OCDE montrent que l'on peut obtenir d'importants résultats en termes de santé grâce à des interventions brèves dans le cadre de soins primaires, qui ciblent généralement des consommateurs à haut risque, et à des hausses des taxes qui pénalisent tous les consommateurs. L'impact des mesures de réglementation et d'application de la législation, ainsi que d'autres interventions sanitaires, dépendent davantage du contexte et du mode d'application, tandis que les programmes en milieu scolaire semblent quant à eux moins prometteurs. Dans les pays étudiés, les politiques de l'alcool peuvent permettre à des centaines de milliers de personnes en âge de travailler d'éviter les incapacités et les blessures liées à l'alcool, ce qui améliorerait beaucoup leur productivité. On estime que la plupart des politiques de l'alcool pourraient contribuer à réduire les dépenses de santé dans la mesure où leurs coûts de mise en œuvre seraient plus que compensés. Les interventions sanitaires et l'application de restrictions concernant l'alcool au volant constituent des mesures plus onéreuses, mais présentent quand même des rapports coût-efficacité très positifs.

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SECTION 1.BACKGROUND

1.1. Introduction

1. The OECD has undertaken a project on the economics of chronic disease prevention starting in 2007 (Sassi and Hurst, 2008). The primary aim of this project is to determine whether preventive interventions have the potential to increase health outcomes and social welfare of a population and are an efficient investment for governments. The focus of the work is to identify policies able to pursue population health improvements, generating savings on the health expenditure and decreasing the health inequalities across different population subgroups. In the first phase of the work the OECD Economics of Prevention team, in collaboration with WHO, analysed a range of policy option to tackle obesity and related unhealthy behaviours as poor diet and lack of physical activity (Sassi et al. 2009a, Cecchini M et al., 2010). This paper reports on the extension of this work to analyse policies to tackle harmful consumption of alcohol.

1.2. Objectives

2. This paper is built upon previous experience of the OECD in modelling the cost-effectiveness of prevention interventions to tackle overweight, obesity and associated risk factors at the population level. The focus of this new modelling attempt is on identifying efficient and equitable means of improving the health of OECD countries through appropriate combination of preventing strategies to tackle alcohol harmful consumption. The focus of this paper is on three OECD countries: Canada, Germany and the Czech Republic.

3. The remainder of this section will provide an overview of the generalized cost-effectiveness analysis approach as well as the results of a review of previous modelling attempts in the area of alcohol policies. Section 2 will introduce the modelling approach employed to develop the OECD CDP-alcohol model as well as the evidence used to model the impact of prevention policies. Section 3 will report the results of our analyses in terms of change in behaviours, health effects and cost effectiveness of interventions. A final section, Section 4, will take stock of the results presented in Section 3 and will present the key policy implication that can be drawn on such results.

1.3. Cost-effectiveness analysis: a generalized approach

4. To determine whether an innovative policy will increase social welfare, the costs and benefits of such interventions need to be assessed against those of alternative courses of action. Routinely, assessment of the allocative efficiency of interventions and programmes is based on the framework of cost-effectiveness analysis, which avoids placing monetary values on health outcomes by using quality-adjusted life years, disability-adjusted life years, or simply life years gained as common health outcome measures.

5. Cost-effectiveness analysis (CEA) is concerned with how to make the best use of scarce resources for health policy interventions. The large and growing literature on the topic is dominated by the comparison of interventions aimed at a particular disease, risk factor or health problem, which provides relevant information to programme managers or practitioners with this specific disease mandate. In

practice, however, different types of policy makers and practitioners have different demands. Managers of hospital drug formularies must decide which of a vast array of pharmaceuticals they should stock, taking into account the available budget. Countries where health is funded predominantly from the public purse make decisions on what type of pharmaceuticals or technologies can be publicly funded or subsidized, while all types of health insurance - social, community or private - must select a package of services that will be provided. These types of decisions require a broader set of information, involving comparison of different types of interventions across the entire health sector - whether they are aimed at treating diabetes, reducing the risk of stroke, or providing kidney transplants. This type of analysis can be referred to as "sectoral cost-effectiveness analysis".

6. Although the number of published cost-effectiveness studies is now huge, there are a series of practical problems in using them for sectoral decision making (Hutubessy et al., 2003). The first is that most published studies take an incremental approach, addressing questions such as how best should small changes (almost always increases) in resources be allocated, or whether a new technology is more cost-effective than the existing one it would replace. Traditional analysis has not been used to address whether existing health resources are allocated efficiently, despite evidence that in many settings current resources do not in fact achieve as much as they could (Tengs et al., 1995). A second problem is that most studies are very context specific. The efficiency of additional investment in an intervention aimed at a given disease depends partially on the level and quality of the existing health infrastructure (including human resources). This varies substantially across settings and is related to a third problem - individual interventions are almost always evaluated in isolation despite the fact that the effectiveness and costs of most will vary according to whether other related interventions are currently undertaken or are likely to be introduced in the future.

7. In response to these concerns, a more generalized approach to cost-effectiveness analysis has been developed by WHO in order to allow policy makers to evaluate the efficiency of the mix of health interventions currently available and to maximize the generalizability of results across settings. Generalized cost-effectiveness analysis (GCEA) and its implementation via the CHOICE framework (in the broader context of which the first version of the CDP model has been developed) allows for an assessment of the efficiency of the current mix of interventions by analysing all interventions and combinations incrementally, with respect to a counterfactual of a ‘business as usual’ scenario in which no new intervention is implemented in addition to policies currently in place in that country (Murray et al., 2000; Tan Torres et al., 2003; www.who.int/choice).

8. Many interventions interact in terms of either costs or effects at the population level and interacting interventions are undertaken in different combinations in different settings. Neither the health impact of undertaking two interventions together nor the costs of their joint production are necessarily additive. To understand whether they are efficient uses of resources independently or in combination requires assessing their costs and health effects independently and in combination. Only then is it possible to account for non-linearities in costs and effects.

9. GCEA seeks to maximize generalizability across settings. Most cost-effectiveness studies have been undertaken in developed countries, but not even the wealthier have been able to evaluate the full set of interventions required to undertake a sectoral analysis specific to their own country. All countries need to borrow results of cost or effectiveness studies from other settings, but the fact that most published studies are very specific to a particular setting makes this difficult. WHO-CHOICE reports results for 14 sub-regions of the world, but has developed tools enabling county-level analysis too.

10. GCEA has now been applied to a wide range of specific diseases (including malaria, tuberculosis, cancers and mental disorders) as well as risk factors (for example, child under-nutrition, unsafe sex, unsafe water, hygiene and sanitation, hypertension, smoking and obesity) (see, for example, Chisholm et al.,

2004a; Chisholm et al., 2004b; Groot et al., 2006; Murray et al., 2003; Shibuya et al., 2003; WHO, 2002; Cecchini et al., 2010; Sassi et al., 2010). Like all CEA, GCEA focuses on only one outcome, population health. There are many other possible outcomes people care about - inequalities in health, responsiveness, fairness of financing, for example (Murray and Evans, 2003). Accordingly, the results of GCEA cannot be used to set priorities by themselves but should be introduced into the policy debate to be considered along with the impact of different policy and intervention mixes on other outcomes.

1.4. Previous modelling attempts

11. A review was undertaken to identify and assess previous attempts to model alcohol consumption, related morbidity and mortality and effectiveness and cost-effectiveness of prevention policies to tackle harmful alcohol consumption. In total we were able to identify six major modelling approaches: ACE-Prevention (University of Queensland, Deakin University), CDM (RIVM), CHOICE (WHO), Dynamo (a consortium of European Universities/research centres with LSHTM leading on the alcohol component), POHEM (Statistics Canada), 'Sheffield-model' (University of Sheffield). The rest of this section will provide a brief description for each of these modelling approaches; it will highlight major strengths and will identify areas that may be improved. A final section reports on key conclusions.

12. ACE-Prevention. The ACE-Prevention approach (Cobiac et al., 2009) has been widely used to test, in a consistent framework, a number of policies of primary and secondary prevention for all the major risk factors and diseases. Analyses mainly rely on Markov models and multistate life tables to predict, in discrete steps over time, the health risks, costs and outcomes for the average individual in the target population calculating differences between the comparator scenario and an intervention scenario. The model was built in Excel and uses @Risk for uncertainty analysis. Consumption of alcohol is modelled in four categories (abstinence, low, hazardous and harmful) and alcohol dependence. Different levels of consumption increase, through relative risks, the chance of developing all the major diseases using a set of differential equations that allows the transition of people between four states (healthy, diseased, dead from the disease, and dead from all other causes) based on rates of mortality, incidence, case fatality and remission. The potential impact of all the major policies is assessed through the standard PIF (potential impact fraction) technique. ACE-Prevention analyses of alcohol policies concluded that taxation policies are supported by strong evidence of effectiveness and can be cost saving. Weaker evidence was found for advertising bans and for an increase in legal drinking age to 21, but, if effective, these would also be cost saving. Brief interventions in primary care, licensing controls and roadside breath testing were found to be effective and cost-effective interventions, whereas evidence in support of mass media campaigns against drinking-and-driving was more limited.

13. CDM. This model (van den Berg et al., 2008) describes the life course of cohorts in terms of changes between risk factor classes and changes between disease states over a period of 100 years. It allows for co-morbidity and includes epidemiological data on the most important chronic diseases and their risk factors. Risk factors and diseases are linked through relative risks for disease incidence. The model relates alcohol use to a small set of diseases: CVDs and cancer (oral cavity, laryngeal, oesophageal, breast) and to total mortality. Alcohol consumption is divided, with different thresholds, into 4 groups for both men and women (abstinence, moderate, excessive and dangerous). Only two potential interventions are taken into account: fiscal measures and brief intervention (Tariq et al., 2009). The effectiveness of the intervention is calculated with what looks the standard PIF technique (i.e. the new distribution, after the intervention, is combined with the relative risks to calculate the new health outcomes); however, compared to other approaches, the authors specify that they account for the time dimension by employing a "long-term maintenance fraction". Different tax hikes were shown by CDM analyses to be cost effective, relative to taxation levels in use in the Netherlands in 2008, and so was the use of brief interventions, with cost-effectiveness ratios marginally exceeding EUR 5 000 per QALY gained (van den Berg et al., 2008; Tariq et al., 2009).

14. CHOICE. PopMod (Lauer et al., 2003), which is the epidemiological platform of the WHO-CHOICE model has been widely employed to simulate the effects of policies to tackle alcohol harmful use virtually across a large number of country with different levels of income (Chisholm et al., 2004b; Anderson et al., 2009a). PopMod is a state transition population model which traces the development of a regional population taking into account the following age- and gender-specific parameters: simplified population dynamics, a specific risk factor and health states for the population with the disease in question and the non-diseased population. The adaptation to the alcohol area includes high-risk alcohol use as the only risk factor. Hazardous alcohol use is linked to total morbidity and mortality through relative risks; however, no specific disease is explicitly included in the model. Interventions are implemented for a period of 10 years and results evaluated over a period of 100 years against a counterfactual null scenario. The output of the model is an estimate of the total healthy life years experienced by the population over lifetime.

15. Dynamo-HIA. This tool (Lhachimi et al., 2012a) is a Markov-type model based on a multi-state model. The change of the state depends only on current characteristics (age, sex, risk-factors) and health status which are updated annually on specific transition probabilities. The multi-state model is implemented as a partial microsimulation combining a stochastic microsimulation to project risk-factor behaviour with a deterministic macro approach for the disease life table. Alcohol is one of the considered risk factors and is modelled in five categories which are linked, through appropriate relative risks, to total mortality and a small set of diseases including CVDs, major cancers, diabetes and COPD. Policies are modelled by defining a counterfactual risk-factor prevalence that is assumed to be reached after a successful one-off intervention, or by altering the transition probabilities between different risk-factor states. The only policy of interest assessed is fiscal policy which has been modelled for EU countries over a 10 year period (Lhachimi et al., 2012b). Dynamo is primarily conceived as a health impact assessment tool assessing policies exclusively in terms of changes in mortality and morbidity without allowing a full cost-effectiveness analysis. It was used to estimate the impacts of tax increases in EU countries over a ten year period, showing that price increases up to prevailing price levels in Finland would lead to major health gains, but cost effectiveness was not assessed.

16. POHEM. POHEM (Wolfson MC, 1994; Will et al., 2001) is longitudinal discrete-event, continuous time, Monte Carlo microsimulation model of diseases and risk factors, realistically representing lifecycle dynamics. Hazards compete to determine the time of the next event in a person's life. Events compete to be the next to occur. The monte carlo process involves the generation of a random number that influences the occurrence of events and allows outcomes to vary from one individual to another. The dynamic framework ages the individual through their lifecycle and allows for time spent with multiple health conditions. Individuals experience health-related events, such as developing risk factors and diseases, experiencing treatments, gaining or losing health and eventually dying. A number of risk factors are explicitly modelled, including, up to a certain level, alcohol consumption. The POHEM framework, and the availability of longitudinal data on alcohol consumption patterns, would enable an extension of POHEM to assess the effectiveness and the cost-effectiveness of alcohol policies.

17. 'Sheffield-model'. The modelling approach developed by the University of Sheffield (Meier et al., 2008b; Purshouse et al., 2010) is based on three linked modules: population, price-to-consumption and consumption-to-harm. Alcohol consumption quantities are modelled in three categories (moderate, hazardous and harmful drinkers) split by sex and nine age bands; each of these 54 groups is subsequently divided by product category (beer, wine, spirits and ready-to-drinks), point of sale (on- / off-trade) and price (low / high price). The distribution of price paid, by each subgroup, for each of the 16 alcohol categories, can then be estimated, resulting in 864 separate price distributions. The list of considered diseases is, again, very comprehensive including 47 chronic and acute conditions attributable either wholly or partially to alcohol. Effectiveness of policies is calculated with the PIF approach, through the use of relative risks, assuming a period of 10 years to reach the full effectiveness. Tested policies include: fiscal policies (taxes, minimum pricing, discount bans), brief intervention, regulation of advertising and regulation of availability. Effectiveness and cost-effectiveness are calculated taking into consideration effects of policies on health, crime, unemployment and absenteeism.

18. Some important conclusions can be drawn from the findings of our review of models to test alcohol policies. Most of the modelling approaches are, essentially, static (ACE-Prevention, CDM, CHOICE, 'Sheffield-model') and employ variants of the PIF approach to calculate the health effects of innovative alcohol policies. Compared to others, the 'Sheffield-model' presents some strengths which include the ability to simulate in a very detailed manner a larger number of drinking patterns and related chronic and acute diseases. In addition, it takes into account effects on domains external to the health sector such as crime and the labour market. The WHO-CHOICE model stands out for the flexibility to assess virtually all the possible policies to prevent alcohol harmful consumption in a large number of different settings from developing to developed economies. Dynamo-HIA is the only model which simulates a population in a dynamic fashion and in which alcohol consumption is associated to a large number of other risk factors. On the other hand it does not cover, as other modelling approaches, mental health which is a major determinant of morbidity due to alcohol. Only the POHEM platform seems to be able to fully address two of the most important issues that may affect the estimated impact of policies: time and a comprehensive set of diseases.

1.5. Alcohol policies in the examined countries: Canada, the Czech Republic and Germany

19. Germany has, by a wide margin, the largest population of the three countries examined, with a current population of over 81 million people. Canada follows with 34 million, while the Czech Republic has a population of about 10 million. The Canadian population is projected to grow over the next 40 years, mainly due to migration, unlike those of Germany and the Czech Republic, which are projected to decline. The German population has the oldest age structure, followed by the Czech and Canadian populations. Life expectancy at birth is similar in Germany and Canada, around 81 years on average, but three years lower in the Czech Republic. Cardiovascular mortality is over twice as large in the Czech Republic as in Germany and Canada. Mortality from traffic accidents is higher than the OECD average in the Czech Republic and Canada, but significantly lower in Germany.

20. Beer drinking accounts for the largest proportion of alcohol consumption in all three countries, with spirits coming second in the Czech Republic and Canada, and wine in Germany. Average (recorded) alcohol consumption is among the highest in the OECD area in Germany (11 litres) and the Czech Republic (11.6 litres). Consumption per capita is significantly lower in Canada, with an average of 8.1 litres, although WHO holds that roughly 20% of all alcohol consumption in Canada is unrecorded, while the corresponding estimates for Germany and the Czech Republic are proportionally less than half (4% and 9%, respectively). The levels of risk associated with typical patterns of drinking, as estimated by WHO on a five-point scale (from 1 – lowest risk – to 5 – highest risk) are 1 for Germany, 2 for Canada and 3 for the Czech Republic. However, based on national survey data, Germany appears to have higher rates of hazardous and harmful drinking, as well as heavy episodic drinking, than Canada, while the Czech Republic outpaces the other two countries on all measures.

21. Taxation rates are somewhat milder in Canada, higher in Germany and higher yet in the Czech Republic, but Canada has minimum price policies in place in several provinces, which contribute to moderating alcohol consumption by raising prices. Blood alcohol concentration limits for drivers are also milder in Canada (0.08, reduced to 0.04 for young drivers), while the Czech Republic has a zero tolerance policy for all drivers, and Germany has zero tolerance for young drivers, and a limit of 0.05 for other drivers. Other regulatory policies are more haphazard, with access to alcoholic beverages limited only for intoxicated persons in Germany and the Czech Republic and limited bans in connection with special events in the Czech Republic. Regulation of alcohol promotion is mostly limited to advertising in the three

countries. Germany has a low minimum legal age for purchasing alcohol (16, raised to 18 for spirits), while the Czech Republic has a minimum age of 18 and Canada has different age limits in different provinces, ranging from 18 to 19.

22. With some notable exceptions, such as minimum price policies in Canada and low blood alcohol concentration (BAC) limits in the Czech Republic and Germany, the policies currently in place in the three countries are not amongst the most restrictive in the OECD area. The analyses presented in this section provide an assessment of the impacts to be expected from developments in a number of policy areas in each of the three countries. Policy developments are generally assessed incrementally, as a scaling up, or tightening, of existing policies. One partial exception is minimum price policies, currently in place in only one of the three countries. These have been assessed as an increase (by 10%) of existing minimum price thresholds in Canada, and as a new policy to be introduced at the national level in Germany and the Czech Republic, based on a minimum price set at a level that would cause a similar average price increase (10%) in the cheaper segment of the respective national alcohol markets.

SECTION 2. MODELLING ALCOHOL-RELATED DISEASES AND THE IMPACT OF INTERVENTIONS

2.1. Introduction

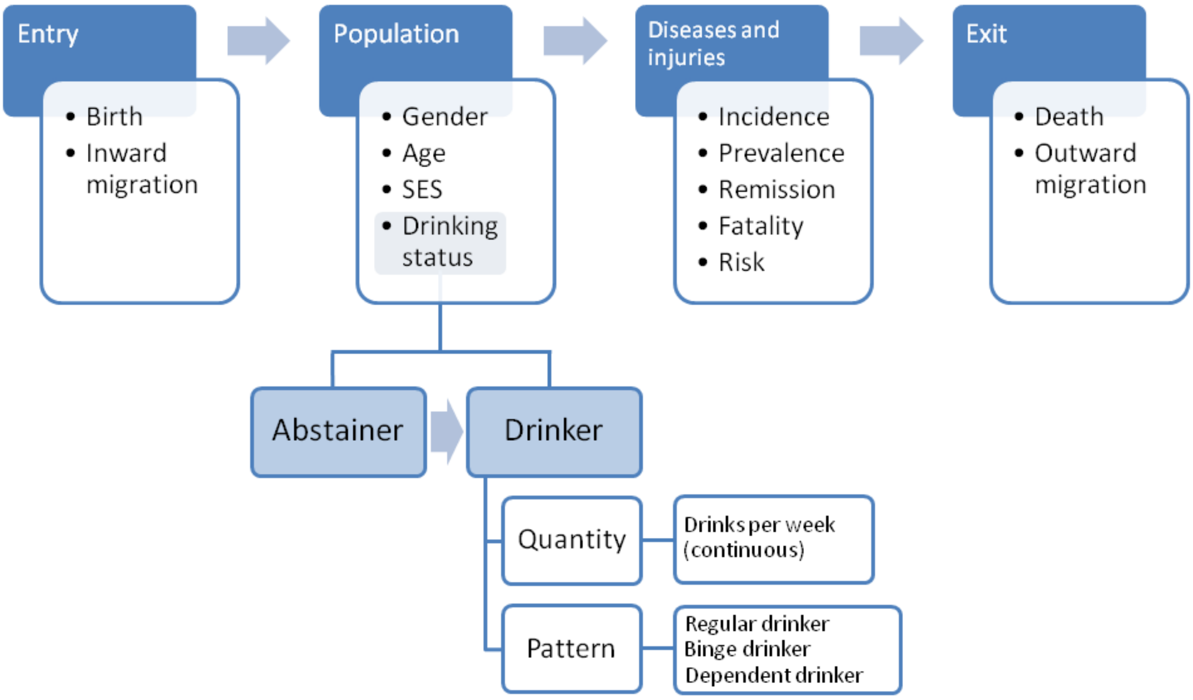
23. This section illustrates the methods and the input data used in the assessment of the efficiency and distributional impact of interventions to prevent chronic diseases linked to harmful use of alcohol. The analysis was undertaken by developing a micro-simulation model of the health outcomes arising from alcohol consumption. The overall structure of the model is described in Section 2.2, while the design, the underlying assumptions and data sources for the individual modules are describes in in Sections 2.2.1 to 2.2.3. Further information on the data sources to feed the model are reported in Annex A. Section 2.3 describes the scope of the model and some key assumptions used in the simulation. The methodology used to calculate the cost involved in the economic component of the analysis is reported in Section 2.4. Interventions are described in Section 2.5 which illustrates the characteristics of the preventive interventions assessed in the analysis, as well as the data sources and assumptions used in modelling the effectiveness of those interventions. The reminder of this section (2.6 and 2.7) presents the process of validation of the model and the approaches used to carry out the extensive sensitivity analysis.

2.2. The CDP-alcohol model

24. The Chronic Disease Prevention, CDP-Alcohol, model was built to simulate population dynamics from individual characteristics and outcomes, including demographic and socioeconomic characteristics, patterns and levels of alcohol consumption, disease incidence and disease-specific mortality. The starting point of each simulation reflects the state of the relevant country in the year 2010, and the simulation projects the population forward for 40 years. In the design of the CDP-Alcohol model, special emphasis was placed on ensuring the relevance of the model to multiple country settings, such as its flexibility and adaptability to alternative demographic, epidemiological and policy contexts, and to different national patterns of alcohol use.

25. The model is designed as a Montecarlo semi-Markov discrete-event microsimulation model with a dynamic population. It is structured in discrete time and state transitions occur in yearly cycles. The model includes three main modules: a) a demographic module, which simulates births, deaths and migration flows; b) an alcohol consumption module, which simulates individual trajectories of drinking, including both levels and patterns of alcohol use; and c) a disease module, which simulates the onset and natural history of a range of alcohol-related conditions. This modular structure is illustrated in Figure 1 below. The model was developed using the software TreeAge Pro 2013 (Treeage Software Inc.) and compiled in Java©.

Figure 1. Structure of the CDP-alcohol model



26. In the business as usual scenario (i.e. the counterfactual scenario), the model projects the country-specific population, alcohol consumption and disease trends into the future under the assumption that no new policy is implemented beyond the policies that are already in place. Following this first step, the model is set on the policy scenario in which the input parameters are modified by the specific policy changes under study. Finally, each policy scenario is compared with the baseline scenario to estimate the net effects produced by the policy changes. The model is designed to sample one person every 10 000 in the Canadian population, one in 25 000 in the German population, and one in 3 000 in the Czech population, in each simulation. However, since the degree of stochastic variation in the results generated by the model is large compared with the size of the effects produced by the policies examined, a high number of simulations were run for each country (more for countries with a larger population, i.e. 5 000 for the Czech Republic; 10 000 for Canada, and 20 000 for Germany), in order to increase the degree of confidence around the results estimated. The sampling value and the number of simulation value were chosen so to allow stable and statistically significant results for country-specific whole populations. Breakdowns by population subgroups (e.g. by age groups) loose some of the significance because for some subgroups the number of individuals is too small.

2.2.1. The demographic module

27. The population module is designed to reproduce the population dynamics of a given region or country. The initial population during the first year of the simulation is modeled on the input data while population dynamics are based on future rates of birth, migration, and death reflecting official population projections for the country concerned. Each individual in the modelled population is assigned a gender and age in line with the relevant observed and projected joint distributions. Individuals in the starting population are also assigned to a socio-economic group (one of two included in the model), based on their age and sex. The socio-economic group is assigned according to age- and gender-specific rates as calculated on relevant national surveys. People may change their socio-economic group throughout the simulation; however, at the population level, the likelihood of switching to a different socio-economic

status is constrained so that, overall, the prevalence of people in high and low socio-economic group is maintained constant by gender and age.

28. More specifically, the model simulates the foreseeable dynamics of a country-specific population in the period 2010-2050 (i.e. 41 years). The model is built to reproduce, in a consistent fashion, the number of individuals by gender and single year of age between 0 and 100 as forecasted by national statistical offices or, if requested data are not available, by the United States Census Bureau (2012). Number of individuals and newborns are, therefore, retrieved from the abovementioned source. All the individuals entering the model with an age of zero are considered born in the country and enter the model on the first day of the year. Data on mortality (total mortality rates) are, again, primarily derived from relevant national authorities or, in second order, from the UN population database and the Human Mortality Database. Once individuals die, they exit the model and are not simulated anymore.

29. Net migration (i.e. number of inward migrants minus number of outward migrants) by gender and age group was calculated ex-post as the difference between the projected number of people in each of the 202 sub-categories (i.e. 2 genders times 101 age groups) or the projected number of newborns (only for age 0) and the projected number of deaths. More formally, net migration is calculated as:

$$NM_{ygas} = Pop_{ygas} - Pop_{(y-1)g(a-1)s} + Mort_{ygas}$$

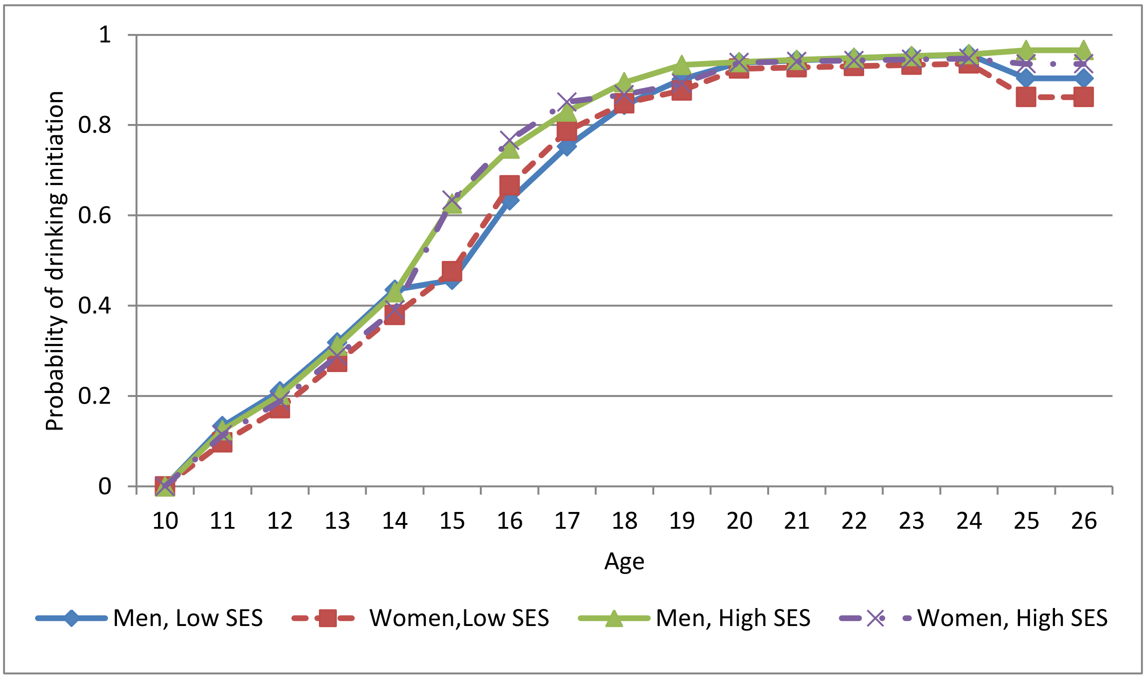
where NM is the net migration for a given year (y) and for a given population subgroup of gender (g), age (a) and socio-economic status (s); Pop is the total number of people; while Mort is the total number of deaths. If NM > 0, the net migration is positive or in other words, the total number of people that enter the country is higher than the total number of people leaving the country. Conversely, if NM < 0 the net migration is negative and the total number of people entering the country is lower than the total number of people leaving the country. Migrants are modelled to enter or exit the country on the first day of the year. Once migrants enter the country, they are modelled as full citizens and can, therefore, change patterns of alcohol consumption, develop diseases and die. Once migrants leave the country they are not modelled anymore and the course of their life do not affect the population outcomes.

2.2.2. The risk-factor module

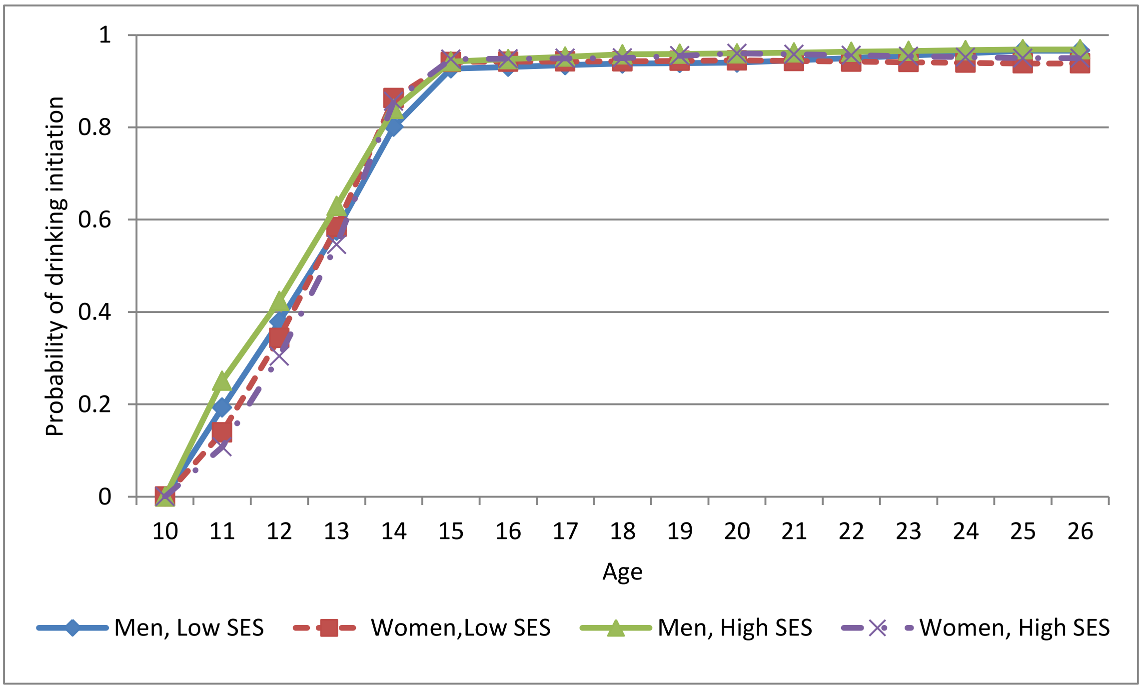
30. Alcohol consumption is the only (modifiable) risk factor simulated in the model. This was modelled along two dimensions: quantity of alcohol consumed (continuous number of drinks per week) and pattern of drinking (regular drinker, binge drinker, dependent drinker), based on evidence that patterns of drinking are at least as important as volume of drinking in the development of certain NCDs, such as alcohol use disorders and coronary heart disease as well as injuries (Rehm et al., 2003). The model randomly assigns drinkers to patterns of drinking based on probability distributions modelled as a function of age, gender, and quantity of alcohol drunk. All individuals are born abstainers in the simulation and remain such until age 10. Transition from the abstainer to the drinker state starts gradually at age 11 and ceases when age 26 is reached (statistically, drinking onset is very rare after age 25). Probabilities of drinking initiation are specific to country, gender and socioeconomic status (SES).

Figure 2: Drinking initiation, probability of being a drinker at age 11 to 26

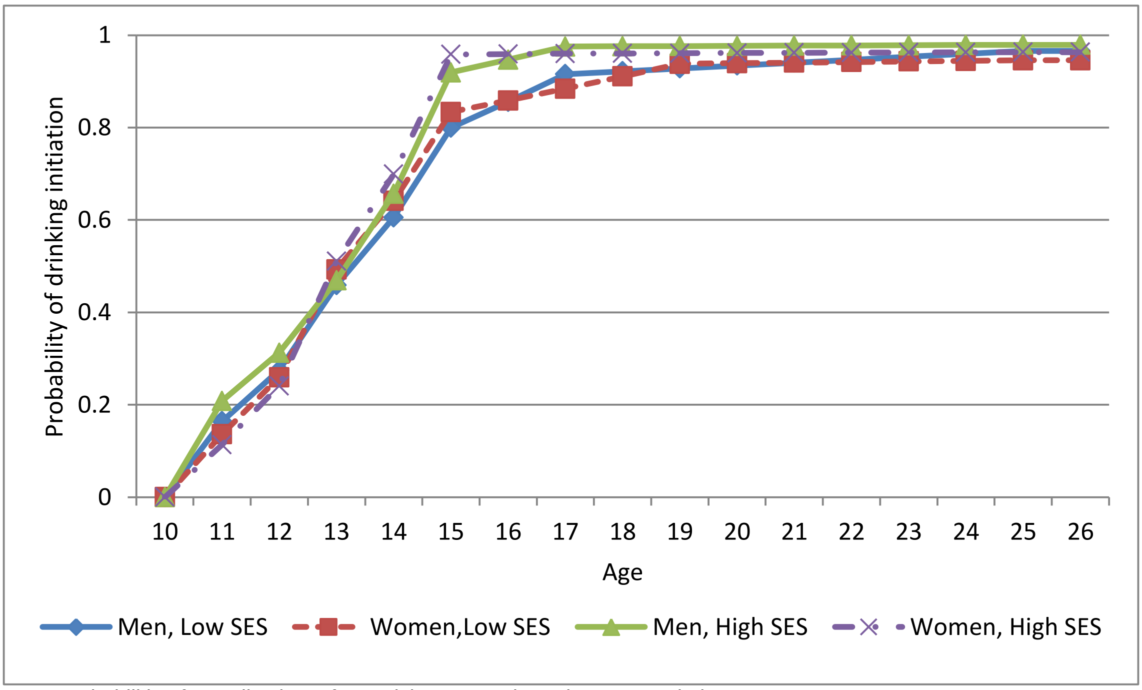
Panel a - Canada



Panel b – Czech Republic



Panel c - Germany



Note: probabilities for earlier (out of sample) ages are based on extrapolations.
Source: OECD analyses on relevant datasets cited in the text

31. Once they enter the drinking state, simulated individuals may reduce their alcohol consumption, even to zero, but will never return to the abstainer state. This is based on existing evidence that a large part of the risks (and possible benefits) of drinking persist for a significant period of time in quitters, so the latter cannot be fully assimilated to abstainers. Throughout the simulation, individuals may change their drinking behaviour and, therefore, their risk, following country-specific algorithms derived from national survey data. In particular, alcohol consumption in a population is modelled to follow a negative binomial distribution based on a Gamma-Poisson mixture. In particular, the number of weekly drinks for each individual is determined on the basis of a Poisson distribution Poisson(λ), in which the parameter λ is gender-specific and function of the age, squared age, and socioeconomic status of each individual, following a Gamma distribution.

$$Y \sim \text{Poisson}(\lambda), \text{ where Y is the number of drinks.}$$

The probability mass function of the Poisson distribution is given by:

$$P(Y = y) = \frac{\exp(\lambda)\,\lambda^y}{y!},$$

where y takes the integer value 0,1,2… and the parameter λ>0 follows a Gamma distribution.

$$\lambda \sim \text{Gamma}(Alpha, Beta)$$

with the shape parameter $Alpha = r$ (calculated from the data through the negative binomial regression)

and the rate parameter $Beta = \frac{r}{mu}$

where mu is gender-specific and $mu = \exp(\beta_0 + \beta_1\,Age + \beta_2\,Age^2 + \beta_3\,SES)$

32. The parameters $r\ \beta_0\ \beta_1\ \beta_2\ and\ \beta_3$ are estimated from regression analyses using national cross-sectional survey data (see below for data description). A negative binomial regression model specific to country and gender is used to model the number of drinks.

Let Y_i denote the number of drinks consumed by individual i.

Let Age_i be the age of individual i, Age^2_i the square of age, and SES_i a dummy variable for the socioeconomic status of individual i.

As the distribution of the number of drinks shows overdispersion, we assume that Y_i follows a negative binomial distribution with the parameters r and p.

$$Y_i \sim NB(r, p)$$

where $E(Y_i) = mu_i = \frac{pr}{1-p}$ and $Var(Y_i) = \frac{pr}{(1-p)^2}$

33. The negative binomial regression model for individual i, is of the form:

$$\log(\mathrm{mu_i}) = \beta_0 + \beta_1 * \mathrm{Age_i} + \beta_2 * \mathrm{Age_i^2} + \beta_3 * \mathrm{SES_i} + \mathrm{e_i}$$

where $e_i \sim N(0,\sigma^2)$ and where $\mathrm{mu_i}$ represents the expected number of drinks.

34. A zero-inflated negative binomial model –instead of a negative binomial distribution- was used for Canada because of its better fit with the survey data. This means that the model calculates in a first step the probability of "having zero drink" using a gender-specific logistic function with the same covariate as above (age, age squared and SES). In a second step a negative binomial model is applied for individuals who have at least one drink.

35. The logistic regression component of the alcohol consumption model for Canada was implemented in the CDP-Alcohol microsimulation model as follows:

Where D is the number of drinks, β_{Age} is the (linear) coefficient associated with the person's age, as follows:

Age	Men	Women
20-24	-1.23382	-0.7989
25-29	-1.25822	-0.53068
30-34	-1.09975	-0.64269
35-39	-1.0273	-0.89618
40-44	-0.98459	-0.93203
45-49	-0.89999	-0.92628
50-54	-0.90878	-0.88973
55-59	-0.89306	-0.81484
60-64	-0.77283	-0.74287
65-69	-0.78193	-0.45579
70-74	-0.75895	-0.4037
75-79	-0.59774	-0.07169
80+	-0.29554	0.140811

Source: OECD analyses on relevant datasets cited in the text

β_{Low_SES} is the coefficient associated with low SES, and β_0 is the intercept of the logistic regression equation, as follows:

β	m	f
Low SES	0.958798	0.875803
Constant	-0.25809	-0.31497

Source: OECD analyses on relevant datasets cited in the text

36. For drinkers reporting a positive number of drinks, and all drinkers in Germany and in the Czech Republic, the negative binomial model was implemented so as to determine the average number of weekly drinks for each person as a value randomly extracted from a Poisson distribution with a λ parameter, in turn, randomly extracted from a gamma distribution defined on the basis of the parameters below. The parameters were calculated from the respective national data using the zero-inflated (for Canada) and negative binomial models (for other countries) previously described.

37. Alpha (shape parameter):

Alpha	Canada	Germany	Czech R.
Men	0.802445	0.780848	0.65324
Women	0.647787	0.663455	0.409102

Source: OECD analyses on relevant datasets cited in the text

Beta (rate parameter), determined as the ratio between the shape parameter Alpha and the parameter *mu* as above:

$$mu = \exp(\beta_0 + \beta_1\, Age + \beta_2\, Age^2 + \beta_3\, SES)$$

Where, for Canada, β_2=0 and β_1 is age-dependent, as follows:

Age	Men	Women
20-24	0.14304	0.123783
25-29	0.009416	-0.08861
30-34	-0.16443	-0.29786
35-39	-0.18625	-0.36005
40-44	-0.22057	-0.18115
45-49	-0.11646	-0.17258
50-54	-0.14967	-0.29166
55-59	-0.22904	-0.37651
60-64	-0.22985	-0.35634
65-69	-0.25359	-0.35681
70-74	-0.36221	-0.36638
75-79	-0.40876	-0.4074
80+	-0.63274	-0.55312

Source: OECD analyses on relevant datasets cited in the text

And, for other parameters:

β_1	Men	Women
DEU	0.018072	0.009454
CZE	0.053432	0.024143

Source: OECD analyses on relevant datasets cited in the text

β_2	Men	Women
DEU	-0.0001296	-0.0000422
CZE	-0.0006119	-0.0004448

Source: OECD analyses on relevant datasets cited in the text

β_3	Men	Women
CAN	0.0861544	-0.0359797
DEU	0.1293041	-0.1188311
CZE	0.2147332	0.1631951

Source: OECD analyses on relevant datasets cited in the text

β_0	Men	Women
CAN	2.21703	1.50761
DEU	2.04468	1.52002
CZE	1.818284	1.63046

Source: OECD analyses on relevant datasets cited in the text

38. The current CDP-Alcohol model does not distinguish between different types of alcohol (e.g. beer, wine, spirits, etc.) and places of consumption (e.g. on- and off-premises).

39. Quantity of alcohol consumed is also used to classify drinkers into three drinking categories: mild/moderate, hazardous and harmful drinker, based on the following thresholds of grams of alcohol per week:]0-280];]280-420;]420+ for men and]0-140];]140-280];]280+ for women. The pattern of alcohol consumption is modelled into three types: regular drinker, binge drinker, alcohol dependent. Individuals with positive alcohol consumption (i.e. non abstainers) are assigned a pattern of alcohol consumption stochastically, with probabilities determined on the basis of the relevant national data (see below) as a function of the drinking category (quantity of alcohol drunk). All newborns and immigrants below age 11 enter the simulation in the abstainer state, and start their transition into drinking states at age 11. People

who are alive in the initial population (year 2010) and migrants who enter the simulation at age 11 or older are stochastically assigned an initial quantity and pattern of drinking. Throughout the simulation individuals may change their behaviours and, therefore, their quantity and/or pattern of drinking following the algorithm described in Section 2.4.

40. Mathematical algorithms and input data to allow the alcohol module to simulate individual patterns of alcohol consumption were developed by using cross-sectional survey data from the three countries Canada, Czech Republic, and Germany.

Canada

41. For Canada, we used data from the first wave of the cross-sectional component of the NPHS (National Population Health Survey 1994-95) (Statistics Canada 2012b) and several waves of the CCHS (Canadian Community Health Survey from 2000-01 to 2008-09) (Statistics Canada, 2012a). These cross-sectional surveys collect information related to health status, health care utilisation and health determinants for the Canadian population. They rely upon a large sample of respondents and are designed to provide reliable estimates at the health region level. The survey component on alcohol cover adults aged 15 and above.

42. The CCHS data provides information whether people consumed alcoholic beverages in the past 12 months, which permits to derive the probability of being an alcohol consumer in the past 12 months by gender and age group. Moreover, people who did not drink in the past 12 months, were questioned whether they have ever drunk in their life time. Combining both information, it was possible to estimate the probability of “having ever drunk in lifetime” by 10-year age group, which was used to assess the average age of onset of drinking.

43. In CCHS, respondents who reported drinking alcohol in the past 12 months were asked about the number of drinks in the week prior to the interview. One standard drink in Canada is assumed to contain 13.6 grams of pure alcohol. This information was used to derive the following categories of quantity of alcohol consumed: mid/moderate, hazardous, and harmful. The “mid/moderate” category consists of people who drink less than 210 grams of pure alcohol per week for men (140g for women). The “hazardous” category groups people who consume 210g up to 500g of pure alcohol per week (140g to 350g for women) and the “harmful” category 500g or more for men (350g for women).

44. The probability of being a binge drinker was derived from the question “How often in the past 12 months have you had five or more drinks on one occasion?”. Responses were dichotomized into “at least once a month” vs. “less than once a month or never”. Probabilities of being a binge drinker were calculated by category of quantity of alcohol consumed and by gender and age group.

45. In the CCHS 2003 and CCHS 2007-08, people who reported to drink five or more drinks per occasion at least once a month during the last 12 months (i.e. binge drinkers) answered the alcohol dependence questions. Alcohol dependence is defined as tolerance, withdrawal, or loss of control or social or physical problems related to alcohol use. The CCHS questions on dependence consist of a subset of items from the Composite International Diagnostic Interview (CIDI) developed by Kessler and Mroczek (Kessler et al., 1998). And, from the answers to those questions, is derived a probability that the respondents would have been diagnosed with an alcohol dependence, if they had completed the Long-Form CIDI at the time of the interview. Probabilities of being alcohol dependent were then tabulated by category of quantity of alcohol consumed and by gender and age group.

Table 1. Pattern of drinking by category of quantity of alcohol consumed and by gender and age group, Canada

Age group	Pattern of drinking	Men			Women		
		Moderate	Hazardous	Harmful	Moderate	Hazardous	Harmful
15-19	Regular	66.7%	6.4%	3.1%	79.8%	18.8%	7.8%
	Binge	21.7%	43.2%	44.7%	13.3%	42.5%	48.3%
	Dependent	11.6%	50.4%	52.2%	6.9%	38.6%	43.9%
	Total	100%	100%	100%	100%	100%	100%
20-29	Regular	56.8%	6.5%	3.0%	79.8%	19.2%	7.6%
	Binge	30.6%	55.0%	57.0%	15.8%	42.0%	48.0%
	Dependent	12.6%	38.6%	40.0%	4.5%	38.8%	44.4%
	Total	100%	100%	100%	100%	100%	100%
30-44	Regular	72.3%	11.4%	5.2%	91.1%	41.0%	18.0%
	Binge	23.9%	62.0%	62.0%	7.3%	47.2%	32.4%
	Dependent	3.8%	26.6%	32.8%	1.6%	11.9%	49.5%
	Total	100%	100%	100%	100%	100%	100%
45-64	Regular	78.5%	19.2%	3.8%	94.7%	59.4%	30.9%
	Binge	19.4%	70.8%	76.5%	4.9%	36.5%	54.3%
	Dependent	2.0%	10.1%	19.7%	0.4%	4.1%	14.8%
	Total	100%	100%	100%	100%	100%	100%
65+	Regular	92.4%	54.5%	4.9%	98.7%	89.0%	69.2%
	Binge	7.4%	44.3%	87.4%	1.3%	10.5%	30.3%
	Dependent	0.2%	1.2%	7.7%	0.0%	0.5%	0.5%
	Total	100%	100%	100%	100%	100%	100%

Source: OECD analyses on relevant datasets cited in the text

Czech Republic

46. For Czech Republic, we used data from the 2002 GENACIS study (Bloomfield et al., 2005), the 2005 Czech National Survey on Mental Health, and the 2012 National Survey on Tobacco Smoking and Alcohol Consumption in the Czech Republic. These data reflect whether respondents consumed alcohol in the past 12 months. Similar to Canada, we estimated initiation of drinking using the probability of having ever drunk in lifetime by age group.

47. Quantity of alcohol consumed and the three categories (mid/moderate, hazardous, and harmful) are derived from the average daily consumption of alcohol reported in the 2002, 2005 and 2012 surveys. One standard drink in Czech Republic is assumed to contain 16 grams of pure alcohol.

48. Patterns of drinking are built from the probabilities of being a binge drinker and alcohol dependent. Being a binge drinker is defined as having more than 60 grams of pure alcohol per occasion at least once a month. Probabilities of being a binge drinker were calculated by category of quantity of alcohol consumed and by gender and age group. Probabilities of being alcohol dependent were derived for binge drinkers – using the same probabilities as those in Canada – and were tabulated by category of quantity of alcohol consumed and by gender and age group.

Germany

49. For Germany, we used data from the Epidemiological Survey on Substance Abuse in Germany (ESA) 1995 and 2009 (IFT, 2011). These data reflect whether respondents consumed alcohol in the past 12 months. Similar to Canada, we estimated initiation of drinking using the probability of having ever

drunk in lifetime by age group. Additionally, data from the KIGGS 2003-2006 (RKI, 2008) were used to estimate initiation of drinking among young people aged 10 to 17.

50. Quantity of alcohol consumed and the three categories (mid/moderate, hazardous, and harmful) are derived from the quantity of alcohol consumed on a typical drinking day multiplied by the frequency of drinking in the past 30 days as reported in the 1995-2009 surveys. One standard drink in Germany is assumed to contain 12 grams of pure alcohol.

51. Patterns of drinking are built from the probabilities of being a binge drinker and being alcohol dependent. Being a binge drinker is defined as having 5 or more drinks (equivalent to 60 grams of pure alcohol) per occasion in the last 30 days. Probabilities of being a binge drinker were calculated by category of quantity of alcohol consumed and by gender and age group. Probabilities of being alcohol dependent were derived for binge drinkers -using the same probabilities as those in Canada- and were tabulated by category of quantity of alcohol consumed and by gender and age group.

52. The model does not reproduce individual longitudinal patterns of drinking. Further OECD analyses showed that an advanced modelling approach could enhance the simulation of alcohol consumption over the lifetime, although this approach was not able to be implemented here. Such an advanced method relies on using a growth-curve model with a Gamma distribution -which offers a more flexible distribution-. While this method would in theory allow the model to simulate individual trajectories of drinking patterns, it is extremely difficult to get the growth-curve model converge on the observed data.

2.2.3. The disease modules

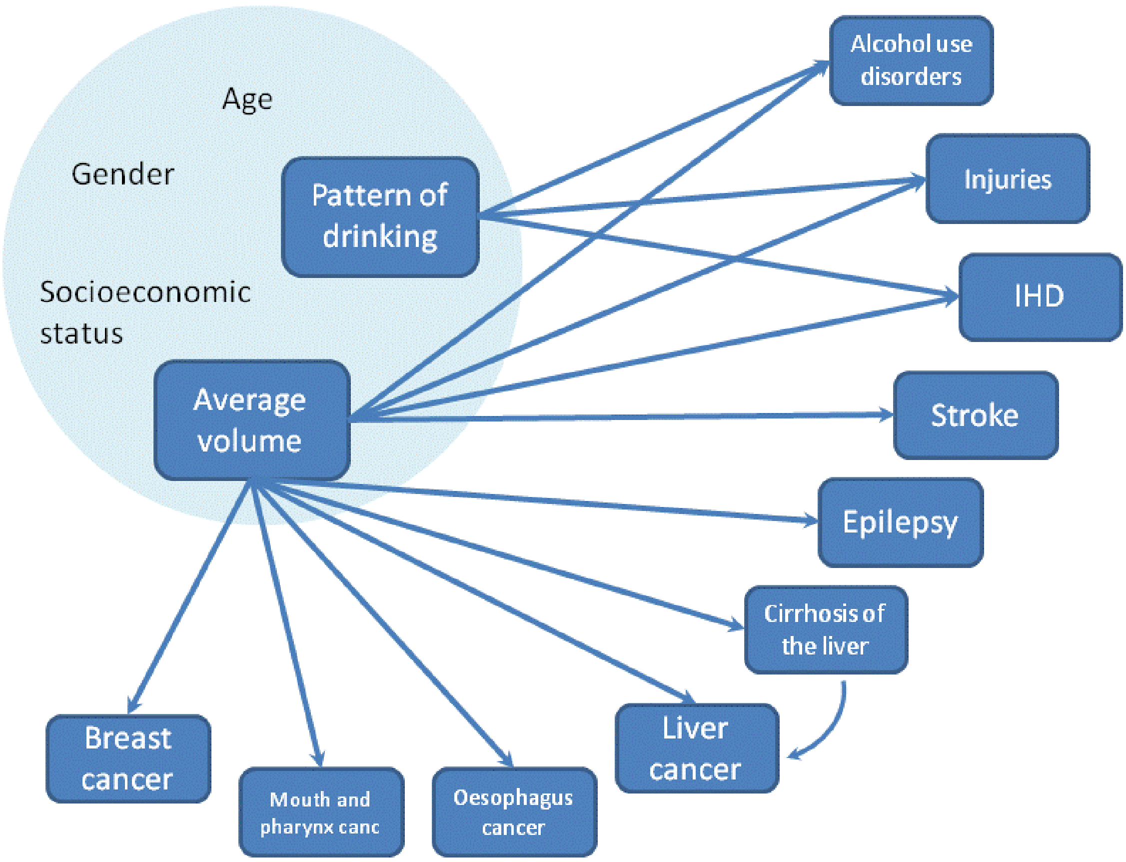
53. The CDP-alcohol model explicitly accounts for ten conditions whose incidence is affected by the volume and/or pattern of alcohol consumption. These include: alcohol use disorders; injuries; cirrhosis of the liver; liver cancer; epilepsy; ischaemic heart disease; cerebrovascular diseases; oesophagus cancer; mouth and oropharynx cancers and breast cancer, as shown in Figure 3. The full list of diseases, their ICD codes and their contribution to the alcohol-related burden of disease, can be found in tables 2 and 3.

Table 2. List of considered health conditions and relevant ICD-10 code

Health condition	*ICD-10 codes*
Alcohol use disorders	F10
Breast cancer	C50
Cirrhosis of the liver	K70.4, K71.7, K74
Epilepsy	G40-G41
IHD	I20-I25
Liver cancer	C22
Mouth/oropharynx cancer	C00-C14
Oesophagus cancer	C15
Traffic-related and other relevant injuries	V02-V04(.1,.9), V06.1, V09(.2,.3), V12-V14(.3-.9), V19.4-V19.6, V19.9, V20-V28(.3-.9), V29-V79(.4-.9), V80.3-V80.5, V81.1, V82.1, V82.9, V83-V86(.0-.3), V87, V89-97; W00-W19, W24-W34, W65-W74, W78-W79; X00-X09, X31, X60-X99; Y00-Y34
Stroke	I60-I66, I69.0-I69.4

Source: OECD analyses on ICD-10 classification (http://www.who.int/classifications/icd/en/)

Figure 3. Dynamic causal web for disease events implemented in the CDP-alcohol model



54. According to the latest available WHO estimates at the time of the beginning of these analyses (WHO, 2011) this group of diseases accounts, globally, for about 98% of DALYs lost and 93% of alcohol-related mortality (table3). Levels of disability associated with specific conditions are based on the disability weights originally used in the WHO (2008) global burden of disease study. Gender-, age- and disease-specific risks of death (i.e. fatality hazards) are conditional on the quantity and pattern of alcohol consumption, based on relative risks modelled on the basis of the best available evidence (data sources are listed in Annex A). Given the scarcity of evidence from existing epidemiological studies (Holmes et al., 2012), mortality and disease incidence could not be modelled as functions of past, or cumulative, alcohol consumption, but only as functions of current patterns and levels of consumption. For most conditions, this approach is likely to be appropriate (Anderson et al., 2012; Rehm et al., 2012), however, it is less appropriate for conditions like cancers, for which the effects of alcohol consumption, and changes thereof, tend to be delayed by several years.

Table 3. List of included diseases and their share of burden of disease amenable to harmful alcohol consumption

	% Burden (DALYs)	% Mortality
Injuries	38.0	41.6
Alcohol use disorders	34.2	3.9
Cirrhosis of the liver	9.6	16.6
Liver cancer	3.2	8.2
Epilepsy	3.1	2.1
Ischaemic heart disease	2.6	3.8
Cerebrovascular disease	2.3	4.9
Oesophagus cancer	2.3	7.0
Mouth and oropharynx cancers	1.4	3.4
Breast cancer	0.8	1.7
Total	97.5	93.2

Source: OECD analysis on: WHO (2011) “Global status report on alcohol and health”. World Health Organization 2011. Switzerland.

55. The physio-pathological process underlying the onset, the development and the ending of diseases has been modelled on four dimensions: incidence, prevalence, fatality and remission/duration. The full list of input data, by parameter and country, can be found in annex B. In general, most of the data we use to feed the model comes from national (often national health surveys) or international datasets. Relative risks were obtained from peer reviewed publications. When it has not been possible to retrieve the required inputs, they were calculated through the WHO software DisMod II (Barendregt et al., 2003). Case fatality input data were often calculated using the following algorithm

$$fatality\ rate_{dgas} = \frac{mortality\ rate_{dgas}}{prevalence\ rate_{dgas}}$$

56. Where d is one of the included diseases, and g, a, s are respectively gender, age group and socio-economic status.

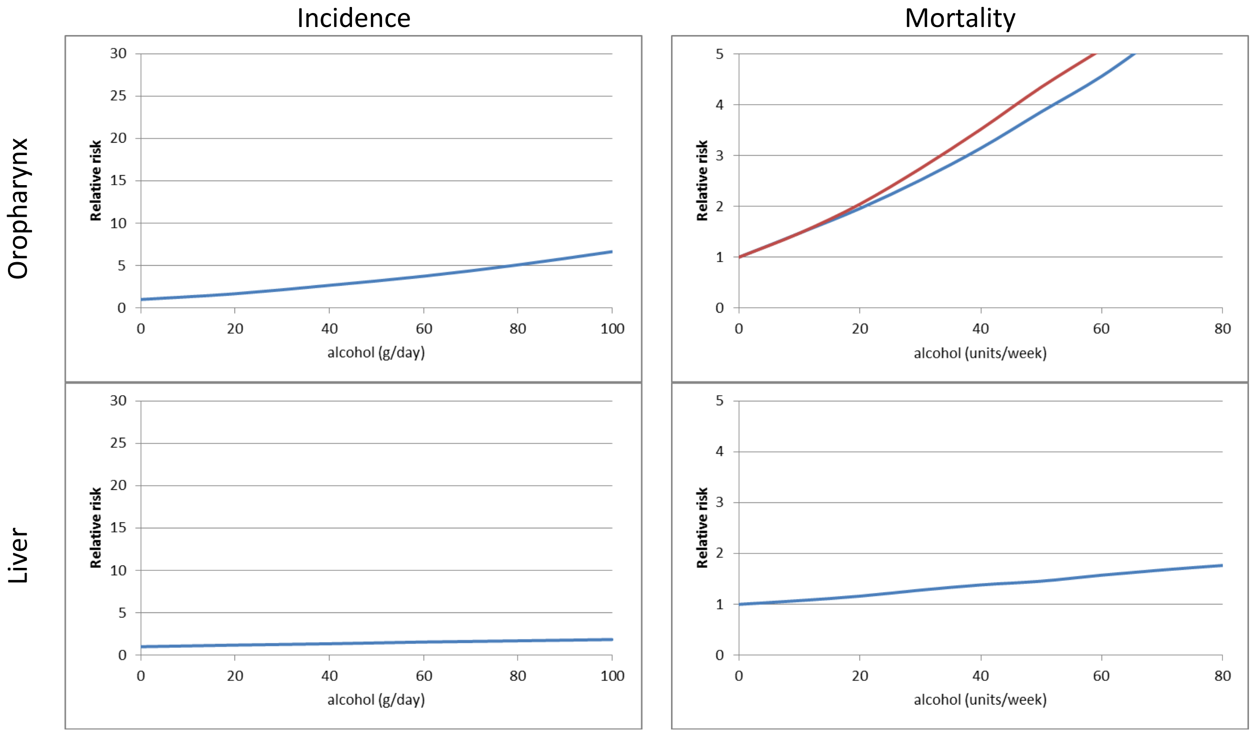
57. The incidence, the development and, in relevant cases, the mortality of diseases are modelled as dependent on alcohol consumption and socio-economic status by employing appropriate relative risks (Figure 4) which were retrieved from two homogeneous sources (Corrao et al., 2004, White et al., 2002). Whether and what dimensions of alcohol consumption affect the onset of diseases has been modelled following the conclusions of a review of the relationship between volume and pattern of alcohol consumption and the burden of disease (Rehm et al, 2003). For all the diseases, the probability of onset is modified by the volume of alcohol consumption; such probability has been modulated according to 10 categories of volume of alcohol consumption (0; 0-67.5; 67.5-112.5; 112.5-157.5; 157.5-202.5; 202.5-247.5; 247.5-292.5; 292.5-382.5; 382.5-472.5; and 472.5+ grams/week). As shown throughout panels in Figure 4, individuals with a non-zero volume of alcohol consumption have generally higher risks of developing and dying of diseases compared to persons with zero volume of alcohol consumption. This is corresponds to a relative risk (RR) higher than 1. For example, individuals with volumes of alcohol consumption of 100 grams per day have a RR of about 27.5 of developing cirrhosis compared to individuals with a volumetric alcohol consumption of 0. In other words, these individuals are between 27 and 28 times more likely to develop a liver cirrhosis compared to other people that do not drink alcohol. In the case of ischaemic heart disease and, to a minor extent, ischemic stroke, the RR lies below 1 which means that individuals consuming alcohol are less likely to develop or die because of a disease.

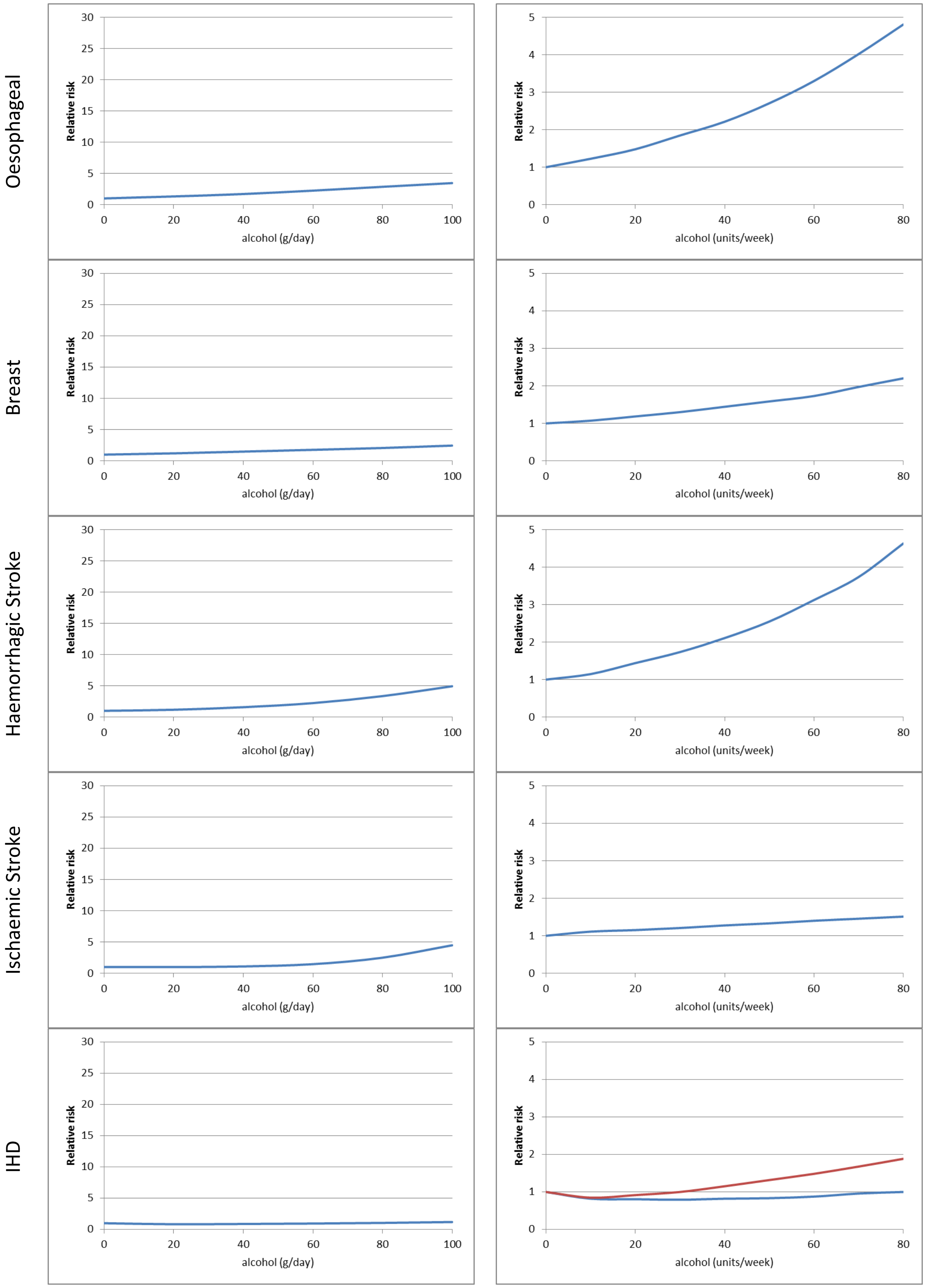
58. For three diseases, namely: alcohol use disorders, injuries and ischaemic heart disease, the risk of developing the disease was also linked to the patterns of drinking (i.e. regular drinker, binge drinker and dependent drinker). In the case of alcohol use disorders and injuries we modelled the effects of patterns of alcohol consumption on the basis of available literature listed in appendix A. In the case of ischaemic cardiovascular diseases instead, we did not model any positive effect (i.e. RR < 1) of low levels of alcohol consumption for those individuals whose pattern of consumption fall outside the normal category. This is consistent with the approach used by WHO in calculating the burden of disease associated to harmful use of alcohol and is based on findings of a series of meta-analyses by Roerecke and Rehm (e.g. 2012, 2014).

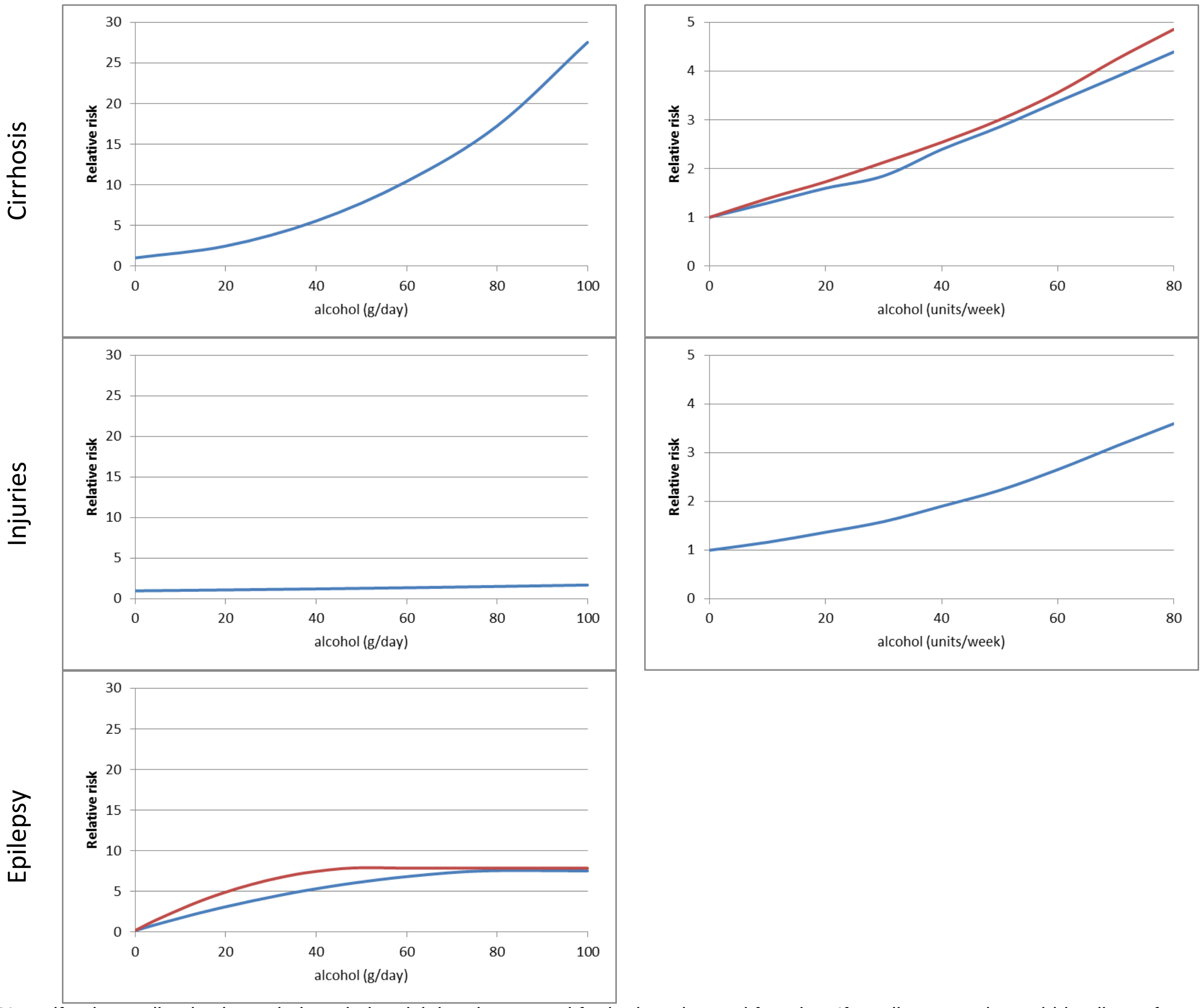
59. In the case of injuries, according to the available evidence, alcohol consumption was also linked to the fatality hazard implying that in the group of people experiencing an injury, persons with higher alcohol consumption tend to have a more serious injury and a higher likelihood of death. The use of relative risks to disentangle input parameters by high and low socio-economic status is used to capture all those dimensions (e.g. higher prevalence of other risk factors in people with low socioeconomic status) that are not explicitly taken into account in the CDP-alcohol model but that have a significant effect on the development of the diseases and the probability of death.

60. The only cross-disease interaction accounted for in the CDP-alcohol model does not account for any explicit interaction between diseases

Figure 4. Relative risks by levels of alcohol consumption




Oesophageal
Breast
Haemorrhagic Stroke
Ischaemic Stroke
IHD
Relative risk
alcohol (g/day)
alcohol (units/week)
0
5
10
15
20
25
30
20
40
60
80
100
1
2
3
4



Note: if only one line is showed, the relative risk has been used for both males and females. If two lines are showed blue line refers to males and red line refers to females

Sources: adapted from Corrao et al. A meta-analysis of alcohol consumption and the risk of 15 diseases. Preventive Medicine. 2004;38(5):613-9; White et al. Alcohol consumption and mortality: modelling risks for men and women at different ages. British Medical Journal. 2002;325(7357):191.

61. Mortality and fatality have been projected throughout the simulation period assuming that the 2010 ratio between the disease-specific mortality ratio and the total mortality ratio would remain constant over time. This means that the CDP-alcohol model assumes that any increase in life expectancy that a population may enjoy in the future would be uniformly spread over all the causes of death or, in other words, that life expectancy for no single disease will marginally increase more than for other diseases. The probability of a person to recover from a disease has been modelled either as a remission rate (i.e. the probability of healing) or as average duration (i.e. average time spent with the disease) according to the evidence available for the single diseases. Some diseases, such as liver cirrhosis, stroke or injuries may cause long-term consequences in all (or a share) of incident cases. These life-long consequences have been modelled according to the available evidence; sources to model such long term consequences can be found in Annex A while the disability weight can be found in table 3. Finally, the probability of dying because causes not related to alcohol consumption (e.g. encephalopathy) is modelled as residual mortality and projected over time under the same assumptions employed to model the considered diseases.

62. The CDP –alcohol model generally assumes that diseases are unrelated one to the others. This means that, for example, a person with ischaemic heart disease is not more likely to develop oropharynx cancer than another diseases-free individual of the same gender, age, socioeconomic status and level/pattern of alcohol consumption. The only exception is liver cirrhosis for which we model a direct relationship with liver cancer. In particular, individuals with liver cirrhosis have a higher risk of developing liver cancer [OR=2.8] (Ha et al., 2012).

63. The quality of life for individuals with diseases has been calculated by employing the standard disability weights originally used in the WHO (2008) global burden of disease study so to increase comparability of results from the CDP-alcohol model with previous OECD studies on obesity and with other WHO publications. Whenever the conditions included in the CDP-alcohol model did not correspond precisely to GBD categories, we estimated disability weights based on similar or partial GBD categories. Following the same approach used in the CDP-obesity model, disability weights have been combined in an additive fashion for individuals with multiple diseases. Weights used in the CDP-alcohol model can be found in table 4. More recently, the Institute of Health Metrics and Evaluation (Solomon et al., 2012) has proposed an alternative, slightly different, set of disability weights. We decided not use this new set of weights because there is still an ongoing debate on the real advantage of the proposed estimates and a shared conclusion has not been reached yet.

64. Following our standard approach for cost-effectiveness analysis, disability weights shown in table 4 have been subtracted from a value of 1 (i.e. full health) to calculate the quality of life of patients spending one year in a given disease state. For example, a person experiencing alcohol use disorders has a quality of life of 0.866 (i.e. 1 – 0.134). In the calculation of the DALY gain produced by the assessed interventions, each person not experiencing a disease contributes to the total DALY gain with the relevant disability weight. So, again, a person that under the baseline scenario has alcohol use disorders but under an intervention scenario has no diseases contributes to the total DALY gain for 0.134 DALY each year spent without the relevant disease. The subject can, however, develop another disease and in this case the DALY gain is calculated as the difference between the two disability weights. So, for example, if instead of experiencing alcohol use disorders, the person develops epilepsy, that person, in that year, will contribute for a DALY gain of 0.021 (i.e. 0.134-0.113). A person can also produce a negative contribution to the total DALY gain if, because of the policy, a disease with a higher disability weight is developed.

Table 4. Disability weights used in CDP-alcohol

Diseases	Disability weights	
	incident case	prevalent case
Alcohol use disorders	0.134	
Injuries	0.137	0.230
Cirrhosis of the liver	0.330	
Liver cancer	0.200	
Epilepsy	0.113	
Ischaemic heart disease	0.439	
Cerebrovascular disease	0.920	0.266
Oesophagus cancer	0.200	
Mouth and oropharynx cancers	0.090	
Breast cancer	0.090	

Source: OECD calculation on WHO. The global burden of disease: 2004 update. Geneva: World Health Organization; 2008

2.3. Scope of the model and key assumptions

65. The present version of the model has been built to simulate dynamics of three countries (Canada, Czech Republic and Germany) and assumes as starting point the year 2010. The population is simulated accounting for its distribution by gender and age (0 to 100) and is projected forward for 40 years (i.e. to 2050). Projections of the population account for new births, immigration and emigration returning, for each year of the simulation, a picture that is consistent with relevant national and international statistics.

66. Analyses presented in the reminder of this paper were calculated by assuming the following:

- A time perspective of 41 years (i.e. between 2010 and 2050 included) to allow policies to show their potential.
- Interventions are assumed to influence individual behaviours in line with existing evidence. We selected, as far as possible, studies with a long follow-up so to accurately model the long-term effects of policies. When this was not possible due to lack of data (e.g. brief intervention) the trend of the effectiveness was projected forward by fitting the function with the highest coefficient of determination.
- In line with most current practice in cost-effectiveness analysis, we discounted both future costs and effects at a 3% rate.

2.4. Cost analysis

67. At a conceptual level, the benefit of an intervention is the gain in welfare associated with the health improvement, while the cost is the loss of welfare associated with foregone non-health consumption (due to resources being used to provide the intervention). Accordingly, costs should be measured from the perspective of society as a whole, to understand how best to use resources regardless of who pays for them, or indeed, whether they are paid for at all. In practical terms, however, there are a number of cost consequences that are difficult to quantify due to lack of good-quality or consistent data, for example the costs incurred by people to access services (e.g. travel costs) or provide informal care-giving. The impact of interventions on the time and potential earnings of patients and unpaid carers - i.e. work time lost - is a vexing question in cost-effectiveness analysis but are often excluded on ethical grounds (inclusion would give priority to extending the life of people who earn more). Domestic taxes are also typically excluded from consideration, since they simply transfer financial resources from one person to another and do not use up a physical resource such as capital or labour. The conceptual foundations and practical implementation of costing within a Generalized cost-effectiveness (GCEA) framework are discussed in greater detail elsewhere (Tan Torres et al., 2003; Evans et al., 2005).

68. In the implementation of GCEA via the WHO-CHOICE project, costs are divided into those incurred at the patient or programme level. Patient-level costs involve face-to-face delivery by a health provider (broadly defined) to a recipient - e.g. medicines, outpatient visits, in-patient stays, individual health education messages. Programme-level costs include all resources required to establish and maintain an intervention - administration, publicity, training, delivery of supplies. Interventions like radio delivery of health education messages largely involve the former, while treatment at health centres largely involves the latter. A standardized ingredients approach is used, requiring information on the quantities of physical inputs needed and their unit cost (i.e. total costs are quantities of inputs multiplied by their unit costs) (Johns et al., 2003, 2006).

69. For patient-level costs, quantities are taken from a variety of sources. Where effectiveness estimates were available from published studies, the resources necessary to ensure the observed level of

effectiveness are identified. In other cases, the resources implied by the activities outlined in WHO treatment practice guidelines were estimated. Since it is not always possible to identify the exact quantities of primary inputs (human resources, consumables) necessary for patient-level costs, certain quantities and prices are estimated at an intermediate level for several inputs - inpatient days at different hospital levels, outpatient visits and health centre visits (Tan Torres et al., 2003).

70. Unit costs for each input were derived from an extensive search of published and unpublished literature and databases along with consultation with costing experts. For goods that are traded internationally, the most competitive price available internationally was used. For example, estimates of drug prices were based on the median supply price published in the International Drug Price Indicator Guide, subsequently marked-up to account for transportation and distribution costs. For goods available only locally (e.g. human resources, inpatient bed days) unit costs have been shown to vary substantially across countries, although international comparisons found similar cost-of-illness patterns in several OECD countries (Heijink et al., 2008). As a result, cross country regressions, mainly accounting for country GDP and local characteristics of the supply of health care, have been run using the collected data to estimate the average cost (with adjustments for capacity utilization) for each setting (Adam et al., 2003, 2006).

71. Costs are reported in international dollars, or dollar purchasing power parities ($PPPs) rather than US dollars, with 2010 as the base year. An international dollar has the same purchasing power as the US dollar has in the United States, and therefore provides a more appropriate basis for comparison of cost results across countries or world regions. Future costs are discounted using a 3% discount rate.

2.5. Modelling interventions

72. Negative health effects and social harm caused by hazardous alcohol consumption can be reduced though effective prevention strategies. In 1979, the World Health Assembly called WHO member states to develop and adopt appropriate legislation and measures to tackle alcohol misuse (WHO, 1979). Such efforts culminated with the endorsement, in 2010, of the global strategy on the harmful use of alcohol (WHO, 2010) that supports ten target areas for national actions including: health sector response, community actions, drink-driving policies, limitation of the availability of alcohol, action on the marketing and pricing policies, reducing the negative consequences of intoxication and reducing the public health effect of illegally and informally produced alcohol.

73. The WHO Global Strategy to reduce the harmful use of alcohol provides a menu of policy options based on international consensus, which OECD used as a starting point in identifying a set of policies to be assessed in an economic analysis based on a computer simulation approach. However, not all types of policies discussed in the Global Strategy lend themselves to a quantitative economic analysis. In particular, certain actions (e.g. monitoring and surveillance) are important in the context of an overall strategy to fight alcohol-related harms, but have only indirect effects on alcohol consumption and harms, and these effects are very difficult to measure or estimate. Other actions have been shown to be effective in reducing alcohol-related harms, but their effectiveness was determined only in qualitative studies, often based on heterogeneous outcomes, not suitable for inclusion in a quantitative modelling framework. Of the remaining actions, some are supported by stronger evidence of effectiveness than others from existing studies.

74. Therefore, the analysis presented here focuses on a subset of the policy options discussed in the Global Strategy and in the current policy debate, without implying that the inclusion of a policy in the set of those assessed corresponds to an endorsement of the policy. The selection of policies is the result of extended consultations with OECD member countries and relevant stakeholders, primarily within the context of the OECD Expert Group on the Economics of Prevention and the OECD Health Committee.

The aim of the selection is not to devise an alternative policy agenda to that endorsed by WHO, but simply to focus the subsequent analysis on policies for which a meaningful assessment can be made. The policy options selected are shown in Table 5. The six policy options included in the main analysis, in bold characters in the table, are those for which a stronger and more consistent evidence of effectiveness is available, generally in the form of systematic reviews and meta-analyses of large numbers of high-quality individual studies. The remaining three policy options, assessed in a further analysis, feature prominently in the current debate, but have been assessed in a smaller number of studies (minimum price policies) or in a large number of studies but with inconsistent results (school-based programmes and workplace interventions).

75. Modelling of policies is evidence-based. Therefore the first step was to retrieve quantitative evidence about the effectiveness of interventions. This entailed a literature review that, in the first instance, focused on meta-analyses and systematic reviews (e.g. Cochrane reviews). Retrieved data was then used to model the effectiveness of an average intervention and, based on the description of the intervention, to calculate the cost of implementing the intervention by employing the WHO-CHOICE approach (Tan-Torres et al, 2003). However, in some cases as, for instance, the school-based intervention, it was not possible to retrieve data that could be useful in modelling the interested intervention. Whenever this was the case, we retrieved the papers cited in the meta-analyses and the reviews and identified an intervention whose characteristics seemed to be representative for an average intervention for that domain. The choice of a single study was driven by its strength and its adaptability to multiple settings and was based on the following characteristics: representativeness of the sample, strength of the methodological approach, length of the follow-up, design of the intervention, adaptability to other countries, assessment of changes in alcohol consumption.

Table 5. Alcohol policy options assessed in the analysis

Target	**Price policies**	**Regulation/enforcement**	**Education**	**Health care**
All consumption	**Tax increase**	**Advertising regulation**		
Heavy use / dependence	Minimum price		School-based programmes	**Brief interventions treatment of dependence** Workplace interventions
Injuries		**Drinking-and-driving restrictions** **Opening hours regulation**		

Note: Policies in bold are those included in the main analysis; other policies are part of a further analysis.

76. The remaining of this section provides a description of the policies analysed with the CDP alcohol model. For each intervention, the relevant section describes the characteristics of the modelled intervention, its effectiveness and the key drivers underlying the implementation costs

2.5.1. Regulation of the marketing of alcoholic beverages

77. Heavy marketing of alcohol is regarded as a causal factor in alcohol consumption, particularly because of its impact on the habits of teenagers and youngsters (Anderson P, 2009; Anderson et al., 2009b; Snyder et al., 2006). Advertising is a global industry employing increasingly sophisticated marketing

techniques in traditional media (e.g. television and print), branding and sponsorship of events, product placement in films and shows, point-of-sale displays and, more recently, new media like internet, social networks and smartphones. Regulation of advertising is a well-established intervention across the OECD. Most countries implement partial bans preventing the marketing of specific types of alcoholic beverages (e.g. spirits), during certain times (e.g. when a large proportion of the audience is made up by youngsters) or for specific media (e.g. television). Regulation may also target the content and mode of delivery of advertising messages. For instance the EU Council Directive 89/552/EC of October 1989 asserts that television advertising for alcoholic beverages should not be specifically aimed at, or depict minors consuming alcohol, it should not link alcohol to enhanced physical performance, driving, social or sexual success and so on. In a number of cases, these restrictions operate alongside industry self-regulation codes.

78. *Selection of the evidence to model the intervention*. The evidence to model this intervention has been selected by reviewing papers referenced in 5 systematic reviews (Anderson et al., 2009b; Bryden et al., 2012; Meier et al., 2008a; Pinsky et El Jundi, 2008; Smith et Foxcroft; 2009) and 2 meta-analyses (Gallet CA, 2007; Nelson JP., 2011). In general, there are two kinds of studies providing evidence to model the effectiveness of interventions aimed at regulating advertising. A first type provides elasticities calculated as changes in consumption of alcoholic beverages following changes in industry spending on advertising. A second type employs longitudinal approaches by following groups of people (often teenagers) to estimate how exposure to advertising changes their drinking patterns. We modelled this intervention on the data provided by a meta-analysis of 322 estimates of advertising elasticities by Gallet (2007), supplemented with the results of a study by Saffer and Dave (2006). Other papers that we considered in the review process are listed in the appendix.

79. *Characteristics of the modelled intervention*. The advertising regulation policy scenario is not modelled as a comprehensive ban, but as a series of regulatory measures that would lead to a 25% reduction in advertising expenditure, limiting exposure to alcohol advertising for different types of consumers. This regulatory intervention assumes that restrictions would be applied to traditional and new media, sponsorships, branding and point-of-sale displays. Enforcement would be ensured by existing regulatory authorities, as the necessary infrastructures are already in place in most OECD countries. This intervention also assumes that individuals living in a country are not exposed to a considerable amount of advertising from a neighbouring country that does not implement the same intervention. Finally, we also assume that the intervention becomes effective within the first year of its implementation.

80. *Effects of the intervention*. Existing studies indicate that a 25% decrease in advertising expenditure is expected to produce a 0.8% decrease in alcohol demand (Gallet, 2007). However, there is evidence that young people are more responsive to changes in alcohol advertising (Anderson, 2009b). So, in CDP-Alcohol analyses, their response was modelled on the basis of a study by Saffer and Dave (2006) reporting elasticities of 0.034 and 0.065, respectively, for any drinking and for binge drinking during the past month. For the modelled intervention, the above elasticities translate into a 0.84% reduction of average consumption in young drinkers, and a 1.6% reduction in the number of binge drinkers (all ages). These assumptions are in line, or more conservative, than those used in previous model-based studies. For instance, Chisholm et al. (2004b) assumed that a comprehensive advertising ban would lead to a 2%-4% reduction in the incidence of hazardous alcohol use, while a study using the Sheffield Alcohol Policy Model (Meier et al, 2008b) estimated the effects of partial and total advertising bans assuming 5% and 9% reductions in overall consumption, respectively, in line with Saffer and Dave (2002).

81. *Cost of the intervention*. We estimated the total cost of this intervention at 0.54 (CAN), 1.66 (CZE) and 0.30 (DEU) 2008 US$ PPP per capita. The intervention involves basic administration and planning costs at the national and local levels. In addition, minor training may be required for the communication authority staff charged with the task of overseeing the implementation of the scheme. Finally, our estimation includes the cost of monitoring and enforcing the new regulation which, actually, represent the most expensive components of the intervention. A breakdown of the contribution of the different drivers underlying the cost of the intervention is provided in figure 5.

2.5.2. Taxation of alcoholic beverages

82. Sales taxes and excise duties are the most widely used fiscal measures affecting the price alcohol, virtually everywhere in the OECD area. Although taxes on alcohol were originally conceived as a means to raise revenues for the public sector (Smith A., 1776), they are increasingly seen as by some a public health measure (e.g. Rice, 2012). The impact of changes in the price of alcoholic beverages has been extensively studied and a consistent body of evidence shows that increases in taxation reduce alcohol consumption. In particular, the effects of taxation would be larger for moderate drinkers relative to heavier drinkers (Manning et al., 1995), for women (Elder et al., 2010), for young consumers (Xu X & Chaloupka, 2011) and for white people relative to other ethnic groups (An & Sturm, 2011). There is also good evidence demonstrating different levels of elasticity for different types of alcoholic drinks (Wagenaar A et al., 2009), while cross-country differences in elasticities were found to be insignificant when accounting for relevant confounding factors, such as per capita alcohol consumption and relative ethanol share of beverages in the relevant countries (Fogarty, 2006; 2008). Much of the effect of increased alcohol taxation on consumption depends on the degree to which the tax is passed on to consumers. In 1991, a 9$ increase in the US Federal excise tax on beer resulted in an almost immediate increase in retail price by 15 to 17 USD (Young & Bielinska–Kwapisz, 2002). More recently, a comparison of how taxes on alcohol are passed on to consumers in Ireland, Finland, Latvia and Slovenia showed a more complex and heterogeneous pattern, with a pass-through ratio for beer ranging from 0 (i.e. no change in consumer price) for on-trade sales in Ireland to 2.5 for off-trade sales in Slovenia (i.e. a price increase of 2.5 times the tax increase), and between 0.1 (on-trade in Ireland) and 1.4 (off-trade in Finland) for spirits (Rabinovich et al., 2012).

83. Some studies (e.g. Ayyagari et al., 2013) suggest limited or no effects of taxation on alcohol consumption by the highest-risk drinkers. This evidence was taken into account in modelling the impacts of taxation, although the balance of evidence, as reviewed by Babor et al. (2010) indicates that "all groups of drinkers [respond to changes in alcohol prices], including young people and heavy or problem drinkers".

84. Increases in taxation may have impacts on tax avoidance (e.g. cross-border trade) and illicit production and trade. Evidence of the likely size of these effects is not available, therefore the effects has not formally assessed in the analysis.

85. Selection of the evidence to model the intervention. Several high-quality systematic reviews and meta-analyses examine the link between alcohol prices and levels of drinking (Dhalwani, 2011; Elder et al., 2010; Gallet., 2007; Fogarty, 2008; Wagenaar et al., 2009; Wagenaar et al., 2010; Nelson, 2013a). The modelling of this intervention in CDP-Alcohol is mainly based on two studies. Price elasticity values are derived from a meta-analysis of 112 studies that took into account more than 1000 different estimates (Wagenaar et al., 2009) while the effect of gender and age groups have been calculated on a different meta-analysis, which provides a more detailed account of the effects of a number of individual characteristics on price elasticity (Gallett, 2007). Based on studies that show a further reduced response of harmful drinkers to price changes (Ayyagari et al., 2013; Nelson, 2013b), an alternative scenario was developed to test the sensitivity of model outputs to assumptions regarding price elasticities. The full list of additional papers considered in the selection process can be found in the appendix.

86. Characteristics of the modelled intervention. The modelled intervention essentially consists of a change in existing alcohol taxes which would generate an average price increase of 10% at the point of consumption across all alcoholic beverages. Alcohol taxation systems and rates vary widely across countries; therefore, no specific assumptions were made on how the above price increases would be achieved, e.g. whether by increasing excise duty rates, by modifying other existing taxes, or by introducing new fiscal measures. In the implementation of a similar policy at the country level, multiple changes would likely be required in alcohol taxation in order to obtain a 10% price increase across all alcoholic beverages, given that beverages are often taxed differently, and taxes tend to be passed on to consumers at different rates for different beverages, partly depending on where they are typically or predominantly consumed. The policy scenario also entails increased law enforcement efforts to prevent the spread of tax avoidance and consumption of unrecorded alcohol, including from illicit trade and informal and illicit production. Consistently with available evidence, the tax increase is assumed to translate almost immediately into an increase in the price of alcoholic beverages (Young and Bielinska-Kwapisz, 2002).

87. *Effects of the intervention*. A 10% increase in the price of all alcoholic drinks sold in a country is assumed to produce a decrease in consumption ranging from 1.7% for young men who drink alcohol at harmful levels, to 6% for adult women (age 25-59) who are moderate drinkers, as shown in table 6. These estimates are at the conservative end of elasticity ranges used in other modelling studies (e.g. Meier et al., 2008b; Lai et al., 2007). Effects on individual drinkers are randomly determined on the basis of a normal distribution, whose mean equals the above elasticities. In the sensitivity analysis scenario, the price responsiveness of harmful drinkers (men and women, of all ages) was cut to one tenth of the values used in the main taxation scenario (e.g. assuming a 0.17% change in consumption for young male harmful drinkers).

Table 6 Price elasticity values used in CDP-alcohol main analyses

Age	Men, not harmful drinkers	Women, not harmful drinkers	Men, harmful drinkers	Women, harmful drinkers
Under-25	-0.029	-0.042	-0.017	-0.024
25-59	-0.042	-0.060	-0.024	-0.035
60 and over	-0.041	-0.059	-0.024	-0.034

Source: Adapted from Wagenaar, A.C., M.J. Salois and K.A. Komro (2009), “Effects of Beverage Alcohol Price and Tax Levels on Drinking: A Meta-analysis of 1003 Estimates from 112 Studies”, Addiction, Vol. 104, No. 2, pp. 179-190, February, and Gallet, C.A. (2007), “The Demand for Alcohol: A Meta-analysis of Elasticities”, Australian Journal of Agricultural and Resource Economics, Vol. 7, No. 51, pp. 121-135.

88. The elasticities used in the CDP-alcohol model are at the conservative end of elasticity ranges used in previous modelling approaches. For instance, the Sheffield model (Meier et al., 2008b) assumes elasticities of -0.47 and -0.21 respectively for moderate and hazardous/harmful alcohol drinkers while the WHO-CHOICE study on Estonia (Lai et al., 2007) assumes an elasticity ranging from -0.4 to -1.2 according to the different types of alcoholic beverages (e.g. wine, beer, etc.).

89. *Cost of the intervention*. The estimated total cost of this intervention is 0.13 (CAN), 0.42 (CZE) and 0.06 (DEU) 2008 US$ PPP per capita. The estimated cost of an increase in taxation includes basic administration, planning, monitoring and enforcement at the national level, with the latter accounting for most of the total cost. Additional tax revenues are not accounted for in the analysis as they represent transfers rather than costs. Nonetheless, these revenues may be substantial; for instance, in the US in 2008 the tax revenues from alcoholic beverages amounted to about 5.75 billion US$ (Tax Policy Center, 2012). A breakdown of the contribution of the different drivers underlying the cost of the intervention is provided in figure 5.

2.5.3. Minimum pricing

90. An alternative policy measure taken by some governments to make alcohol less affordable involves the setting of floor (minimum) prices for alcoholic beverages. Compared to taxation (e.g. sales and excise taxes), setting a minimum price produces larger effects on drinkers with heavier consumption

patterns as they tend to purchase cheaper alcoholic beverages (Black et al, 2010). On the other hand, this intervention does not typically generate additional revenues for governments as the extra money spent on drinks by consumers would remain with retailers and would not be transferred to the treasury as it happens with taxes (Brennan et al, 2008). Modelling studies estimated that implementing a minimum pricing policy in the UK would have positive health effects (Anderson et al, 2012), would increase productivity and would produce a reduction of crime (Purshouse et al 2010). The same intervention would also be minimally regressive (Ludboook et al 2012). Minimum pricing has been already introduced in Canada (Stockwell et al., 2011; 2012a; 2012b). In Europe, the Scottish government has approved the alcohol minimum pricing bill in May 2012 (Scottish Government, 2012) although the new law has not yet come into force due to legal challenges.

91. Selection of the evidence to model the intervention. Most of the evidence available on the effectiveness of minimum price policies is from studies carried out in the Canadian provinces of British Columbia (Stockwell et al., 2012a) and Saskatchewan (Stockwell et al., 2012b) exploiting the variation associated with sequential minimum price adjustments over the periods 1989-2010 and 2008-12, respectively. By employing time series and longitudinal models of aggregate alcohol consumption, Stockwell and colleagues estimated by how much a 10% hike in minimum prices decreased the consumption of different alcoholic beverages, as well as alcohol-related deaths (Zhao et al., 2013) and hospitalisations (Stockwell et al., 2013). A study based on the Sheffield Alcohol Policy Model also investigated the effects of changes in minimum prices in British Columbia, producing slightly more conservative estimates than the above studies (Hill-McManus et al., 2012). The Sheffield model, however, was primarily used to predict the impacts of alcohol policies, minimum unit prices, in Scotland and in England. Price elasticities were estimated from survey data for different population groups and alcoholic beverages. Estimates were then used to assess the potential effects of different minimum unit price options, ranging from 0.20 to 0.70 GBP in England (Brennan et al, 2008; Meier et al, 2009; Purshouse et al, 2009a; Purshouse et al, 2010) and Scotland (Purshouse et al, 2009(b); Meng et al, 2010; Meng et al, 2012; Scottish Government, 2012). The additional papers considered in the selection process can be found in the appendix.

92. Characteristics of the modelled intervention. The modelled scenario consists of the setting, or raising (for countries that have already adopted the policy), of minimum prices for all alcoholic beverages. This policy would be designed to produce a 10% increase in current minimum price levels, or in the prices of the lowest-priced alcoholic beverages relative to their prevailing market prices in national markets. The policy is typically designed to affect only the cheapest segment of the alcohol market, unlike tax increases, however, relatively to the latter it would have the additional effect of preventing price promotions below the set minimum price levels. The implementation of this policy includes law enforcement efforts to ensure that minimum prices are consistently applied and to prevent increases in illicit trade and informal and illicit production of alcoholic beverages. This intervention assumes that the increase of the tax almost immediately triggers an increase in the price of the alcoholic drinks.

93. Effects of the intervention. Stockwell et al. (2012a) estimated that a 10% minimum price increase in British Columbia would produce a decrease in the consumption of spirits and liqueurs by 6.8%, of wine by 8.9%, of alcoholic sodas and ciders by 13.9%, of beer by 1.5%, and of all alcoholic drinks by 3.4 %. Estimates based on data from Saskatchewan (Stockwell et al., 2012b) show that a 10% minimum price increase would produce a reduction in beer consumption by 10.1%, of spirits by 5.9%, of wine by 4.6%, and of all beverages combined by 8.4%. In CDP-Alcohol analyses, the overall effectiveness of this intervention was modelled based on the lower effectiveness estimated in the two Canadian provinces (that of British Columbia). Effects were differentiated by drinking group based on estimates derived from the work of the University of Sheffield on the potential impact of minimum prices in England, particularly with regard to differences in drinkers’ responses to a minimum unit price of GB P 0.50, to fit with the average effect calculated for British Columbia. Therefore, the overall reduction in alcohol consumption was assumed to be 1.7% for moderate drinkers, 2.9% for hazardous drinkers, and 6.4% for harmful drinkers.

94. *Cost of the intervention*. The estimated total cost for this intervention is 0.12 (CZN), 0.30 (CZE) and 0.08 (DEU) 2008 US$ PPP per capita. The main drivers of these figures are basic administration, planning, monitoring and enforcement at the national level. The latter, in particular, accounts for most of the total cost. A breakdown of the contribution of the different drivers underlying the cost of the intervention is provided in figure 5.

2.5.4. Measures to counter drink-driving

95. Alcohol is a major contributing factor for traffic fatalities among children and young adults between 5 and 29 years old (Peden et al, 2005). Usually, the enforcement of laws that prohibit driving under the influence of substances like alcohol has been viewed as an adequate way of limiting harm, but in practice enforcement is often haphazard and punishment is not always timely and commensurate to the offences committed (Babor et al, 2010). As a result, existing policies for countering drink-driving are not always as effective as they may be, and significant scope remains for improving their ability to reduce traffic accidents and fatalities in many countries. A WHO (2009) review of policy options to counter drink-driving and their effectiveness included: the introduction or reduction of blood alcohol concentration (BAC) limits, for all drivers or for higher-risk categories, such as young and professional drivers; designated driver policies; license suspension; checkpoints and breath testing.

96. There is a consistent evidence that driver's ability to operate a vehicle is progressively affected by alcohol intake as the concentration of alcohol in their blood increases, therefore the setting of a legal BAC limit was found to have beneficial effects (Mann et al, 2001; Shults et al, 2001; Nagata et al, 2008). Drivers with a BAC of between 0.02 and 0.05 "have at least a three times greater risk of dying in a vehicle crash and this risk increases to at least six times with a BAC between 0.05 and 0.08, and to 11 times with a BAC between 0.08 and 0.10" (Killoran et al, 2010). However, beneficial effects appear to decrease over time due to a diminishing perceived risk of being caught (WHO 2009), although at least two studies (Albalate et al., 2008; Eisenberg et al., 2003) report no declines after 2 years or more. BAC control is the most widely adopted intervention in OECD countries and many countries already have lower limits for young and professional drivers (up to "zero tolerance" – e.g. in Australia), which is also a policy of documented effectiveness (Dee et al., 2001; Shults et al., 2001; Albalate et al., 2008; Russel et al., 2011). The scope for a further tightening of this policy may be limited or absent in many OECD countries and there may be a greater value in focusing on improving enforcement. For this reason, changes in BAC limits are not specifically addressed in OECD analyses.

97. Designated driver programmes, i.e. the selection of a member in a group of drinkers who is designated as sober driver, shows low or marginal effectiveness (Ditter et al, 2005). Education-based interventions, like school-based education, driver training programmes and mass media campaigns were shown to be ineffective or to have mixed results (Novoa et al., 2009; Elder et al., 2004). Administrative licence suspension or revocation appears to be an effective policy in reducing drink-driving where adequate law enforcement is in place (Wagenaar et al, 2007; Babor et al, 2010).

98. Selective breath testing (SBT) and random breath testing (RBT) to test BAC level are often indicated among the most relevant interventions to tackle drink-driving (e.g. Anderson et al, 2012). The first (SBT), more widely used in the United States, involves enforcement officers systematically stopping every vehicle and giving breath tests at a predetermined location, often during weekends and at night. The second (RBT), more widely adopted in Australia and Europe, involves that any driver at any time may be stopped and required to take a breath test. These programmes are often implemented with the support of media campaigns to increase drivers' awareness and impact (Shults et al., 2001). Both approaches have

been shown to be effective, but a national survey in the United States and anecdotal evidence from other countries suggests that programmes involving checkpoints and breath testing are rarely conducted by law enforcement agencies (e.g. Fell et al., 2003).

99. *Selection of the evidence to model the intervention*. One meta-analysis (Erke et al., 2009) and one systematic review (Shultz et al., 2001) provide a basis for modelling the impacts of checkpoint and breath testing programmes. Among the various outcomes reported in existing studies, we selected road traffic fatalities as the main outcome in the analysis of population-level impacts, because evidence of the effects of such programmes on average alcohol consumption is weaker. The meta-analysis by Erke et al. (2009) concludes that both the establishment of new programmes and the strengthening of existing programmes are similarly effective, which indicates that health gains can be made even in countries where programmes are already in place. However, the same meta-analysis also concludes that the effectiveness of these programmes declines over time, from a peak of effectiveness within three months from the start of the programme to progressively weaker effects which tend to stabilise after a few years. Finally, Erke et al. make a rare effort to correct their findings for publication bias, which leads to lower, but still statistically significant, estimates of effectiveness. Shults (2001) provides estimates of fatal and non-fatal outcomes, as well as an assessment of feasibility and possible unintended effects. Other papers that we considered in the review process are listed in the appendix.

100. *Characteristics of the modelled intervention*. The policy scenario modelled in the analysis involves a tightening of the enforcement of drinking-and-driving restrictions. The design of the policy is based on the example of a sobriety checkpoint programme implemented in Charlottesville (Virgina, United States), thoroughly described and evaluated in a published study (Voas, 2008). The programme involved five-officer checkpoint teams working four hours per night to stop and test drivers on weekend nights (Friday and Saturday) each week. Sites were chosen in advance and signs warned drivers of the checkpoints and breath testing. In one year, 94 checkpoints operations were conducted, for a total of 1 880 hours of work for the officers concerned. Around 24 000 vehicles were stopped and 290 drivers were arrested.

101. *Effects of the intervention*. Sobriety checkpoints were found to be most effective in the first half year (Erke et al., 2009). The decline in traffic accidents over time, as estimated in the above meta-analysis, started from 29% after three months, decreasing to 21% at 6 months, and becoming almost stable between years 1 and 8 (with estimates ranging from 13% to 11%). Decreases in fatal crashes and all crashes reported by Erke et al. (15% and 19%, respectively) are broadly in line with those reported by Shults et al. (2001) who estimated decreases of fatal crashes between 20% and 26% with SBT , and between 13% and 36% (median 22%) with random breath testing. In our analysis, a corresponding reduction in traffic-related injuries (fatal and non-fatal, in constant proportions), equivalent to 22% in the first year, 8.9% in the second year, and 7.9% thereafter, was applied assuming coverage of 80% of the population.

102. *Cost of the intervention*. The estimated total cost of this intervention is 2.05 (CAN), 2.05 (CZE) and 0.63 (DEU) 2008 US$ PPP per capita. The most expensive item is the manning of checkpoints. A media campaign is included in the intervention package. A breakdown of the contribution of the different drivers underlying the cost of the intervention is provided in figure 5.

2.5.5. Brief interventions in primary care

103. Counselling services to individuals with harmful alcohol consumption are offered across OECD countries in a number of different ways, for instance, through the medical system (e.g. hospitals, residential facilities, out-patient services) or by social services. General practitioners in particular have a key role as first point of contact both for patients requiring healthcare services and as advisors on lifestyle and prevention for non-treatment seeking patients. Brief intervention in the alcohol domain usually targets this

second category of patients with the aim of reducing alcohol consumption among problematic drinkers. A large body of evidence has been developed to assess a number of different approaches or combination of approaches. A number of quantitative and qualitative studies report about expected effectiveness of brief interventions implemented in different facilities, test the effects of interventions managed by non-physician personnel and show the importance of the screening component as complementary part of the intervention. Previous studies also suggest that the small coverage rates granted by this intervention (WHO-Europe, 2009) would be the result of lack of time of physicians and obstacles in reimbursement arrangements (NICE, 2010).

104. *Selection of the evidence to model the intervention*. At least two, partly overlapping, systematic reviews and meta-analyses provide solid evidence of the effectiveness of brief interventions in primary care (Kaner et al., 2009; Jonas et al., 2012). The primary care setting has been selected based on the availability of stronger evidence of effectiveness than for emergency care (Nilsen et al., 2008), general hospital settings (McQueen et al., 2011), e-interventions (Khadjesari et al., 2010; Sullivan et al., 2011) and obstetric or antenatal care (Doggett et al., 2009). Our analysis focuses on brief interventions, as opposed to extended interventions, because the latter were found to produce a non-significantly larger reduction in alcohol consumption (Kaner et al., 2009), and on non-dependent drinkers, as the effectiveness of brief interventions in dependent drinkers has not been established (Saitz et al., 2010). Other papers that contribute to define brief intervention are listed in the appendix.

105. *Characteristics of the modelled intervention*. The programme is assumed to target harmful drinkers (regular or episodic), but who are not alcohol dependent, aged 18-70 (Kaner et al., 2009). Dependent users, eligible for the drug and counselling intervention, or patients already on a treatment programme are not eligible (Anderson et al., 2012). The intervention typically targets people who are not seeking treatment for alcohol abuse, therefore recruitment typically occurs opportunistically by screening patients who visit a health care facility for a non-alcohol-related problem (Kaner et al., 2009). Screening is by questionnaire (AUDIT or equivalent) requesting information on health status and alcohol consumption, either delivered on the spot or mailed to the patient’s address. Given levels of health care coverage and the likelihood of regularly seeing a general practitioner in the countries concerned, it is assumed that, each year, people in the relevant age group would have a 40% probability of being asked to complete a screening questionnaire, if the programme were offered systematically at all general practices in the country. After accounting for non-compliance with screening or intervention (based on Kaner et al., 2009), it is estimated that each year 30% of those who meet the criteria will receive the intervention, corresponding, for instance, to 6.2% of all men and women in the age group 18-70 in Canada (and larger proportions in Germany and the Czech Republic, where harmful drinking is more common).

106. *Effects of the intervention*. The intervention was modelled after the “brief lifestyle counselling” option in the English Screening and Intervention Programme for Sensible drinking (SIPS) trial (Kaner et al., 2013). During an initial five-minute session, a general practitioner explains the potential harm caused by drinking and suggests practical strategies to reduce alcohol consumption highlighting the benefits of the recommended behaviour change. Printed materials (self-help leaflet, booklet to report consumption and a visual to compare own consumption with the average) are handed to participants. Structured lifestyle counselling would be delivered during a 20-minute follow-up appointment with a trained health professional.

107. During the course of a brief intervention, male drinkers are assumed, for the purpose of the modelling exercise, to reduce their alcohol consumption by 57 grams/week (i.e. about six standard drinks) and female drinkers by ten grams/week, in line with Kaner et al. (2009). Evidence about the long-term effectiveness of the intervention suggests a limited persistence. A Cochrane review of studies in hospital settings (McQueen et al., 2011) found “no significant difference between the groups at one year follow up”. Likewise, other studies (Burge et al., 1997; Wutzke et al., 2002) found a benefit until the 9th month

after the intervention but no significant difference after 12-18 months. Based on these studies and a recent meta-analysis (Jonas et al., 2012), we modelled a linearly declining effectiveness, vanishing one year after the end of the intervention.

108. Cost of the intervention. The estimated total cost of this intervention is 5.11 (CAN), 6.02 (CZE) and 8.96 (DEU) 2008 US$ PPP per capita. The main drivers of these figures are costs for the time of doctor and nurses, followed by provision of printed material for patients. This intervention involves basic expenses for administration, monitoring and training for doctors and nurses delivering the intervention. Even if brief intervention is provided by facilities already in place and delivered by specialized health personnel, programme and training costs account for a significant part of the total expenditure per target individual because all the fixed costs of the intervention are spread only on a relatively small population subgroup. A breakdown of the contribution of the different drivers underlying the cost of the intervention is provided in figure 5.

2.5.6. Pharmacological treatment and psychosocial programme for alcohol dependence

109. Alcohol dependency affects millions of individuals in the OECD area. In the EU alone, it is calculated that between 11 million (Rehm et al., 2012) and 12 million (WHO, 2008) people, in large part males, are affected by this disease that is deemed responsible both for about three quarters of the mortality attributed to alcohol consumption and 60% of the social costs of alcohol. Pharmacological treatment combined with a psychosocial programme to cut down alcohol consumption or to maintain abstinence is the most commonly used approach to treat individual experiencing alcohol dependence.

110. Selection of the evidence to model the intervention. The effectiveness of pharmacological therapies for alcohol dependence is documented by two Cochrane reviews (Rösner et al., 2010; Rösner et al., 2011), a WHO report (Anderson et al., 2012) and Centre for Addiction and Mental Health report (Rehm et al., 2012). Priority was given to Cochrane reviews and to the drug Naltrexone (rather than Acamprosate) based on its lower cost, shorter treatment duration and equivalent effectiveness in terms of "return to any drinking, return to heavy drinking and cumulative abstinence duration" (Rösner et al., 2010). The delivery of the behavioural component was based on the description of the interventions carried out in four clinical trials (Morley et al., 2006; Baltieri & De Andreade., 2004; Lui et al., 2008; Mason et al., 2006), whose results were included in the Cochrane review. Other papers considered in the review process are listed in the appendix.

111. Characteristics of the modelled intervention. The modelled intervention is designed to increase the coverage of alcohol dependence treatment, based on a combination of pharmacological and psychosocial therapy, targeting people aged between 18 and 65 who fulfil the diagnostic criteria of alcohol dependence or alcohol abuse according to the Diagnostic and Statistical Manual of Mental Disorders (DSM) or the International Statistical Classification of Diseases (ICD). Candidates are recruited on an opportunistic basis (Morley et al., 2006).

112. It is currently estimated that only between 10% and 20% of individuals with alcohol dependence are diagnosed and, of these, only 10% receive treatment (WHO, 2008; VisionGain, 2008). The intervention is assumed to raise the probability of receiving treatment for someone who develops alcohol dependence by 8%, representing at least a twofold increase in current levels of medical treatment of alcohol dependence. For instance, the number of people with alcohol dependence currently receiving treatment in Germany is estimated at 297 000 (Kraus et al., 2014), while the modelled intervention would initially increase this number by approximately 250 000, with further increases in subsequent years.

113. When treated once, patients are assumed to have three in four chances of receiving treatment again in case of a new episode of alcohol dependence. Dependent drinkers undergoing the treatment are

first detoxified and must avoid alcohol intake for a period of three to seven days. After this, they undergo a three-month therapy with the drug Naltrexone (50 mg/day) combined with a psychosocial programme. The first, 20 minute-long, psychosocial intervention is carried out by a specialist doctor in a primary care setting and involves a medical assessment and a motivational interview (Lui et al., 2008). This is followed by five additional visits of ten minutes each at weeks 1, 2, 4, 12 and 26, provided by a trained nurse. Patients receive a booklet with information on how to avoid drinking triggers and enhance medication compliance (Morley et al., 2006). About 30% of patients decide to withdraw before the end of the treatment (Baltieri et al., 2004).

114. *Effects of the intervention*. Based on the above evidence built on the combination of results from 50 RCTs (Rösner et al., 2010 and 2011), this intervention, for instance, reduces the risk of return to heavy drinking by 17% during treatment and 14% shortly thereafter. In addition, during treatment, the amount of alcohol consumed per drinking day decreases by 11%; the number of drinking days by 4% and the number of heavy drinking days by 3%. However, there is limited evidence of a longer-term effectiveness of Naltrexone. A systematic review by Roozen (2006) concluded that “moderate evidence” is available of a lack of long-term effects of Naltrexone on “percentage of drinking days and time to first relapse”. Based on this data, the intervention is modelled on the assumption that half of the effectiveness is retained during the first year after the intervention, with no positive effect thereafter.

115. *Cost of the intervention.* The estimated total cost of the intervention is 5.26 (CAN), 12.21 (CZE) and 7.10 (DEU) 2008 US$ PPP per capita. A large share (approximately one third) is represented by the drug (three-month course). The psychosocial programme, primary care visit and follow-up visits managed by a nurse, account for about 20% of the total cost. The remaining costs are for materials handed to patients and programme organisation. A breakdown of the contribution of the different drivers underlying the cost of the intervention is provided in figure 5.

2.5.7. School-based interventions

116. Education and persuasion strategies are among the most popular approaches to avoid, or at least delay and reduce, the use of alcoholic drinks in youngsters. School-based interventions, in particular, are often seen a potentially effective approach to prevent alcohol-related problems. The principal objective of these kinds of interventions is to raise the awareness of students about the dangers caused by alcohol misuse so that, as a result, young people are less likely to overindulge in drink. Generally, interventions tend to tackle a set of unhealthy behaviours together (usually, tobacco, alcohol and narcotics) rather than a specific one. Interventions may include both normative education (i.e. teaching) and resistance-skills training and may be exclusively directed to the students or include their family or the community into the activities. In general such programmes involve all the students in a class or a school but, in some cases, programmes have been carried out on specific subpopulation groups considered at a higher risk. In some cases, such interventions are implemented as one-off but the inclusion of “booster” sessions at later stages would favour the maintenance of positive behaviours over time (Foxcroft DR, et al. 2003; Foxcroft DR, et al. 2011).

117. *Selection of the evidence to model the intervention*. A large body of evidence is available on the effectiveness of this intervention, including ten meta-analyses (Ennet et al., 1994; Bangert-Drowns, 1988; Tobler, 1992; Rundall and Bruvold, 1988; Strøm et al., 2014; Tobler and Stratton, 1997; Bruvold, 1988; Wilson et al., 2001; Tobler et al., 2000; Tobler, 1986), two Cochrane reviews (Foxcroft et al., 2002; Foxcroft and Tsertsvadze, 2011), one review (Skara and Sussman, 2003) and one review of reviews (Jones et al., 2007). Distilling an overall conclusion from this literature is difficult, because studies in this area tend to assess very different outcomes (e.g. knowledge, intention to change, change in behaviour), and interventions tend to tackle harmful alcohol use along with other unhealthy behaviours (usually tobacco and/or drugs). Overall, the existing evidence provides relatively weak support for the use of school-based programmes, although programmes centred on enhancing basic skills such as critical thinking and resistance to social influences (e.g. Spoth et al., 2008) show greater promise (Foxcroft and Tsertsvadze, 2011) as well as programmes tackling multiple unhealthy behaviours at the same time (Skara and Sussman, 2003) but, overall, the evidence remains weak (Strøm et al., 2014). The final intervention was modelled on the School Health and Alcohol Harm Reduction Project (SHARP), an Australian skill-based programme (Mc Bride et al., 2000; Mc Bride et al., 2003; McBride et al., 2004). Other papers considered in the review process are listed in the appendix.

118. *Characteristics of the modelled intervention*. The policy scenario modelled in the analysis involves the delivery of a skill-based educational programme for secondary school students aged 13, during a period of two years. The delivery of the intervention is modelled after Australia's School Health and Alcohol Harm Reduction Project (Mc Bride et al., 2000; Mc Bride et al., 2003; McBride et al., 2004). During the first year, the programme consists of 17 skill‑based activities conducted over 8-10 sessions. This is followed, in the second year, by 12 additional activities over a period of 5-7 weeks. All of the activities involved require active participation and place emphasis on identifying the harms potentially linked with alcohol consumption and ways to prevent them. Approaches used include, among others, the discussion of scenarios and small-group decision making. Students are provided with a workbook and watch a trigger video at the beginning of the second year. School teachers involved in the project undergo a two-day preparatory training. Teachers are also provided with a manual, which contains detailed information on all the activities of the project.

119. *Effects of the intervention*. The modelled approach was shown to be effective in improving risk awareness and drinking attitudes, with a reduction in alcohol consumption, heavy episodic drinking (more than 2/4 standard drinks per occasion for girls/boys) and harm (Mc Bride et al., 2000; Mc Bride et al., 2003; McBride et al., 2004). More in detail, 17 months after the end of the intervention, students that have attended this school-based action would have an alcohol consumption level which is 9.2% lower than the comparator group and are 4.2% less likely to have harmful/hazardous consumption levels. Effects on the volume of alcohol consumption peak at age 14 (-36% for students attending the programme) and tapper off thereafter to disappear by age 17. The effect on binge drinking follows a similar pattern: the maximum effect (-35% of binge drinkers) is reached in students aged 14. The effect starts fading out thereafter and completely disappears when students become 16 year old.

120. *Cost of the intervention*. The estimated total cost is 0.51 (CAN), 2.05 (CZE) and 0.56 (DEU) 2008 US$ PPP per capita and reflects the cost of scaling up an intervention like SHARP at the national level. Data to model the cost of the interventions was provided by the principal investigator of the SHAHRP project (Mc Bride et al., 2000; Mc Bride et al., 2003; McBride et al., 2004). The single largest cost item is extra teaching hours (based on an average of seven hours of extra teaching per class of 26 students), followed by equipment for skill-based activities. Teachers are assumed to be trained at the beginning of the project, with booster sessions every five years. A breakdown of the contribution of the different drivers underlying the cost of the intervention is provided in figure 5.

2.5.8. Policies to limit the availability of alcoholic beverages

121. Limiting the physical availability of alcohol beverages is a way to reduce individual consumption and harm. Interventions in this category may affect retailers (off-premise) as well as bars and restaurants (on-premise), and may use several approaches to reduce alcohol availability. Examples include: sale bans in specific areas, outlets or circumstances; government monopoly arrangements for retails sales; the setting of a minimum legal age for purchasing or drinking alcohol; restrictions in outlet opening or serving hours; and regulation of the density of outlets through licensing or other means (Anderson et al, 2012). Three recent systematic reviews provide a comprehensive summary of the evidence available on the effects of these policies (Popova et al, 2009; Hahn et al, 2010; Bryden et al, 2012).

122. Outright sales bans, consisting of a total or partial prohibition of alcohol sales, are relatively easy to implement in isolated areas and in specific circumstances (e.g. sport events), however, prohibition is unlikely to be politically viable as a large-scale and long-term strategy in most countries.

123. In countries where government monopolies operate, alcohol imports and sales are centrally controlled through direct government ownership of retail outlets, or through strict licensing arrangements, in the interest of public order. There is strong evidence, particularly from northern European countries, of the potential of this policy in reducing alcohol consumption, and it was estimated that ending monopolies where they exist was may significantly increase harmful consumption (Holder et al., 2008). Partial monopolies (covering only certain types of beverages) may lead to substitution, with an increase in the consumption of other types of beverages (Nelson 2003). Where monopolies do not exist at present in the OECD area, their establishment would seem an unlikely prospect, chiefly for reasons of political viability.

124. A minimum legal age, as a policy determining the age at which young people may purchase or possess alcohol, is already in place in all OCED, although enforcement may be difficult, and underage drinking is common in many countries. The existing evidence suggests that the effects of introducing a minimum age are short lived (Miron et al, 2009). There seems to be limited scope for a further tightening of this policy in OECD countries. However, considering to lower existing minimum legal drinking age thresholds (e.g. the United States) might benefit from an evaluation of the effects of such policies.

125. There seems to be a larger scope for OECD governments to use policies involving the regulation of outlet density and/or opening hours. A large body of evidence is available on the effects of such policies, although studies are highly heterogeneous. A broad variety of measures are assessed, using a variety of outcomes (e.g. reduction in alcohol consumption, violence, assaults, traffic accidents, hospital admissions, etc.), and not all studies show positive and statistically significant effects for these measures. Therefore, making a robust prediction of the likely effects of a given policy, if adopted in a particular setting, becomes very difficult.

126. Babor et al.'s (2010) review concludes that existing evidence shows an association between outlet density and alcohol-related harm, but the evidence is mixed on the link between density and alcohol consumption, as illustrated by the opposite results reached by Scribner et al. (2000) and Pollack et al. (2005). Connor et al. (2011) found no statistically significant association between density and average alcohol consumption, but did find an association with binge drinking. Evidence of the effectiveness of restrictions in opening hours is available at the local level in countries like Australia (e.g. Douglas et al., 1998; Gray et al., 2000), and in Sweden at the national level (Norstrom et al., 2005). However, the majority of studies investigate the effects of increases, rather than reductions, in opening hours, and extrapolating the potential effects of restrictive policies from these studies may require a leap of faith.

127. Selection of the evidence to model the intervention. Given the political viability issues and the weaknesses in the evidence base mentioned above, the OECD Expert Group on the Economics of Prevention agreed that the Secretariat should focus on policies to regulate outlet opening hours. Three systematic reviews are available (Popova et al., 2009; Hahn et al., 2010; Bryden et al., 2012), reporting a variety of study approaches and outcome measures. A modelling study by Chisholm et al. (2004b), also used as a basis for modelling the impact of restrictions in opening hours in the context of the ACE Prevention project (Cobiac et al., 2009), quantified the likely effect of this policy on the basis of three northern European studies assessing the effects of Saturday closing (Leppanen, 1979; Nordlund, 1984) or Saturday opening (Norström and Skog, 2003) of (off-trade) outlets in State monopoly settings. A subsequent update of the Norström and Skog study (Norström and Skog, 2005) showed effects in line with their earlier evaluation (an increase in alcohol sales of 3.6%). On average, Chisholm et al. determined that the policy will likely generate a "modest reduction of 1.5%-3.0 % in the incidence of hazardous drinking, and 1.5%-4.0% in alcohol related traffic fatalities". Given the uncertainties in effects on alcohol consumption, our analysis focused on impacts on injuries (traffic- and violence-related), for which the evidence is stronger and more consistent, as shown in a review by Stockwell and Chikritzhs (2009b), and by at least two later studies (Kypri et al., 2010; Rossow and Norström, 2011). Other papers that we considered in the review process are listed in the appendix.

128. Characteristics of the modelled intervention. A policy scenario was modelled, which entails restrictions in on‑trade outlet opening hours leading to a two-hour reduction, with a view to cutting the incidence of alcohol-related injuries, particularly from assaults and traffic accidents. This policy was assumed to target the most densely populated areas of the countries concerned, corresponding to medium- and large-sized cities. The policy scenario involves increased enforcement efforts by the relevant licensing and law enforcement authorities.

129. Effects of the intervention. Based on the study by Rossow and Norström (2012), the impact of a 2-hour reduction in on-trade outlet opening hours was assumed to be a 34% reduction in assault-related injuries. In addition, a 1.5% reduction in traffic-related injuries was modelled, at the lower end of the range used by Chisholm et al. (2004b). The policy was assumed to be implemented in medium- and large-sized cities (with a population of over 30 000), corresponding to an overall population coverage ranging from 68% in Canada to 74% in Germany.

130. Cost of the intervention. We estimated the total cost of this intervention at 0.26 (CAN), 0.90 (CZE) and 0.13 (DEU) 2008 US$ PPP per capita. The intervention involves basic administration at local level and law enforcement. We estimate that enforcing the new regulations represents the most expensive component of the intervention. A breakdown of the contribution of the different drivers underlying the cost of the intervention is provided in figure 5.

2.5.9. Workplace programmes

131. Places of work have the potential to offer all the characteristics needed to carry out successful prevention programmes. The majority of the adult population is employed and spend a significant amount of time at the workplace where the environment and peer-pressure from colleagues shape individuals' behaviours and lifestyles, patterns of alcohol consumption included. From the point of view of the employers, implementing prevention programmes to tackle harmful alcohol consumption may present some positive economic effects. A number of studies emphasize the negative consequences that harmful patterns of alcohol consumption would have on absenteeism, presenteeism, loss of productivity, poor co-worker relations, unemployment and healthcare costs (Anderson et al, 2012). The implementation of preventing programmes could reinforce positive changes in the lifestyle of employees and decrease employers' costs caused by the negative effects of workers' dangerous alcohol drinking behaviours (Dale et al, 2010).

132. Selection of the evidence to model the intervention. A systematic review by Webb et al. (2009) identified ten, mainly US-based, studies that assessed a heterogeneous set of interventions ranging from peer support programmes to brief interventions and counselling-based interventions. Only brief interventions showed a small but clear positive effect (Cook et al., 1996; Richmond et al., 2000). A literature review by Ames and Bennett (2011) also found the evidence base to be relatively weak for several types of interventions including: health promotion, social health promotion, brief intervention and web-based interventions. In our analysis, a brief intervention programme in the workplace is modelled, based on the experience of a large Australian postal network (Richmond et al., 2000). This experience was selected because of the relatively large sample size of the evaluation. Other studies had poor participation rates (e.g. Matano et al., 2007) or did not show statistically significant results (e.g. Hermansson et al., 2010). Other relevant papers analysed during the process are cited in the appendix.

133. Characteristics of the modelled intervention. A policy of screening and brief interventions in the workplace (employers with at least 50 employees) was included in the analysis. Participation is assumed to be voluntary and anonymous for workers reporting excessive levels of alcohol consumption or heavy episodic drinking (Richmond et al., 2000; NHMRC, 1992). Patients with a diagnosis of alcohol dependence are excluded from this intervention but are referred to an appropriate treatment centre. This intervention would reach 12.3% of the potential target in participating workplaces (Richmond et al., 2000).

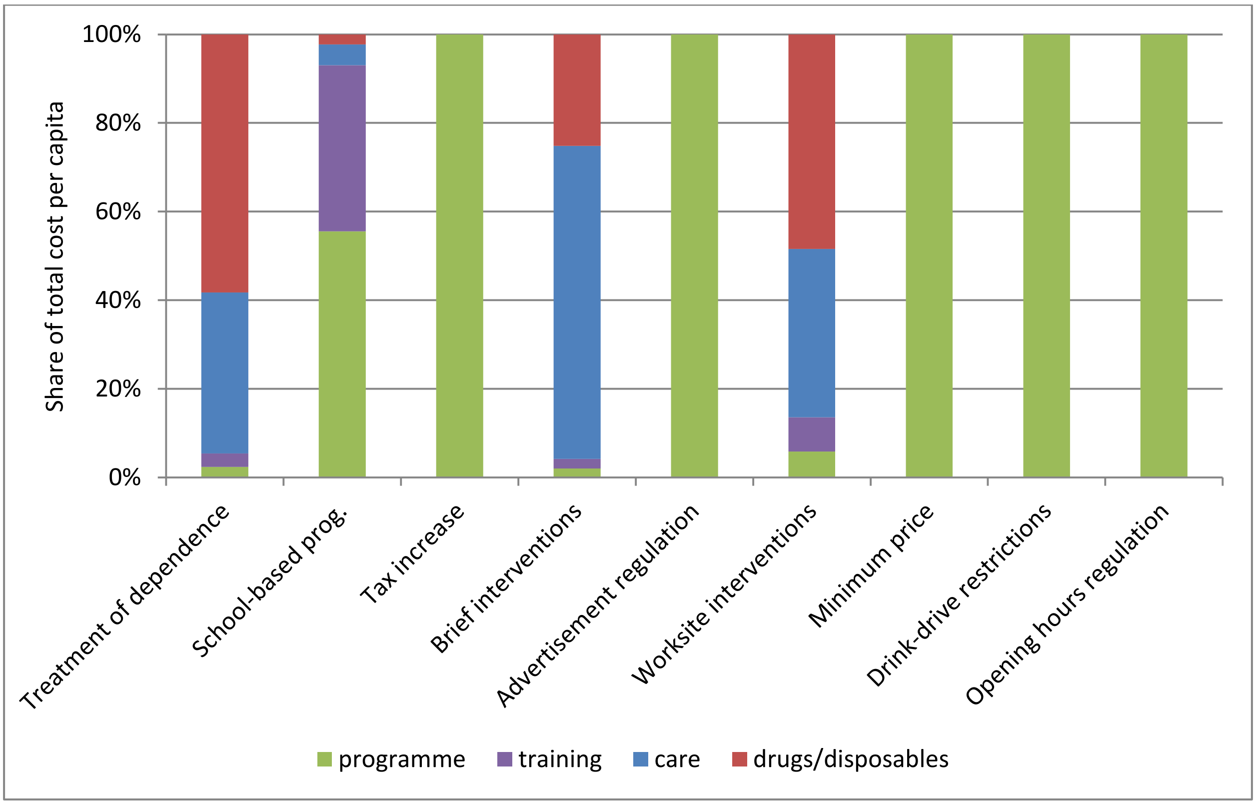
134. The intervention consists of three phases plus a “kick off” period to promote participation by distributing brochures and posters. The initial screening process is carried out during the first phase that lasts four to five months. Workers are administered a questionnaire about their health and weekly alcohol consumption during the previous three months. Those reporting a high daily intake of alcohol (NHMRC, 1992), are asked to fill a more comprehensive questionnaire (phase two) whose results are used to tailor a subsequent brief intervention (one 20-minute visit) delivered by a general practitioner. During the visit the patient is provided with a booklet and receives information about the health effects of harmful alcohol consumption and advice on how to reduce consumption. Ten months after the start of the programme, a final assessment is carried out with a procedure similar to phase one. One in five employees beginning the programme does not complete it (Webb et al., 2009).

135. Effects of the intervention. The modelled workplace intervention is assumed to decrease the consumption of alcohol in men and women by, respectively, 4.8 and 0.7 standard drinks per week during the course of the intervention, consistently with Richmond et al. (2000). Evidence of long-term effectiveness is weak. Consistently with the modelling of brief interventions in primary care, the effectiveness of workplace interventions in changing alcohol consumption was assumed to decline by half in the year following the end of the intervention and to wane thereafter.

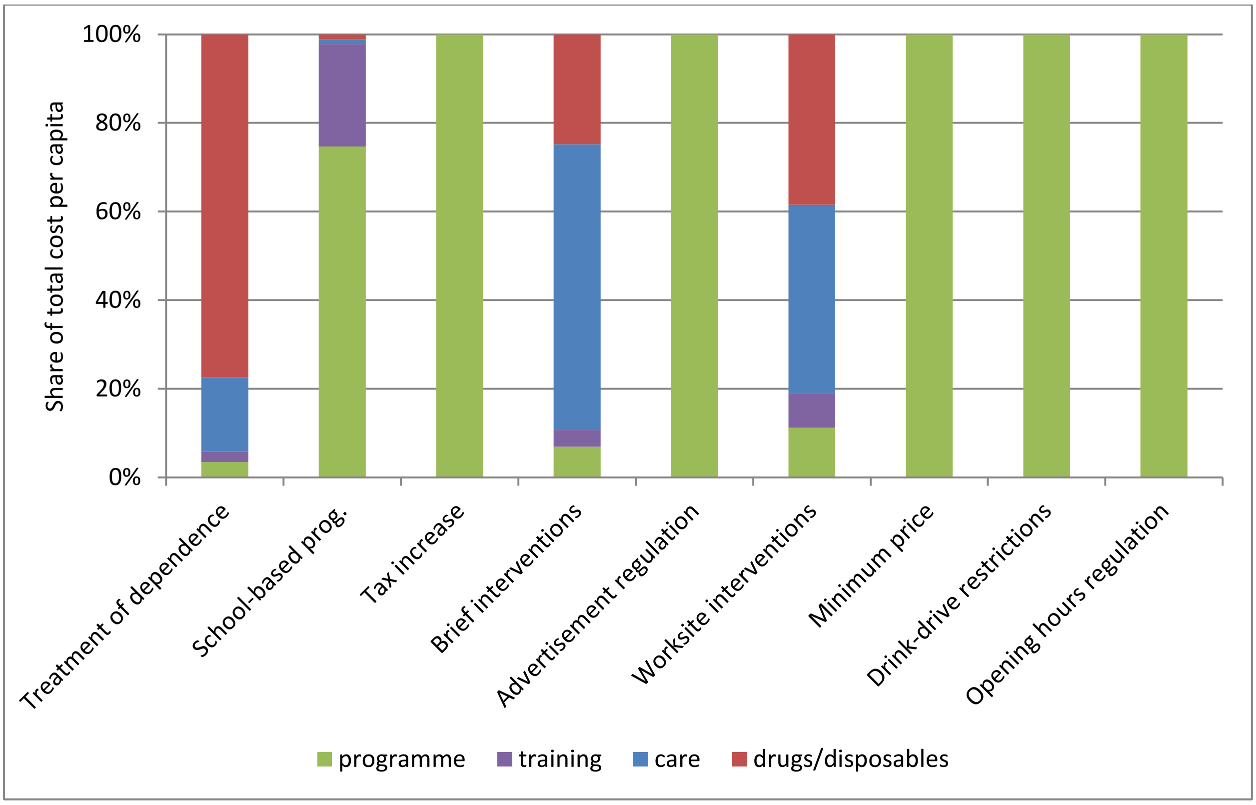
136. Cost of the intervention. The estimated total cost for this intervention is 1.70 (CAN), 2.96 (CZE) and 4.09 (DEU) 2008 US$ PPP per capita. Although the intervention is delivered in the workplace, it is assumed to take place as part of a government-sponsored programme. However, the time spent in the programme by participating employees is not assumed to be subsidised. The most expensive single component of this intervention is the brief intervention delivered by a medical doctor, which accounts for about 25% of the cost. Other cost items include printed materials (booklet, leaflet, posters, questionnaire) and administrative support. A breakdown of the contribution of the different drivers underlying the cost of the intervention is provided in figure 5.

Figure 5. Cost components of interventions

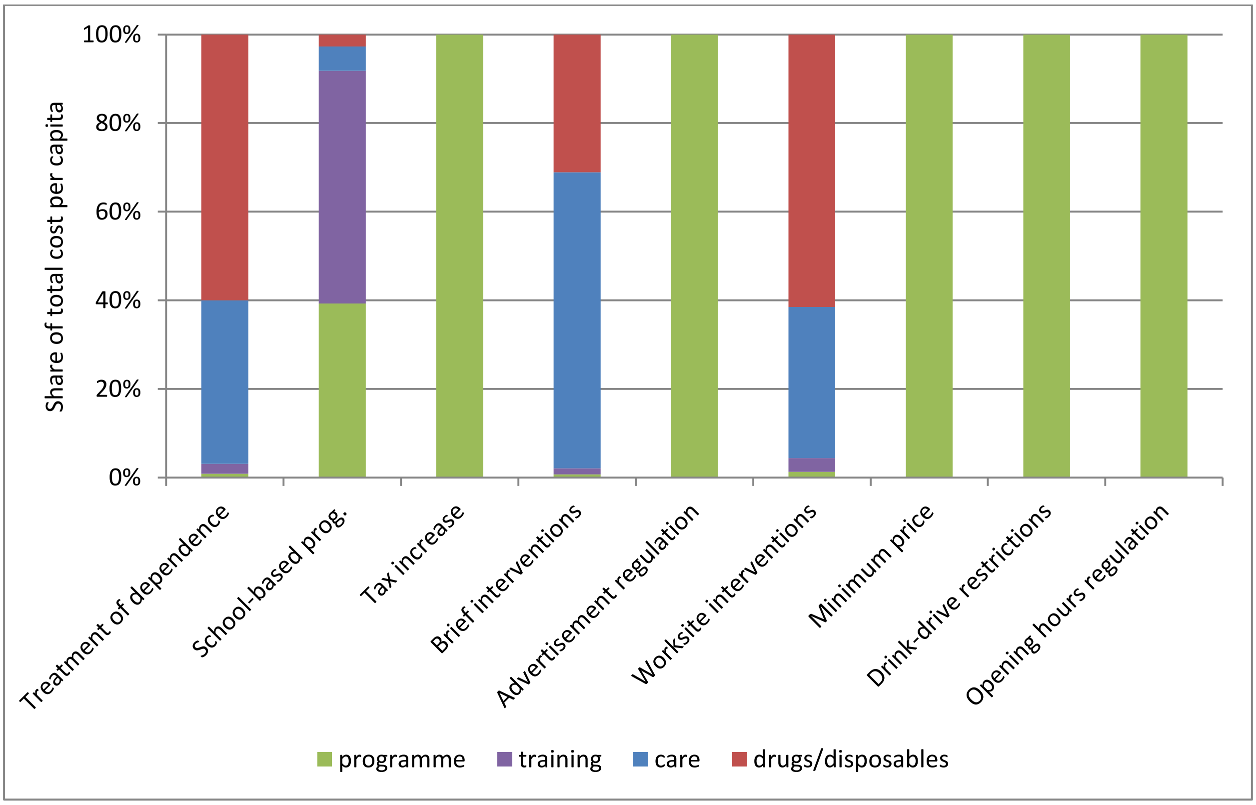
Panel a - Canada



Panel b – Czech Republic



Panel c - Germany



SECTION 3. ASSEMBLING AND VALIDATION OF THE MODEL

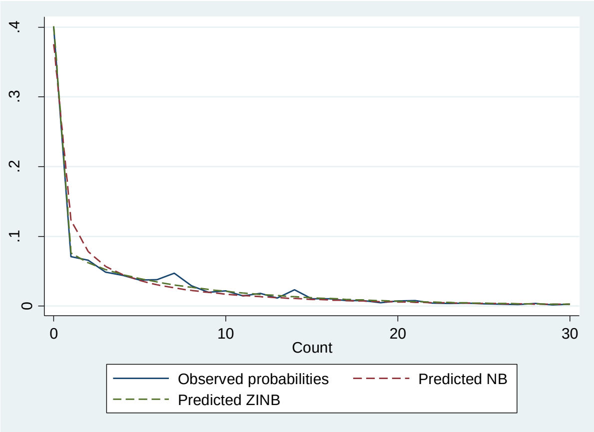
137. The model is built in multiple steps. The first, core, component of the model is the demographic module which is built to perfectly match the specific characteristics of the desired population. The following step is to add drinking habits (i.e. the alcohol consumption module) to the virtual population. The model is run a first time to validate the overall functioning and the reproduction of accurate alcohol consumption rates from the alcohol module. Following to this phase, the disease-specific modules are included one by one, linked to patterns of alcohol consumption through the appropriate relative risks and tested as explained below. At the end of this process the model is considered validated. The same procedure is replicated for each country.

138. To check the validity of the risk factor module, we compared the observed distribution of the number of alcoholic drinks, and the predicted distribution obtained with a negative binomial distribution (a zero-inflated negative binomial model for Canada). The figures below (panels a to f of Figure 6) show that the model accurately reproduces the actual number of alcoholic drinks.

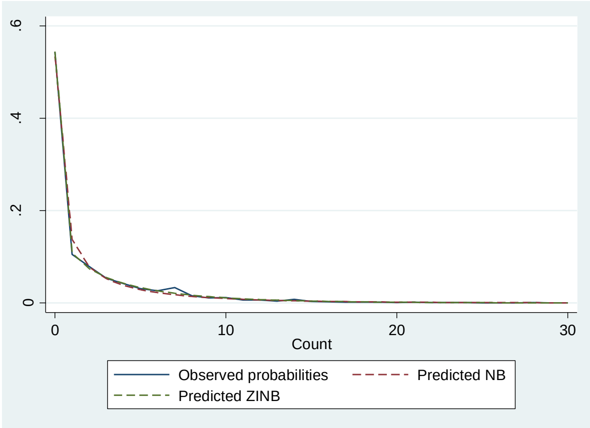
Figure 6. Observed and predicted probabilities of having n alcoholic drinks

Panels a and b – Canada

Men

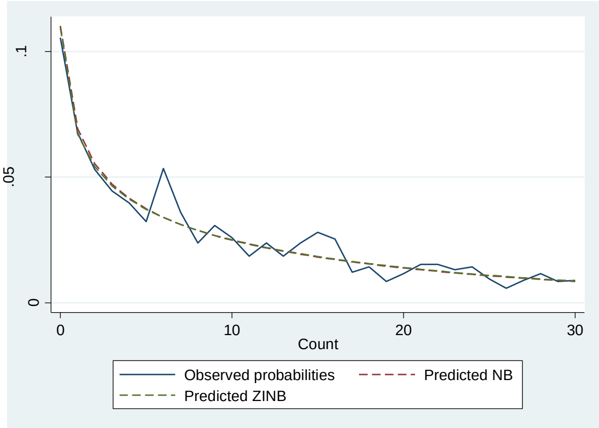


Women

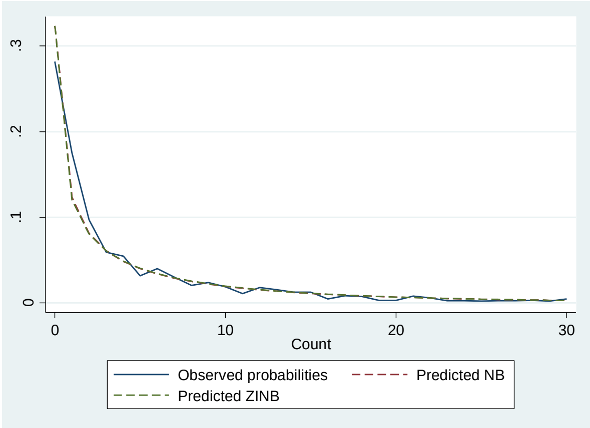


Panels c and d – Czech Republic

Men

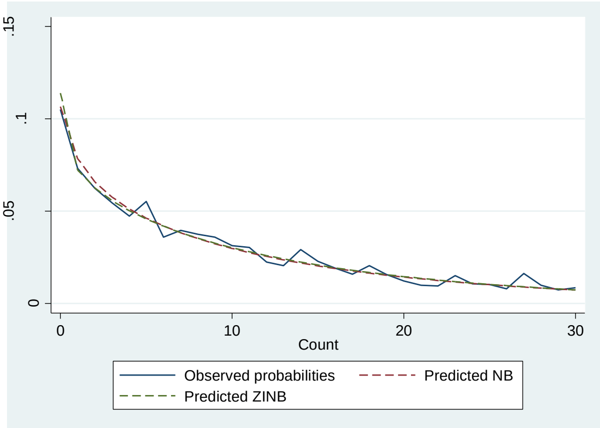


Women

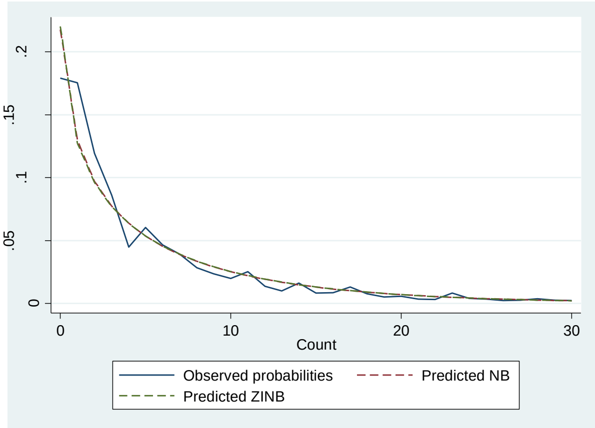


Panels e and f – Germany

Men



Women



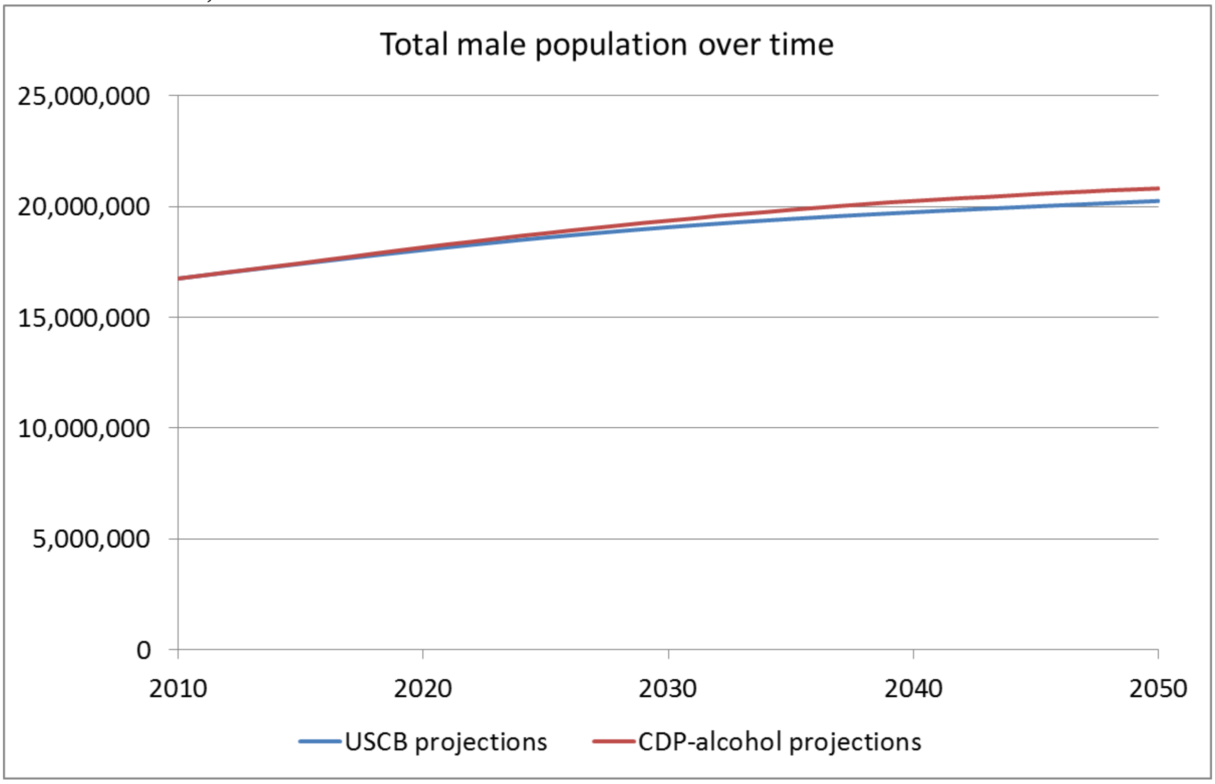
139. We also checked the proportions of drinkers falling in each drinking category, as averages over the simulation period, and compared these with the observed proportions at the start of the simulation. The table below (table 7) shows consistency between the observed data derived from the surveys, and simulated data calculated by the model over the course of the entire simulation.

140. The more demanding task is the inclusion of the disease modules. First a disease module is conceived and designed according to the peculiar physiopathological and clinical aspects of the disease (e.g. acute/chronic diseases, possibility of remission or sequelae, etc.), its association with the different dimensions of alcohol and availability of data. Then the modules are inserted one by one into the model which already includes the demographic module, the alcohol consumption module and any previously tested and validated disease module. The resulting model is run and outputs are analysed for validating purposes. In particular each module is assessed on the following dimensions: i) predicted number of life years by gender and age group; ii) predicted disease prevalence rates and; iii) predicted number of incident cases. In the case of misaligned results, the standard OECD validation protocol requires a process of internal validity and, then, calibration of the input data. If necessary, the process could be repeated reiteratively until the model returns outcomes that are aligned with the validation test.

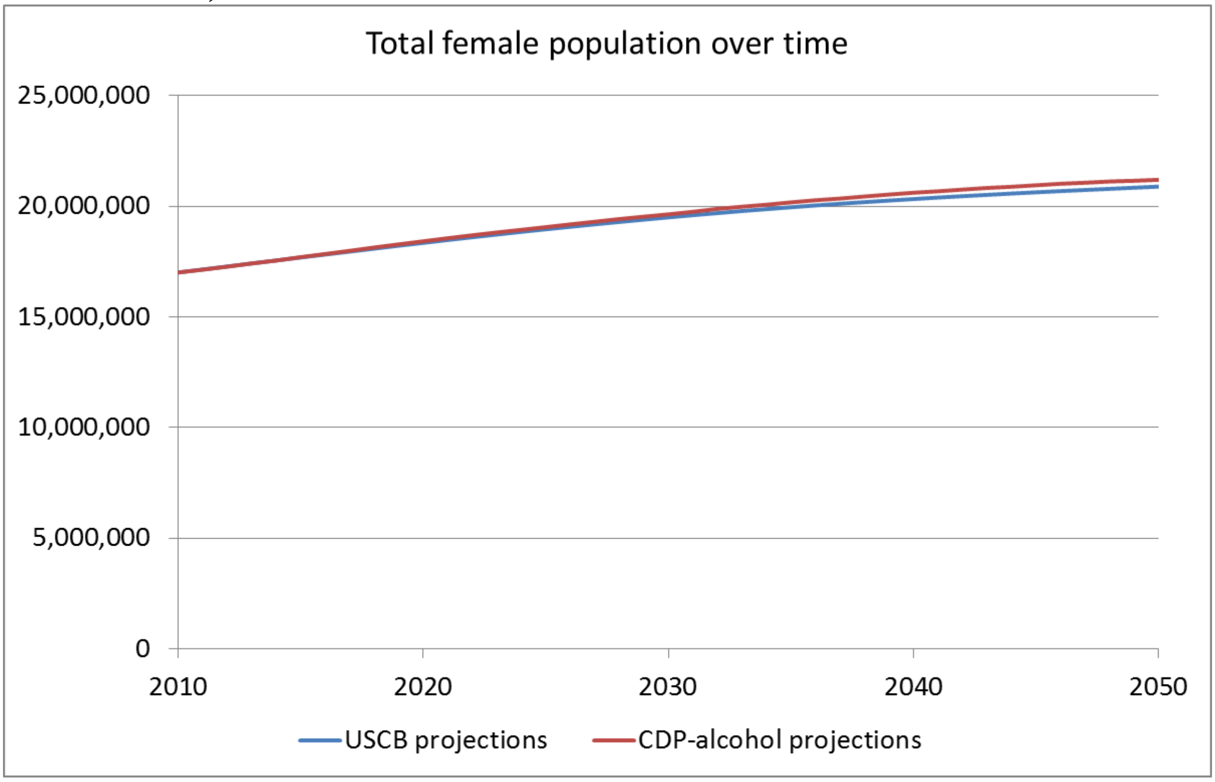
141. Figure 7 reproduces the final step of the validation process (i.e. a validated and calibrated mode) for the three countries in terms of total population (predicted number of life years) by gender. Outputs of the CDP alcohol model are assessed against the original projections by the US Census Bureau. Overall, the CDP-alcohol model does an excellent job in producing similar estimates. For all the three countries and both of genders, the difference over 41 years remains well below a 5% confidence interval

Figure 7. Comparison between CDP-alcohol and US Census Bureau population projections by gender

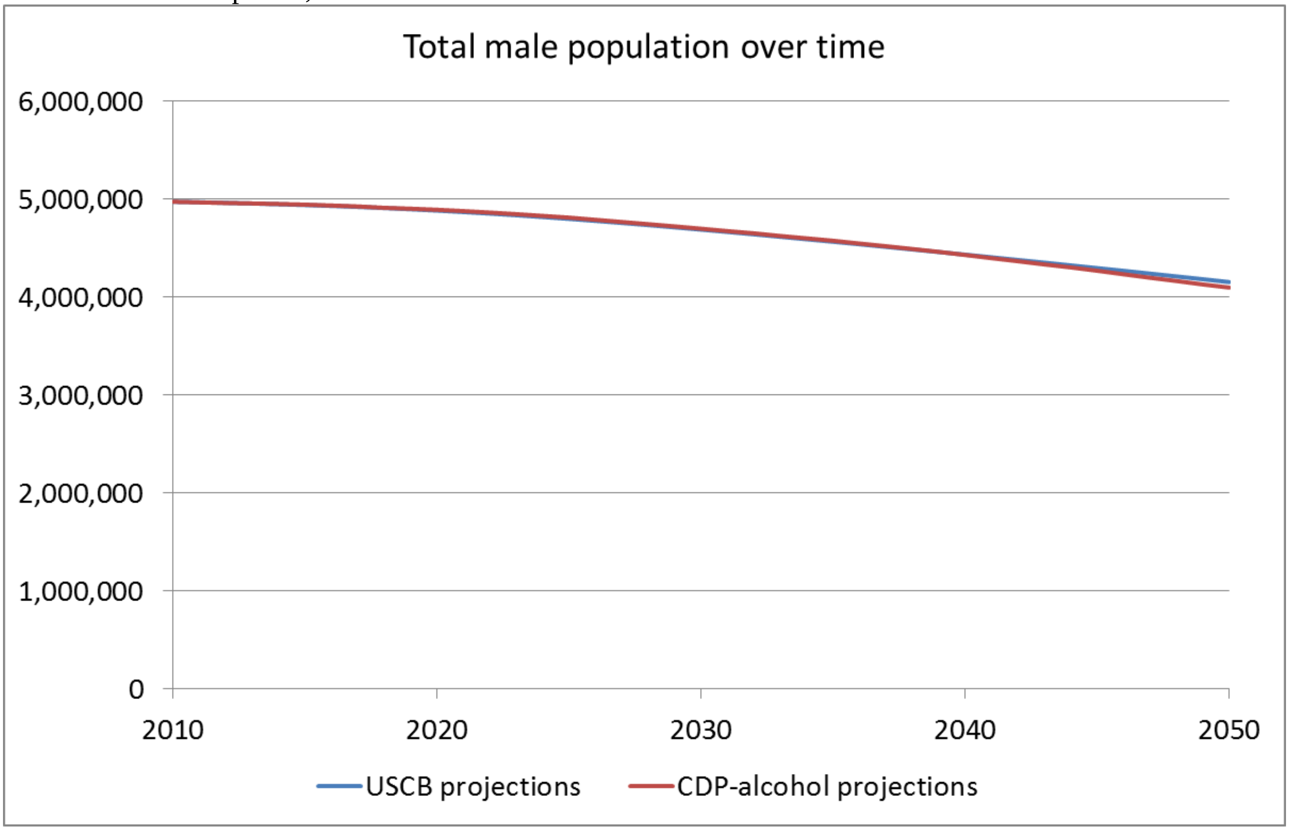
Panel a – Canada, males



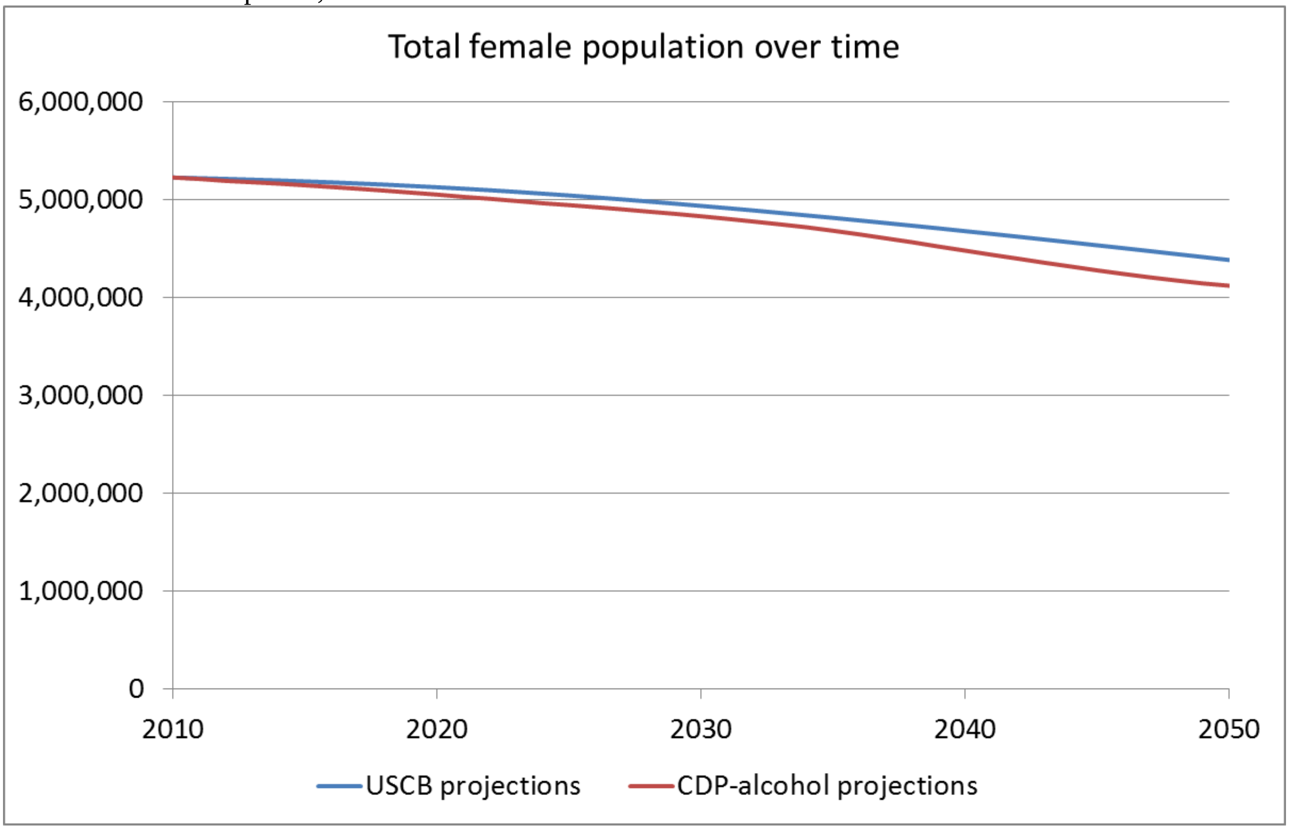
Panel b – Canada, females



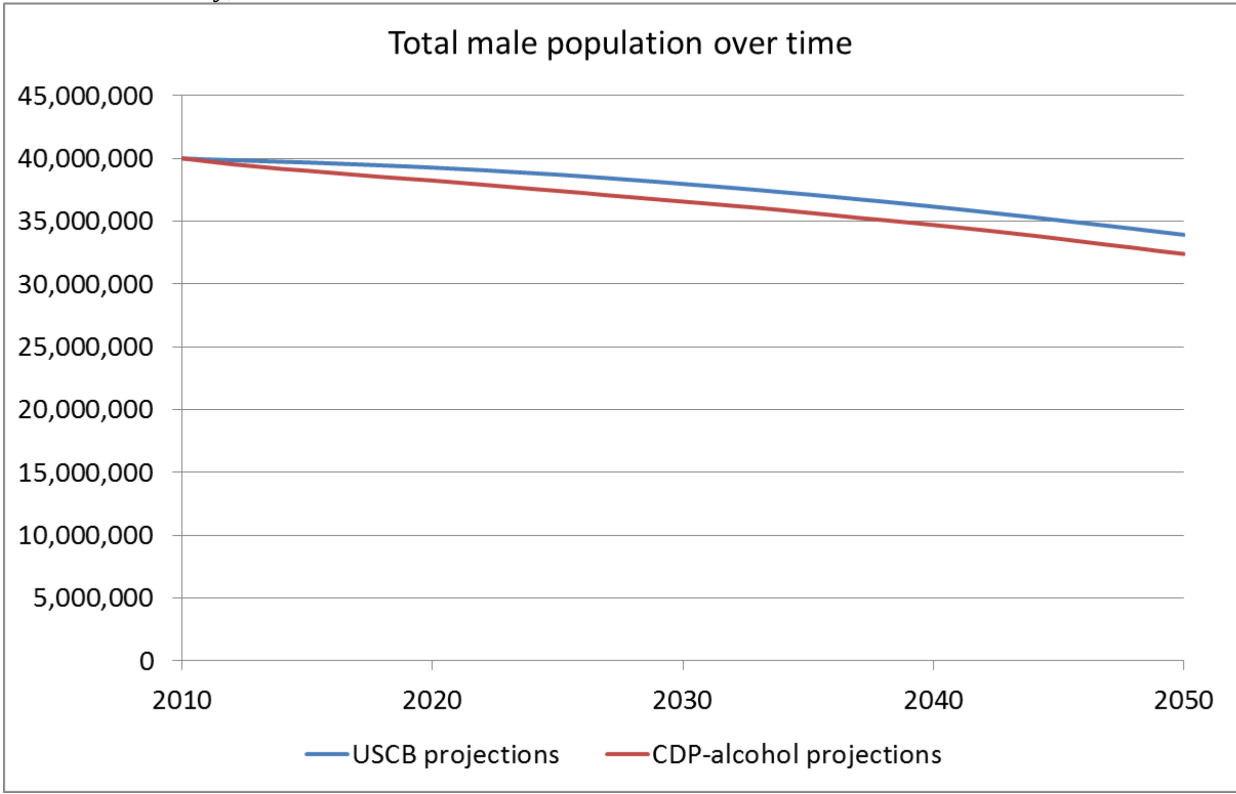
Panel c – Czech Republic, males



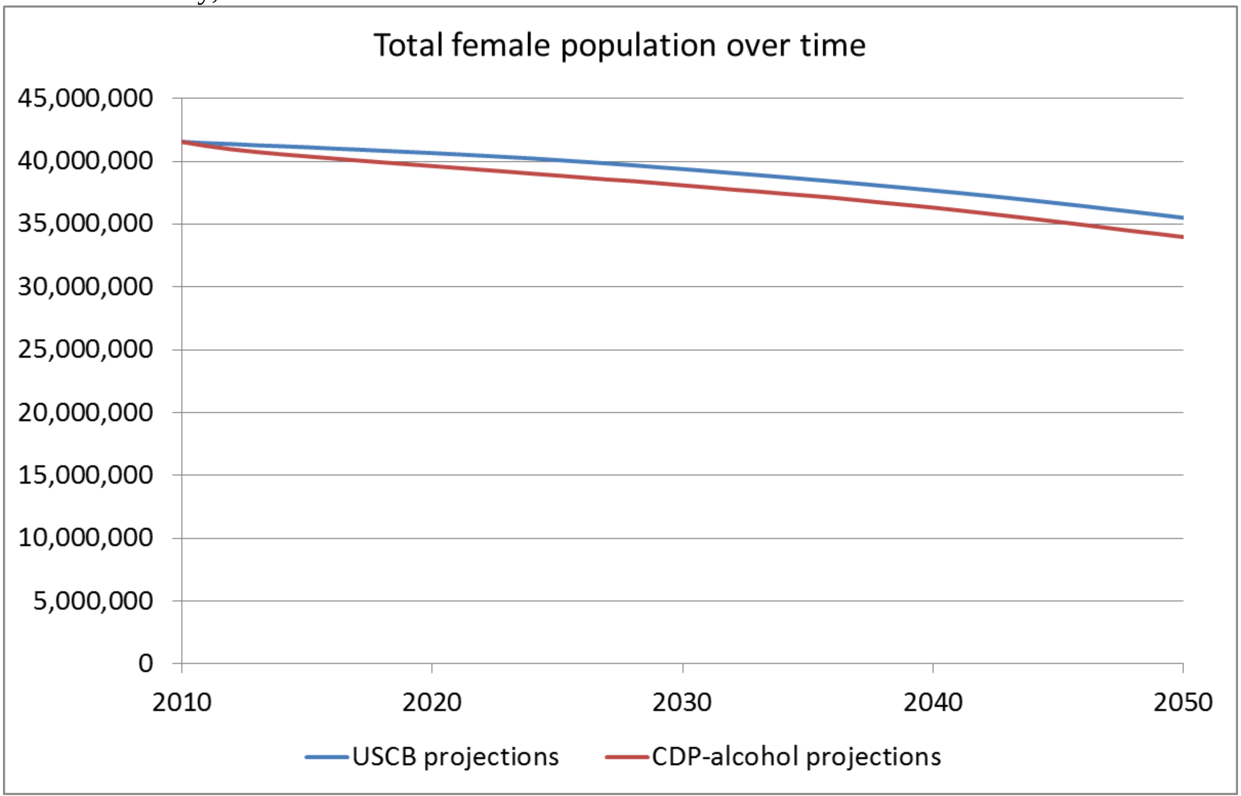
Panel d – a Czech republic, females



Panel e – Germany, males



Panel f- Germany, females



Source: CDP-Alcohol analysis relying on input data from multiple sources listed in Appendix A and US Census Bureau international database

SECTION 4. THE IMPACT OF PREVENTIVE INTERVENTIONS

4.1. Introduction

142. Using the methods and data illustrated in Section 2, the CDP alcohol model was first run to compute the health outcomes associated with a baseline scenario reflecting the epidemiology of the relevant risk factors and chronic diseases in the absence of preventive interventions. Intervention scenarios were then developed, whose health outcomes were compared to those of the baseline scenario. The results of such comparisons are reported in this section in terms of effects on alcohol consumption (3.2); health and longevity (3.3); intervention costs and effects on health care expenditure (3.4); and cost-effectiveness (3.5). The impacts of possible combinations of interventions are also discussed (3.6). Selected results from a range of sensitivity analyses carried out to assess the robustness of model estimates are reported in Section 3.7.

4.2. The effects of preventive interventions on alcohol consumption

143. The CDP-Alcohol model allows the impacts of alcohol policies on drinking patterns to be compared. The largest reduction (10%) in hazardous (including harmful) drinking is seen for a tax increase in Germany. Price policies (especially tax increases), brief interventions and advertising restrictions are all shown to have strong potential effects. Advertising restrictions have a lesser potential effect in Canada on hazardous drinking overall, but model outputs show that a relatively large proportion of the heaviest drinkers would cut their consumption to some degree. School-based programmes lag behind, due to their targeting of a population group with comparatively low rates of high-risk drinking, and due to the temporary nature of the effects assumed for these programmes. Limitations in opening hours and enforcement of drinking-and-driving restrictions were not assumed to impact consumption in this analysis, hence the lack of effects shown in Figure 8 (Panels A, B and C, respectively, for Canada, the Czech Republic and Germany).

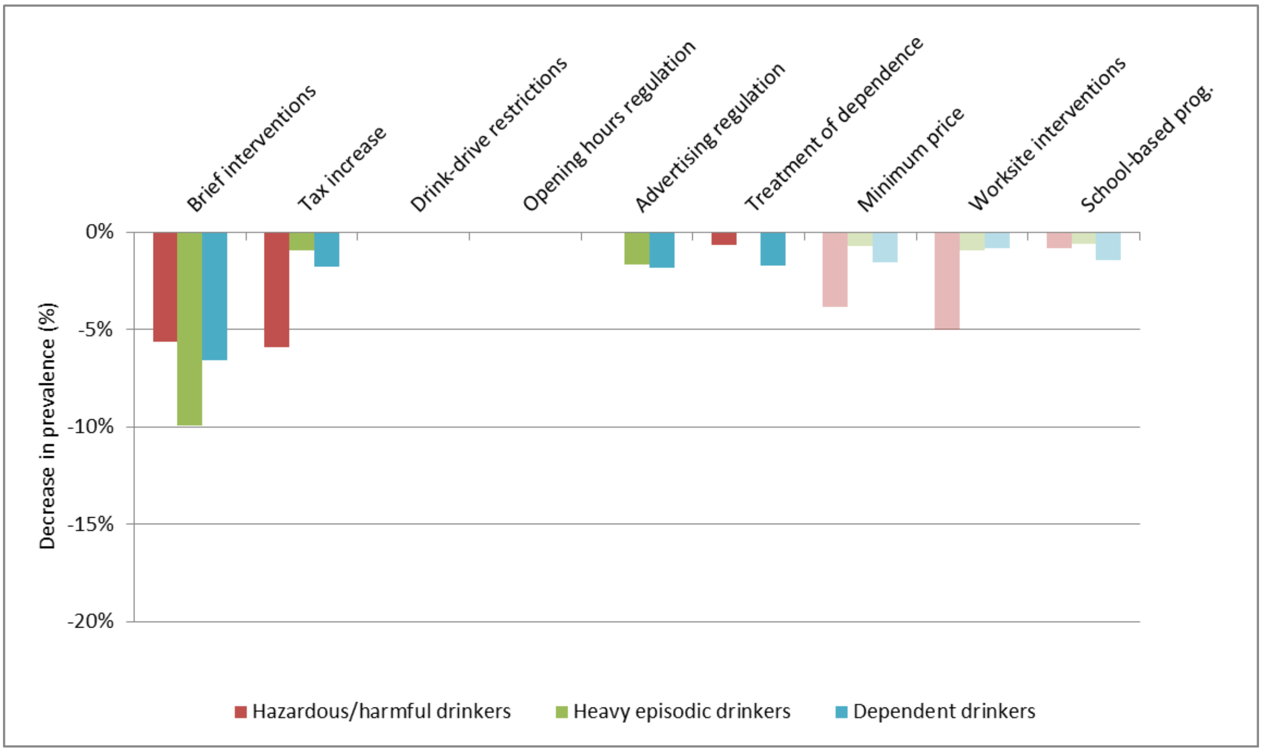
144. Brief interventions, when offered systematically to all eligible patients at all general practices, are shown to have the potential to prevent a significant number of cases of alcohol dependence (as many as 17% in the Czech Republic, 10.5% in Germany and 6.5% in Canada, as shown in Figure 8). Brief interventions are also shown to be effective, albeit to a lesser extent, when delivered in the workplace. In addition, important reductions in the prevalence of alcohol dependence can be obtained with price policies, pharmacological and psychosocial treatment of dependence, and advertising regulation. These effects on alcohol dependence compound the interpretation of the changes observed in heavy episodic drinking (HED). In particular, in countries where a larger reduction in alcohol dependence is obtained (typically countries where dependence is more widespread), the analysis predicts that a number of people who would have become dependent otherwise will still drink heavily on an episodic basis, thus partially or entirely offsetting the reduction in HED obtained by lowering the quantity of alcohol drunk by other heavy drinkers. This is the main reason why we see larger reductions in HED in Figure 8 for Canada (where reductions in dependence are less pronounced) than for the other two countries. Regulation of advertising and school-based programmes have more consistent effects on HED across the three countries, because of the nature of the effects of these interventions.

145. Coverage is as important as the ability to change drinking behaviours at the individual level in determining the overall (i.e. population-level) effects of an intervention. So, for instance, changes in

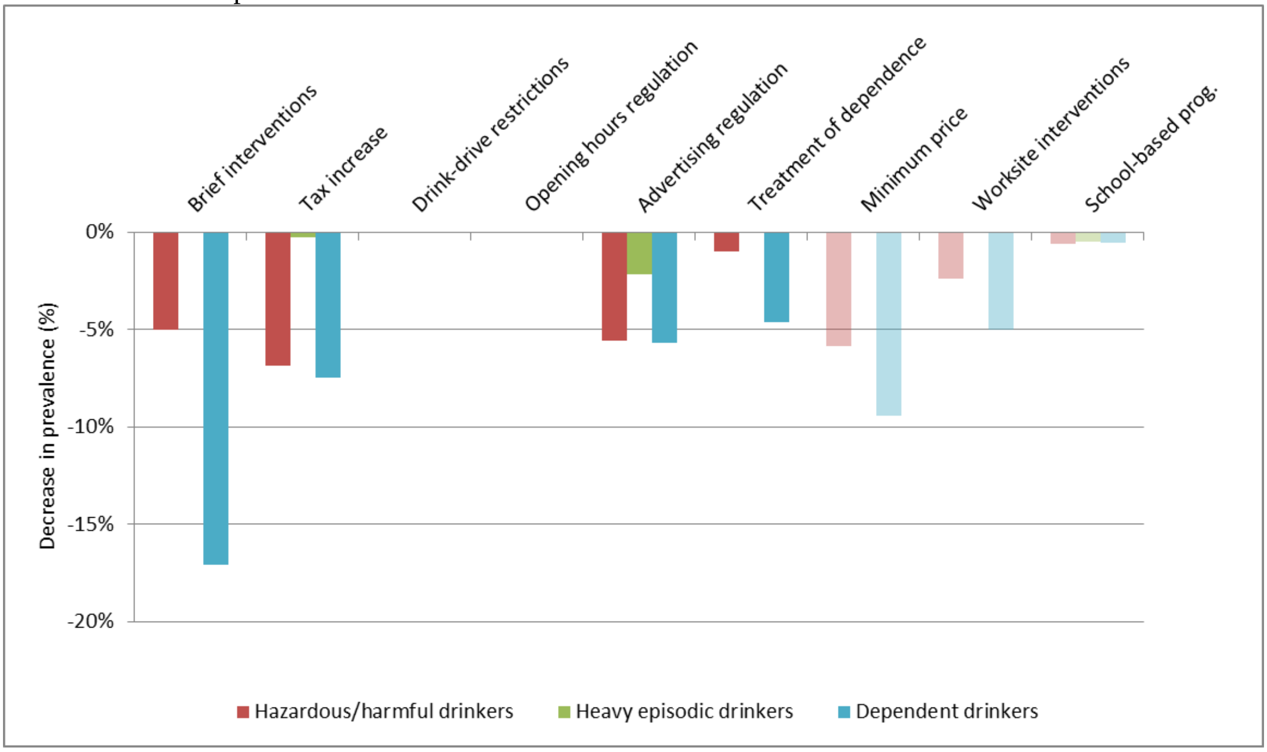
taxation tend to have only mild effects on individual alcohol consumption, but they target large shares of the population (virtually everyone) resulting in large overall effects. On the other hand, brief interventions have larger effects on a smaller number of people.

Figure 8. Decrease in prevalence rates at the population level over the simulation period

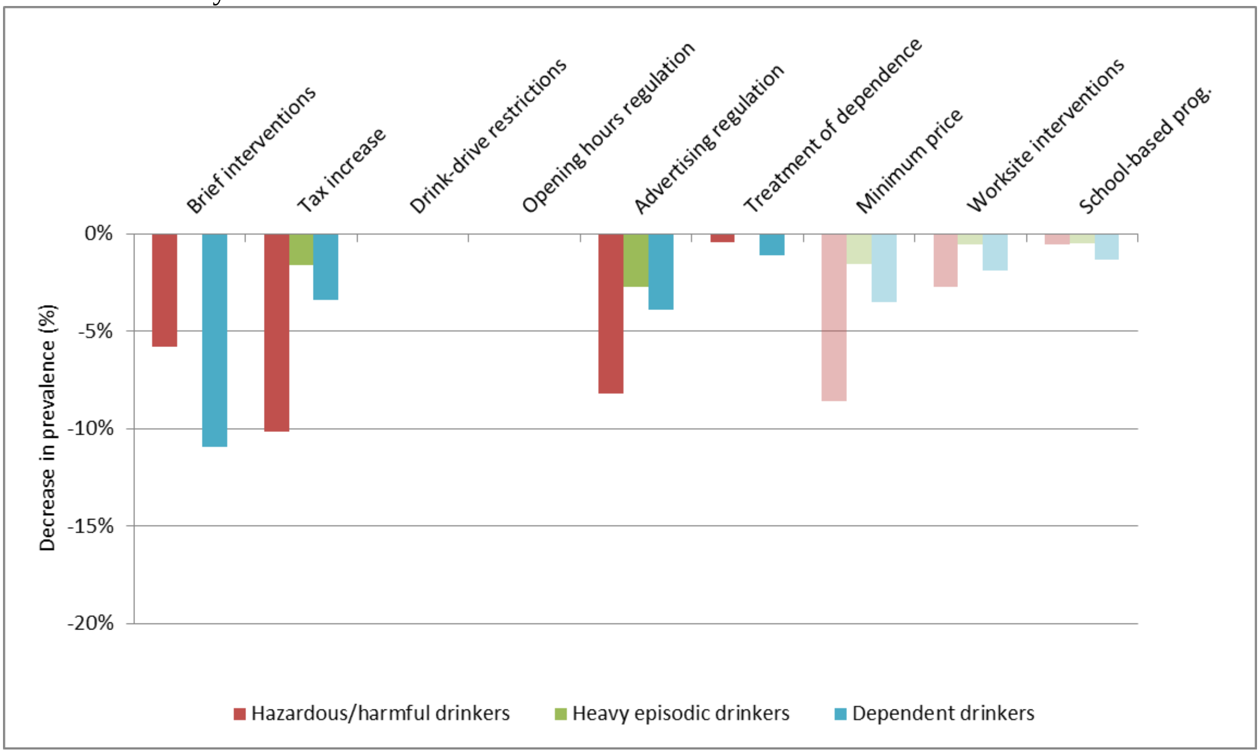
Panel a - Canada



Panel b – Czech Republic



Panel c – Germany



Source: CDP-Alcohol analysis relying on input data from multiple sources listed in Appendix A

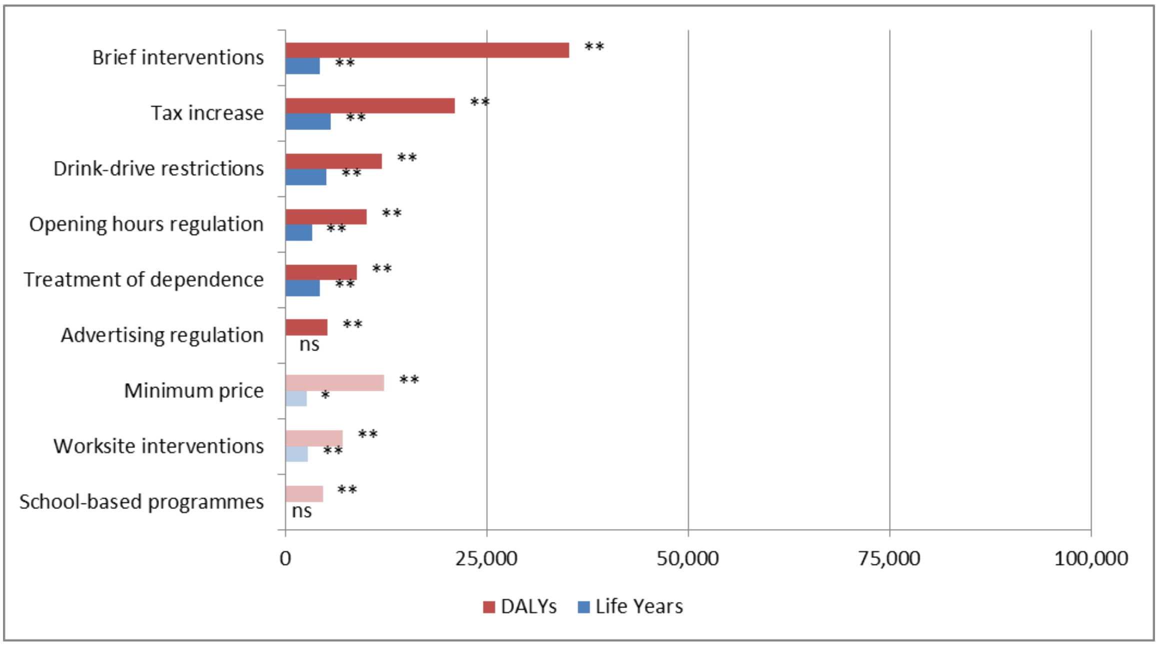
4.3. The effects of preventive interventions on health and longevity

146. Figure 9 shows the average yearly numbers of life years and disability adjusted life years (DALYs) to be gained during the simulation period by implementing individual alcohol policies. Policies are listed in order of decreasing effectiveness (main and further analyses), but the graphs should not be read strictly as a ranking. Results for each policy should be interpreted in the light of the assumptions spelled out above on coverage and effectiveness at the individual level.

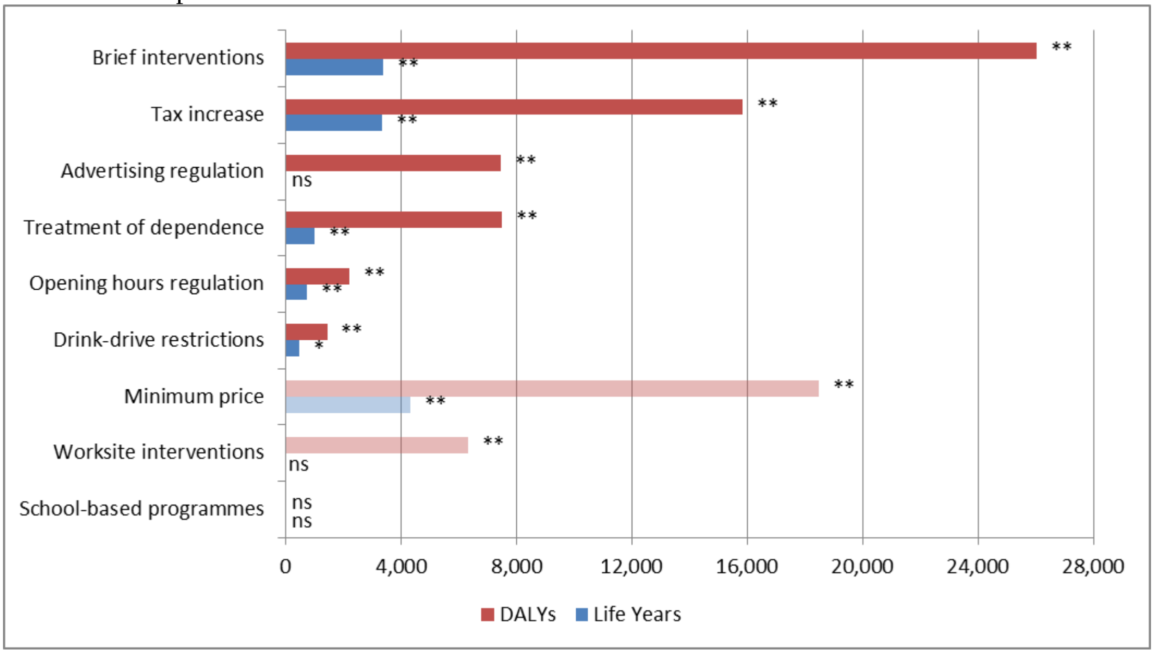
147. Brief interventions in primary care have the potential to produce relatively large health gains at the population level, although it is worth emphasising again that the findings presented here are based on the assumption that brief interventions would be offered systematically by all general practices in a country, throughout the duration of the simulation period, which means that each year approximately 13% of adults in Germany, for instance, would receive brief alcohol advice from their general practitioners. This would involve major efforts to overcome capacity constraints, incentivise and train health professionals. Relatively large health gains are also associated with price policies and advertising regulation (with smaller effects predicted for the latter in Canada). Opening hours regulation and drinking-and-driving enforcement policies, as well as treatment of alcohol dependence and brief interventions at the workplace, are likely to generate smaller but meaningful gains at the population level. Finally, the impacts of school-based programmes are small or not statistically significant in the time frame of the analysis (40 years).

Figure 9. Health outcomes at the population level, average number per year

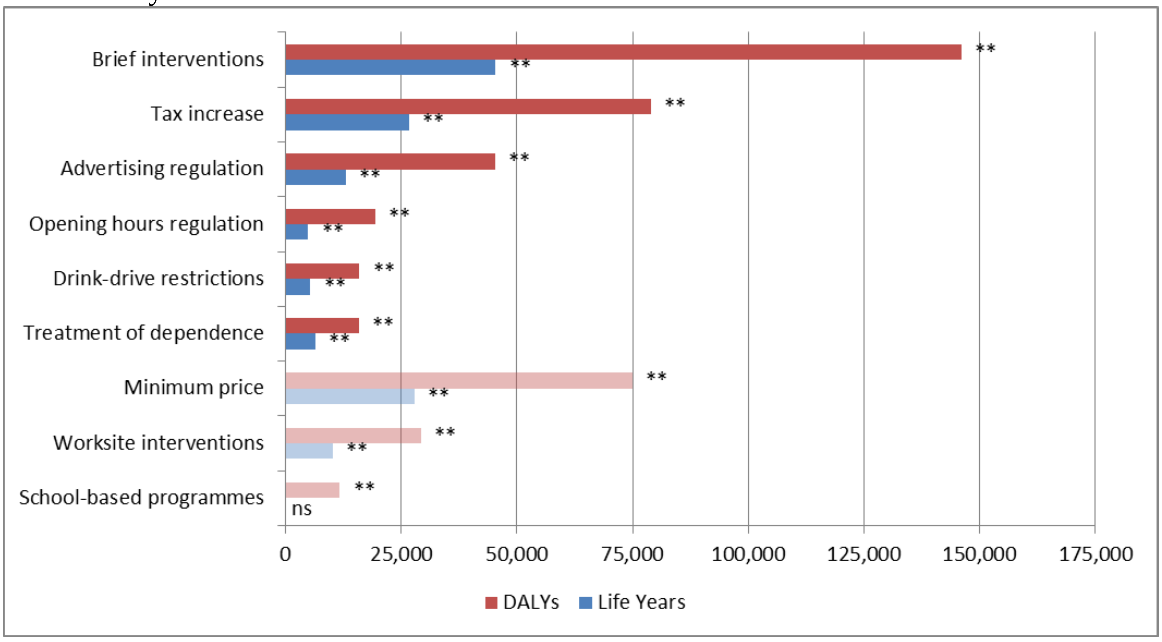
Panel a - Canada



Panel b – Czech Republic



Panel c - Germany

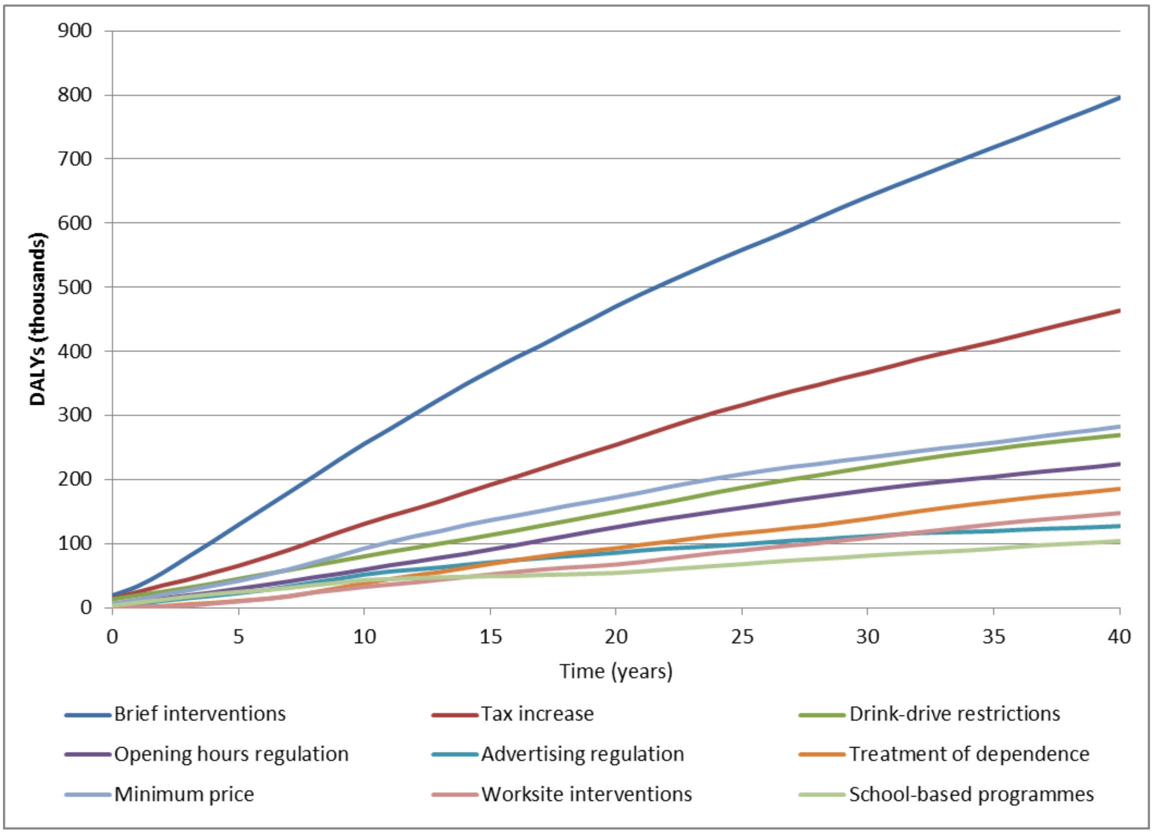


Source: CDP-Alcohol analysis relying on input data from multiple sources listed in Appendix A

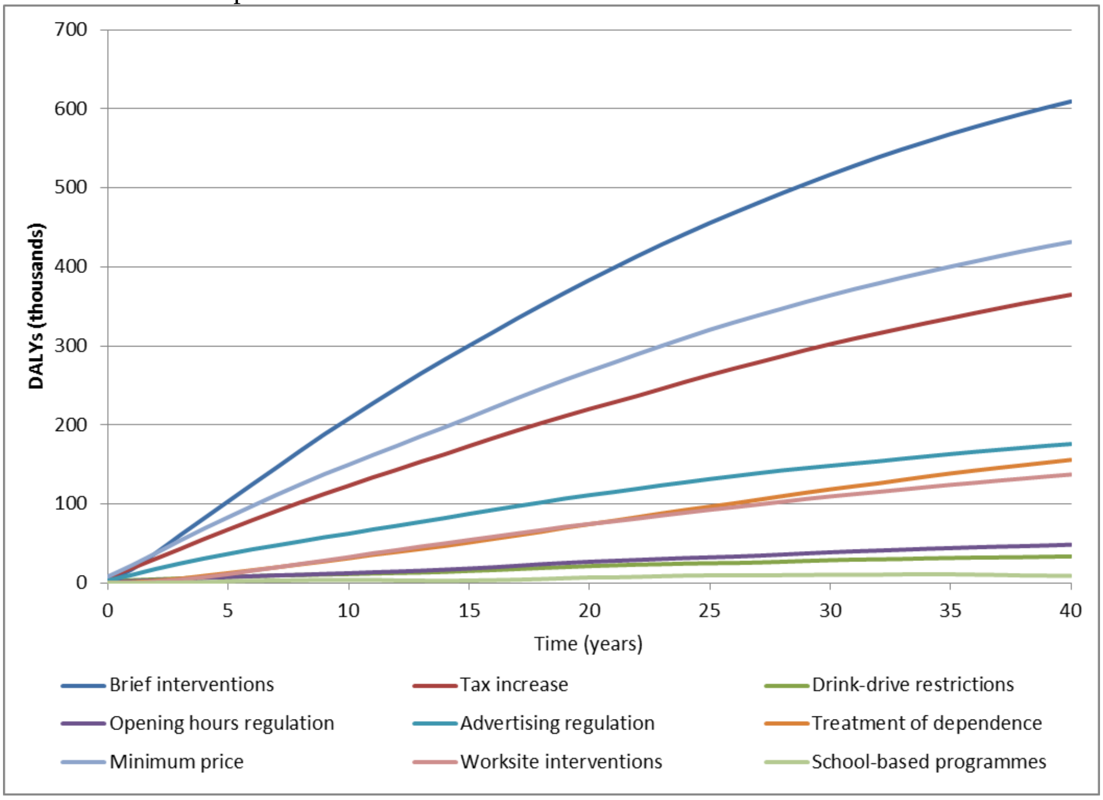
148. Simply looking at average numbers of life years or DALYs gained through prevention policies, shown in Figure 9, is not sufficient when designing a long-term prevention plan. What happens on average is not necessarily what happens in any single year and future outcomes are typically valued less than those occurring in the short term. The health returns of alcohol policies are produced relatively quickly after implementation, compared with other areas of chronic disease prevention policy. The progression is approximately linear over time, but tends to be more rapid in the initial phase with price policies and advertising regulation, with several other policies gaining momentum after five to ten years, as shown in Figure 10 and Figure 22 for the undiscounted results.

Figure 10. Cumulative DALYs saved over time

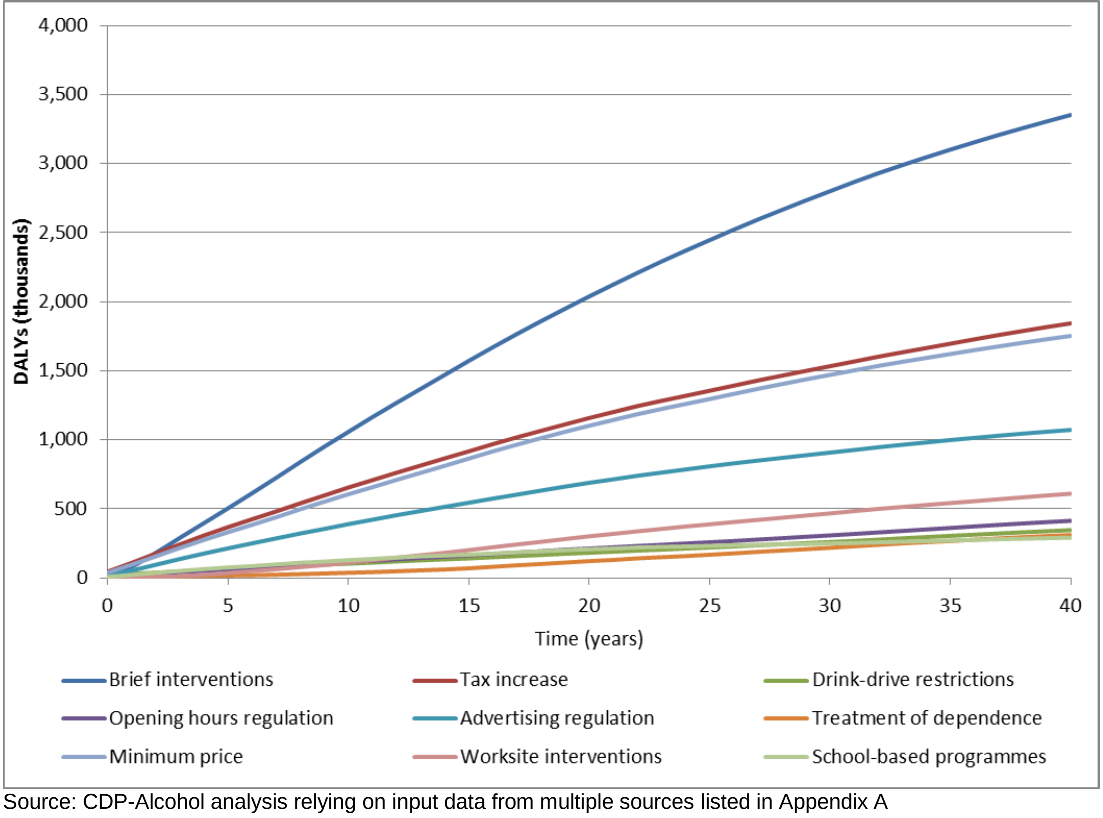
Panel a - Canada



Panel b – Czech Republic



Panel c - Germany

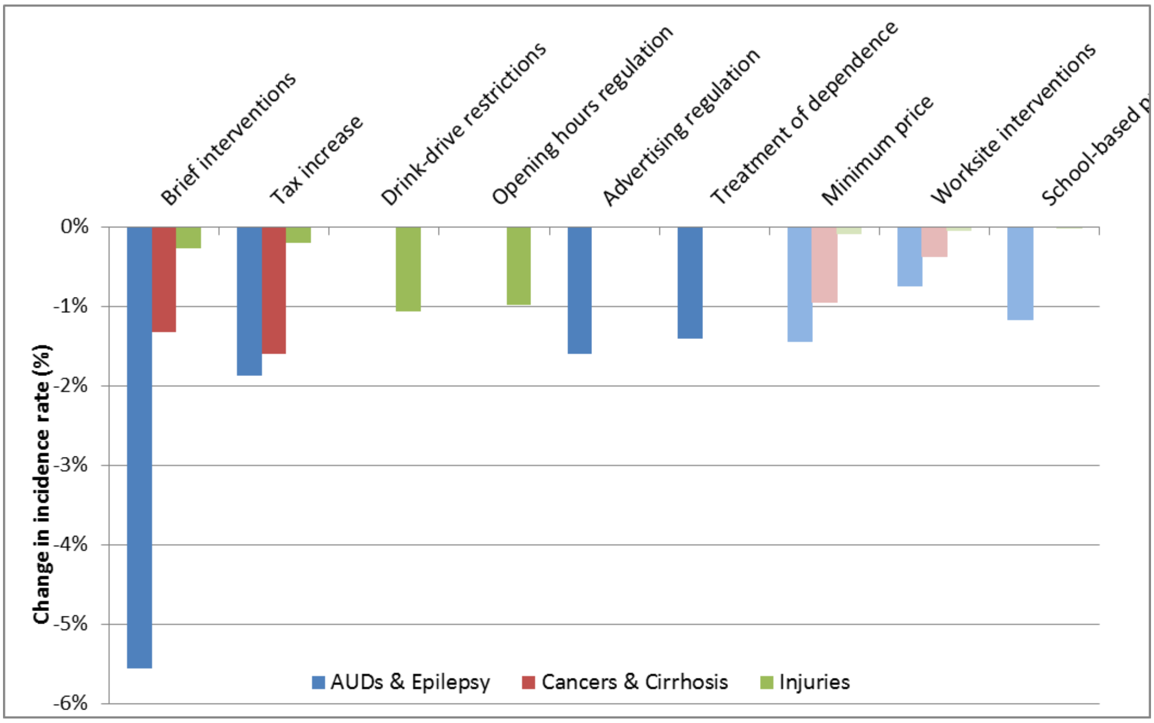


Source: CDP-Alcohol analysis relying on input data from multiple sources listed in Appendix A

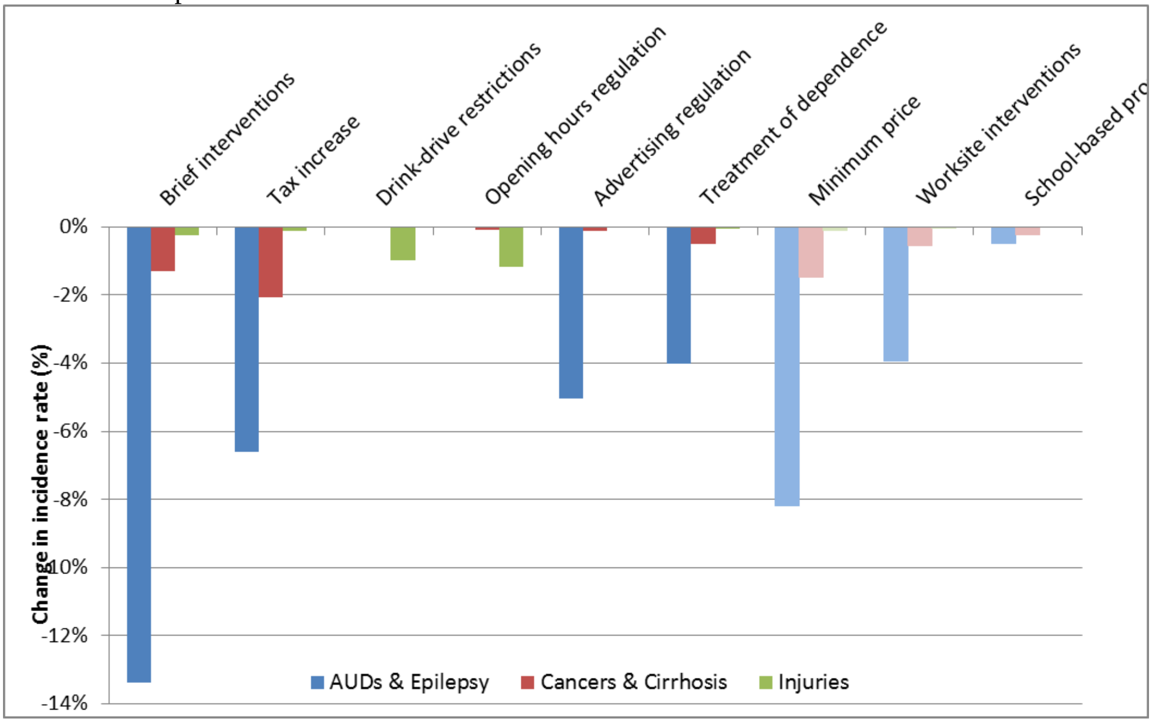
149. The greatest impact of policies on the occurrence of alcohol-related diseases is seen for alcohol-use disorders, a heterogeneous group of conditions which includes, but is not limited to, alcohol dependence. Alcohol-use disorders account for the largest share of the burden of disease associated with alcohol. The largest proportionate reductions in incidence may be obtained with brief interventions in primary care, as shown in Figure 11, mostly through the prevention of dependence. Impacts are larger in the Czech Republic, where dependence is more common. Other policies have smaller, and similar, impacts on the incidence of alcohol-use disorders, with price policies and advertising regulation showing slightly greater effectiveness. Limitations in opening hours and enforcement of drinking-and-driving restrictions have the largest impacts on injuries, with reductions in the order of 1% at the population level. This corresponds, for instance, to 71 000 and 54 000 fewer injuries each year with the two policies, respectively, in Germany, or 37 000 and 41 000 in Canada. However, by design, these policies have no impacts on overall alcohol consumption and other alcohol-related conditions in our analysis.

Figure 11. Decrease in numbers of disease and injury cases, average per year, 2010-50

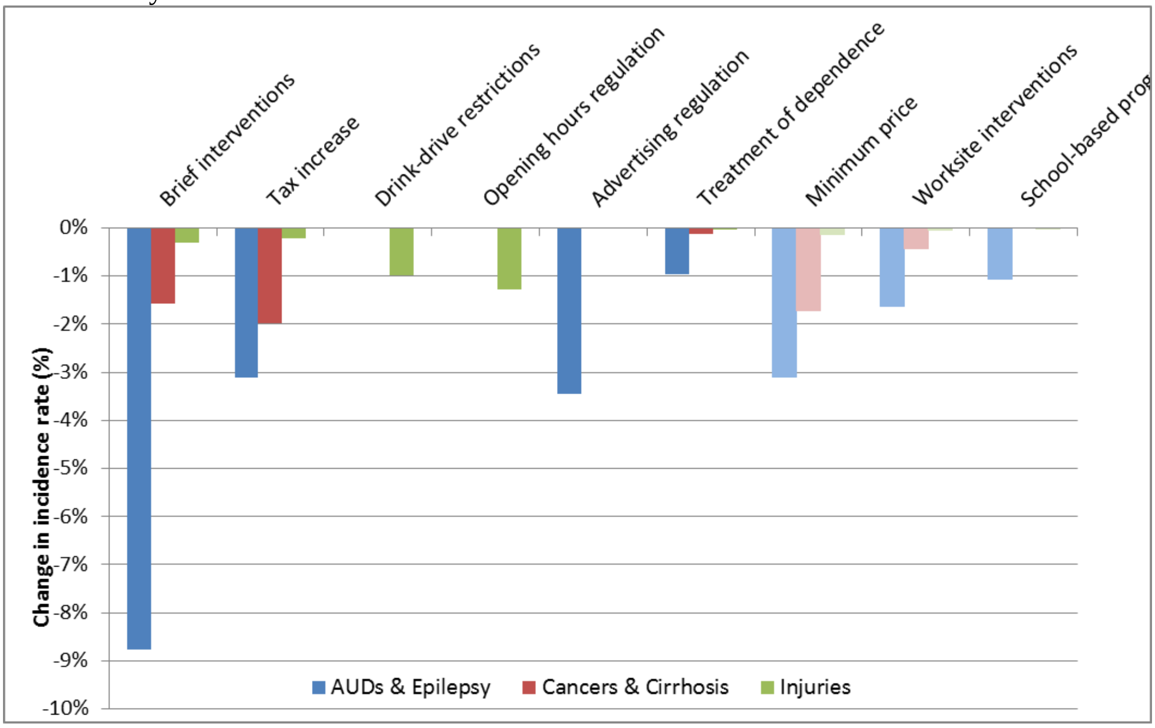
Panel a – Canada



Panel b – Czech Republic



Panel c - Germany



Source: CDP-Alcohol analysis relying on input data from multiple sources listed in Appendix A

150. In the analysis, the greatest impacts on cancer incidence are obtained with price policies and brief interventions in primary care and at the workplace. In particular, the occurrence of alcohol-related cancers

would be cut by up to 2% following changes in taxation leading to a 10% price hike. This corresponds to 4 200 fewer cases each year in Germany, 1 600 in Canada, and 500 in the Czech Republic.

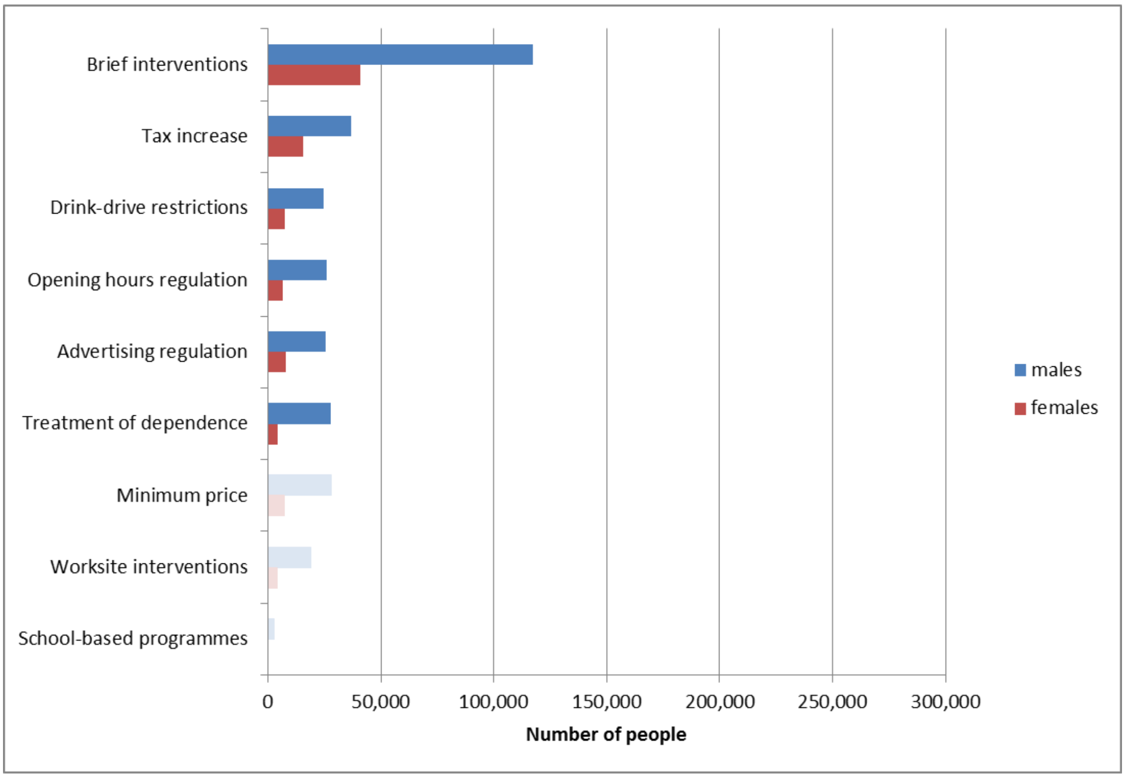
151. In the analysis, approximately two thirds of ischemic heart disease cases occur in people who are mild or moderate alcohol users, whose risk is not increased by alcohol. However, the net effect of most policies is an overall reduction in cardiovascular disease. The size of these effects, not shown in the figure, is generally modest.

4.4. Effects on Employment and productivity

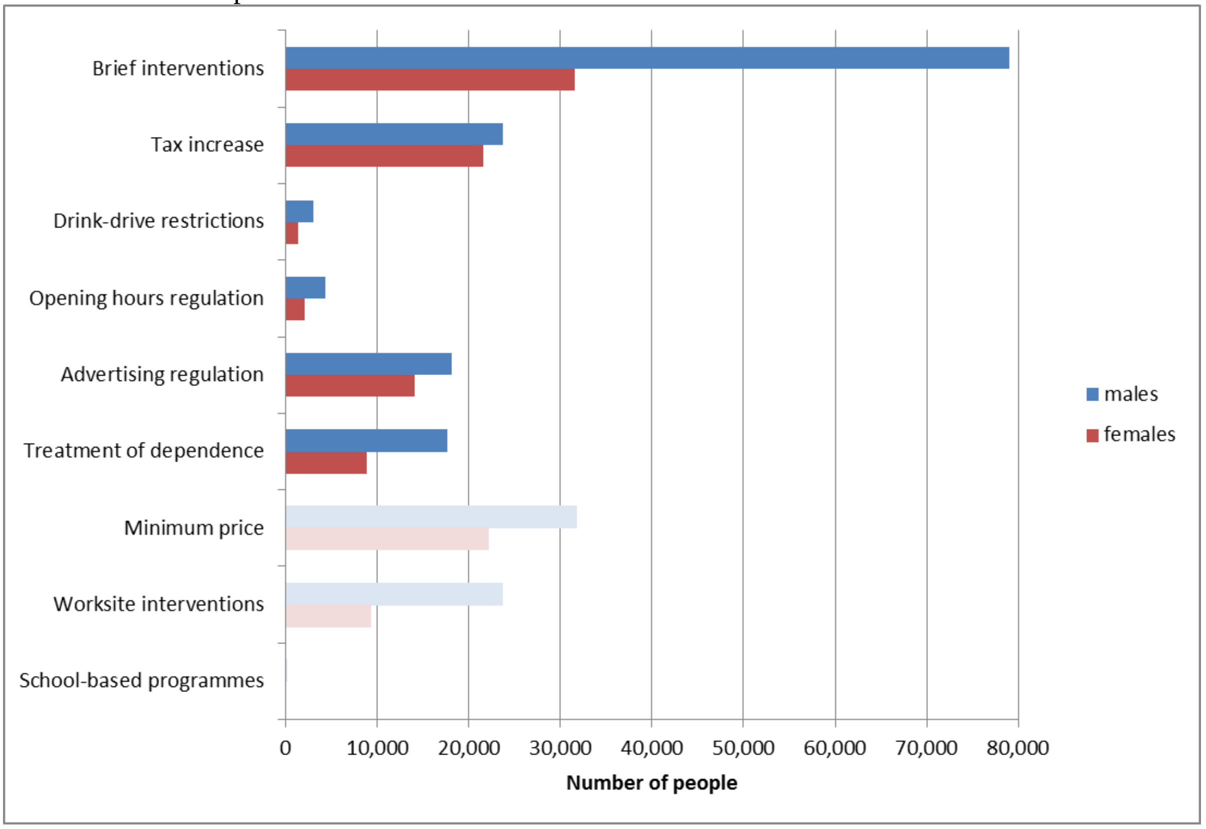
152. A particularly important dimension of the health gains produced by alcohol policies in the analysis is the impact these may have on employment and productivity. While a detailed evaluation of these impacts was beyond the scope of the analysis presented here, the results shown in Figure 12 reflect the extent to which alcohol policies could improve labour outcomes. In particular, the figure shows the numbers of life years free of alcohol-related disabilities gained by working-age people as a result of the implementation of the alcohol policies examined. Essentially, the analysis shows that, every year, hundreds of thousands of working-age people could avoid alcohol-related disabilities (injuries and their sequelae, chronic diseases linked with alcohol) in the three countries. For instance, with a tax increase leading to a 10% hike in alcohol prices 168 000 working-age people in Germany, 45 000 in the Czech Republic and 53 000 in Canada would avoid alcohol-related disabilities each year. The gains estimated for brief interventions would be even larger, although less evenly distributed between men and women than with taxation, due to a larger prevalence of high-risk drinking behaviours and alcohol dependence in men. Larger benefits in men are also observed in connection with alcohol policies whose main effects are on alcohol-related injuries, as these are more common in men than in women. As previously mentioned, figure 12 only refers to disability (i.e. morbidity) in working age people. The graph and the presented results do not take into account the effects of alcohol consumption on other outcomes as, for example, productivity at work and presenteeism. Future analyses, based on work undergoing at OECD, will take this other dimensions into account.

Figure 12. Number of working-age people freed of alcohol-related diseases, average effect per year

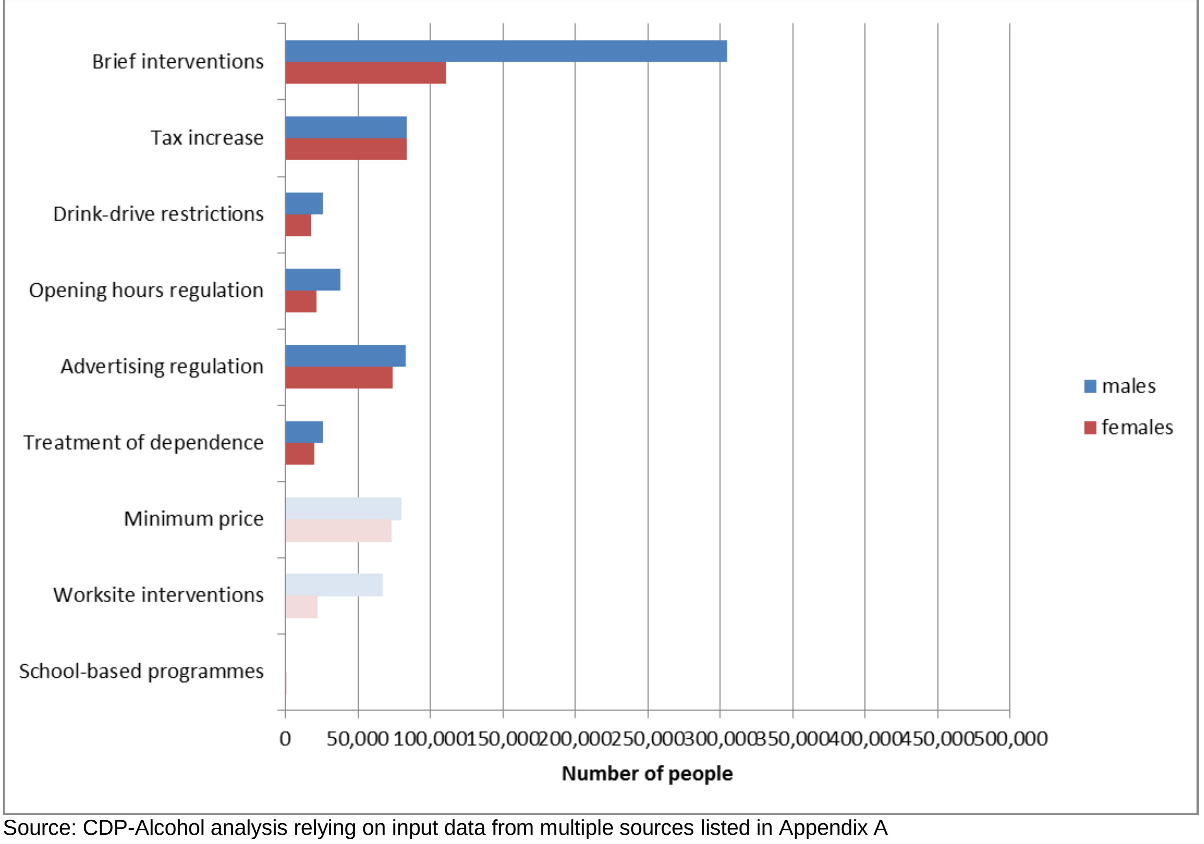
Panel a – Canada



Panel b – Czech Republic



Panel c - Germany



Source: CDP-Alcohol analysis relying on input data from multiple sources listed in Appendix A

4.5. The effects of preventive interventions on costs and health expenditure

153. The estimated costs of implementing alternative alcohol policies and the net effects of the same policies on health care expenditures in the three countries are shown in Figure 13 (the latter in the bars below the horizontal axis, the former in the bars above the axis).

- Policies delivered in health care settings, including *brief interventions* and the *treatment of dependence*, carry the largest implementation costs by a relatively wide margin. This is in connection with the staff and drug costs involved in delivering those interventions and with the scale at which they have been modelled in the analysis. Brief interventions are also expected to produce the largest reductions in health care expenditures. However, these reductions are sufficiently large to offset implementation costs and make the policy cost saving only in the Czech Republic, where the number of cases of dependence prevented is largest.

- Several policies (especially *price policies*) are shown to have the potential to generate savings in health care expenditure which more than offset implementation costs. Price policies, especially tax hikes, are shown to be cheaper to implement, relative to other policies, and to produce large savings in health care expenditure, with cumulative gains of up to USD PPP 55 per person after ten years in the Czech Republic, as shown in Figure 14 and Figure 22 for undiscounted results.

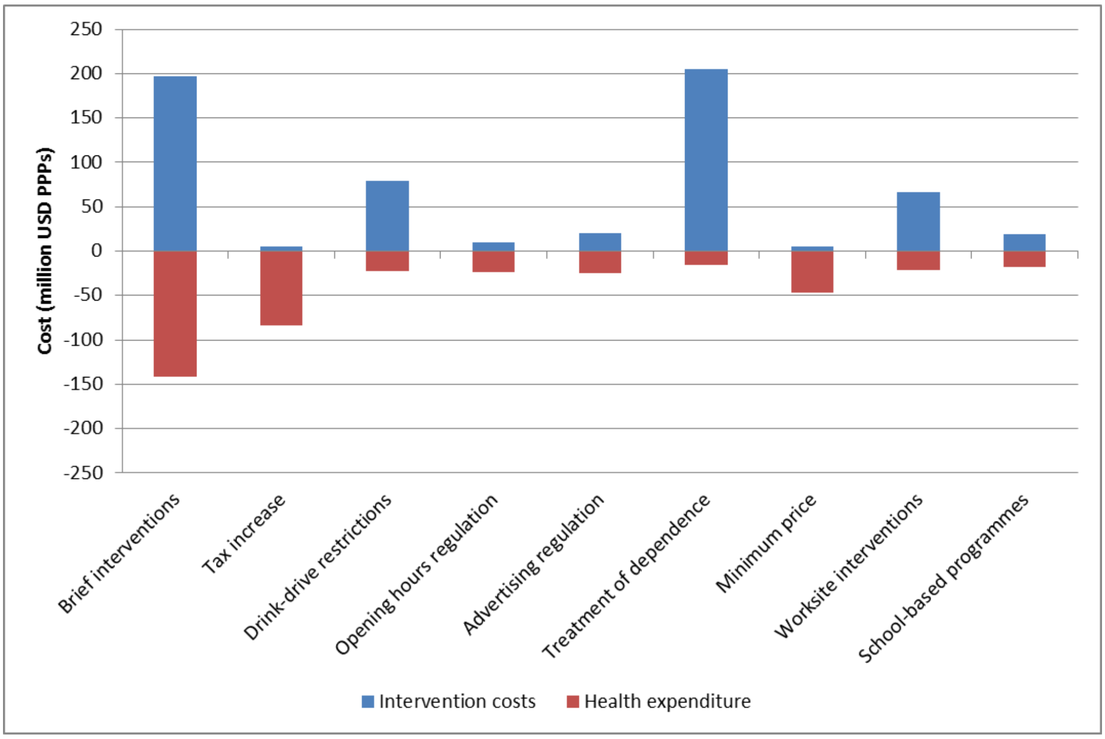
- Other policies are likely to generate a net increase in government expenditure, although financial savings from possible crime reductions are not accounted for in our analysis.

- The costs of *worksite interventions* and enforcement of *drinking-and-driving restrictions* are generally higher than those of regulatory and fiscal policies, and neither of the above produces sufficiently large savings in health care expenditures to offset implementation costs.

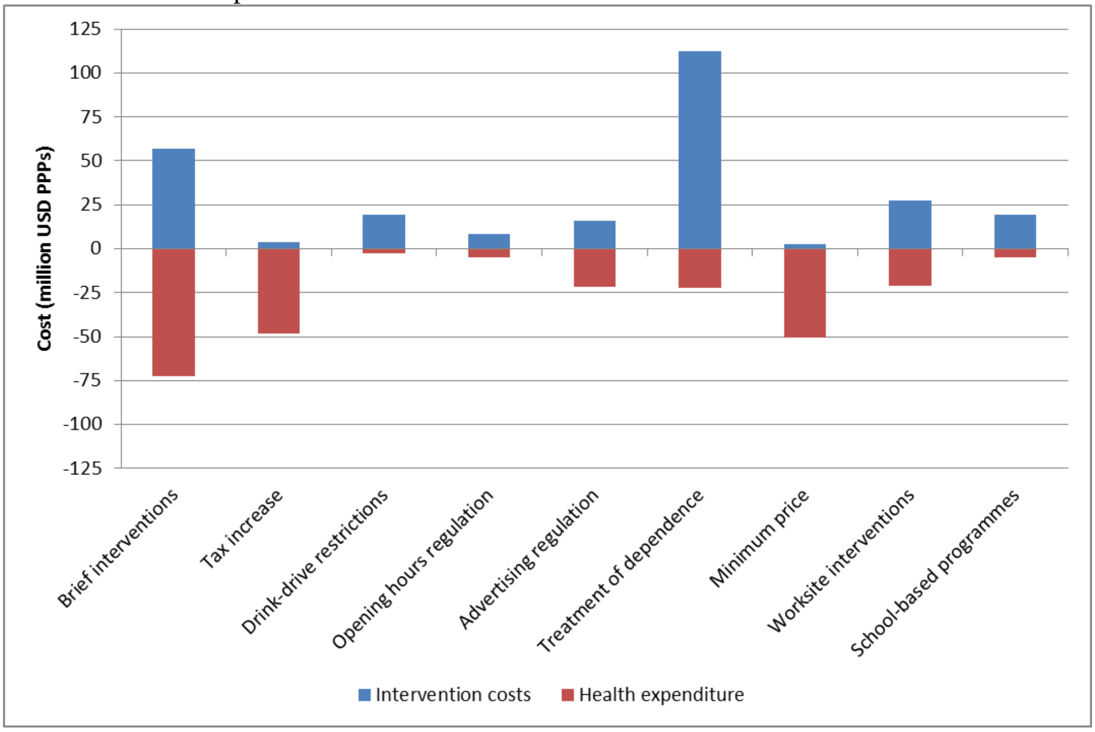
- The costs of *school-based programmes* are modest, but so are their effects too.

Figure 13. Economic impact at the population level, average per year, 2010-50

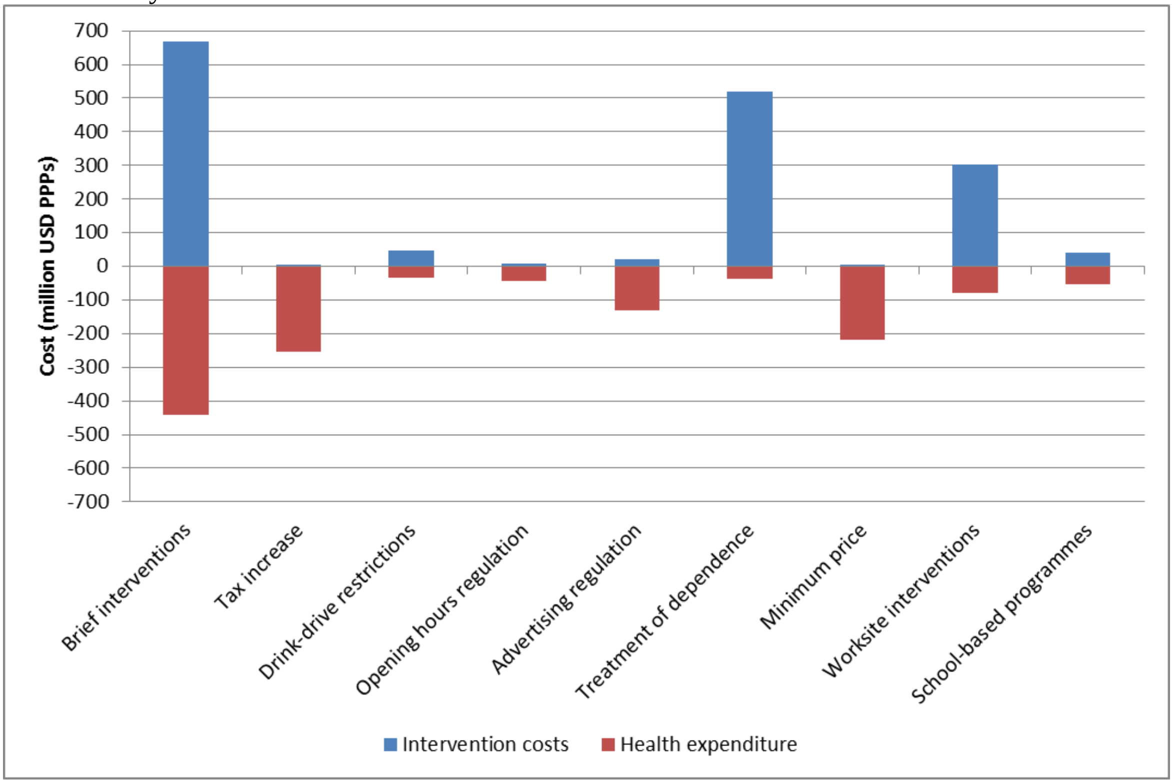
Panel a – Canada



Panel b – Czech Republic



Panel c - Germany

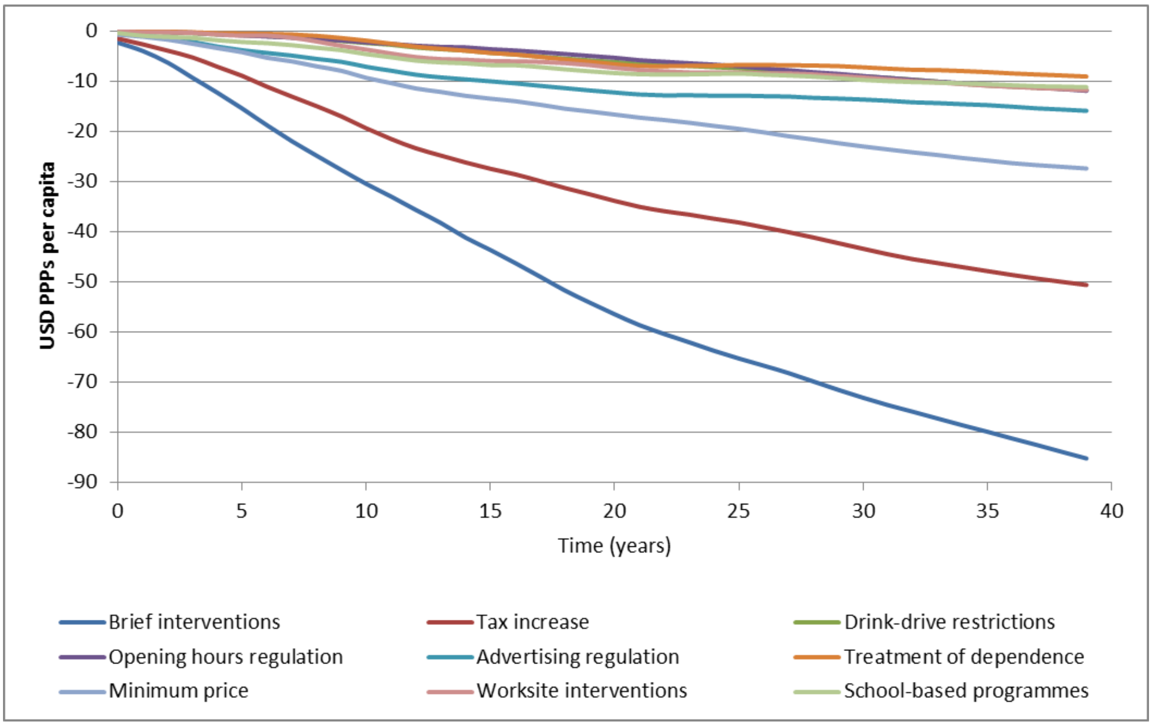


Source: CDP-Alcohol analysis relying on input data from multiple sources listed in Appendix A

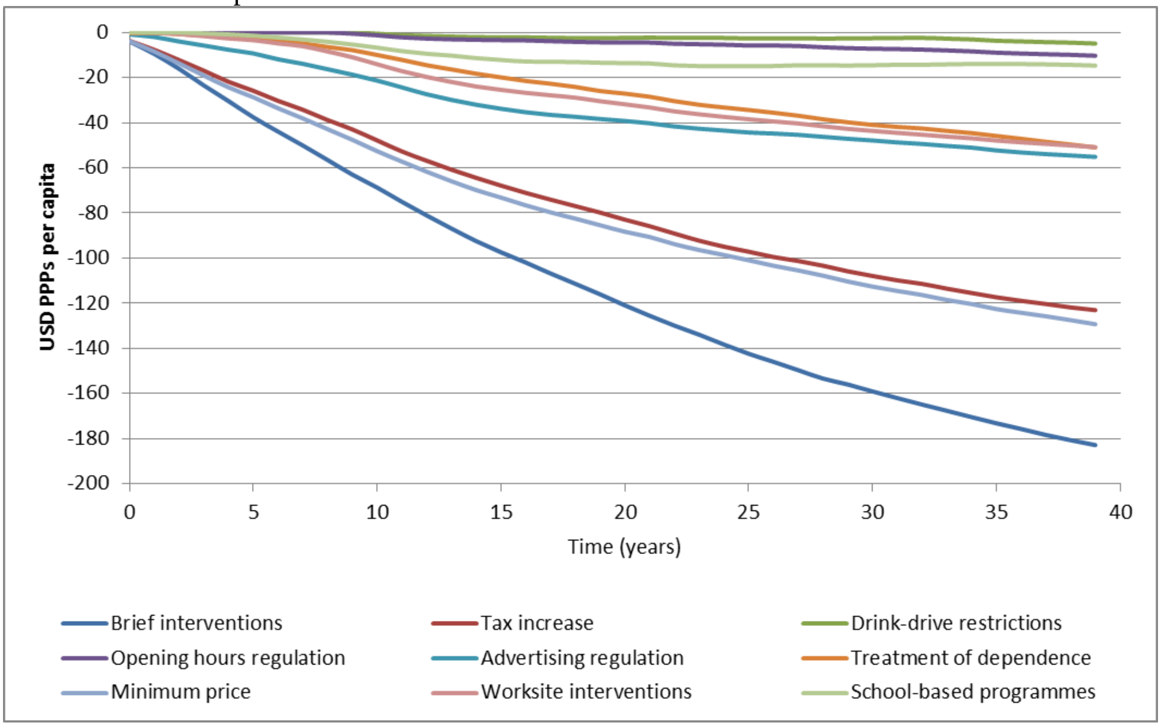
154. Even after discounting future savings at a 3% rate, reductions in health care expenditures potentially generated by alcohol policies are shown to be substantial and build up linearly over time, as shown in Figure 14 (and in Figure 22 for results not discounted over time), contributing to a favourable cost-effectiveness profile for those policies.

Figure 14. Cumulative impact on health expenditure over time

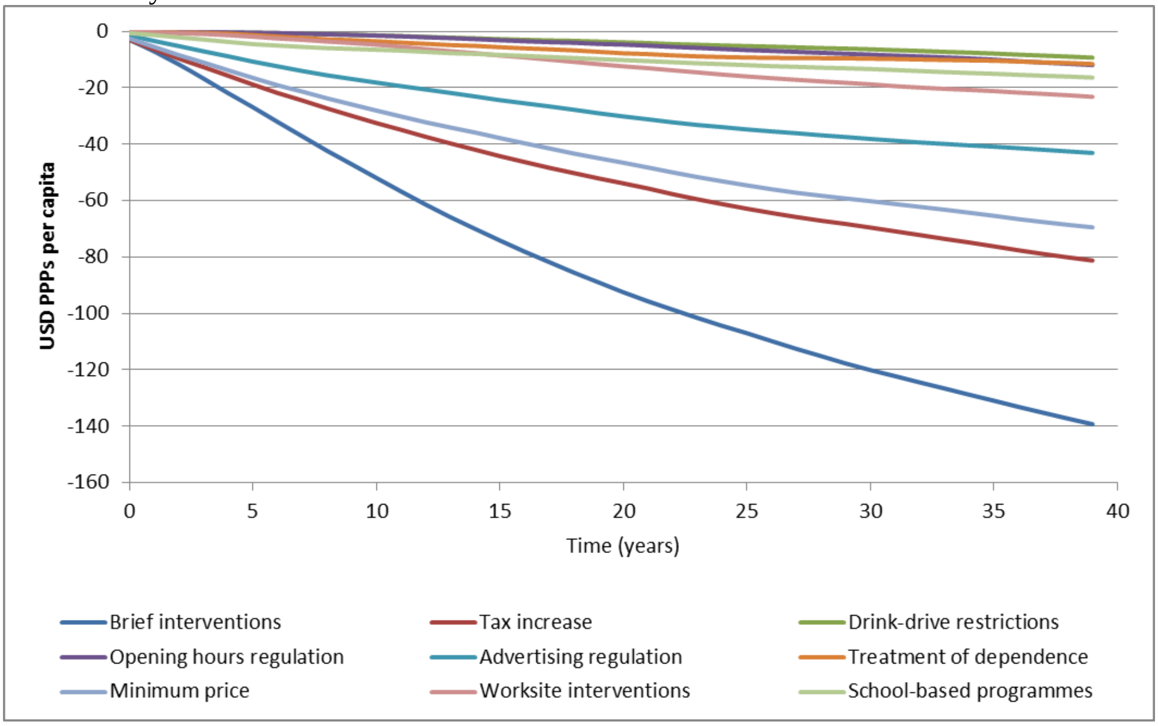
Panel a – Canada



Panel b – Czech Republic



Panel c - Germany



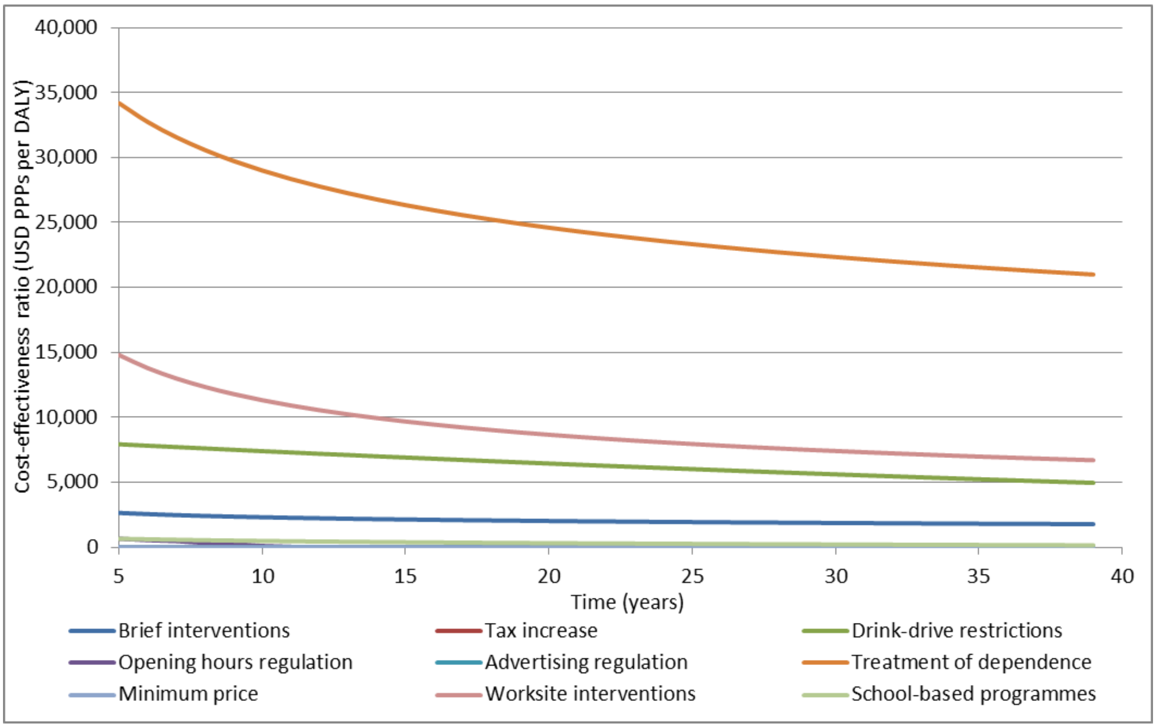
Source: CDP-Alcohol analysis relying on input data from multiple sources listed in Appendix A

4.6. The cost-effectiveness of prevention interventions

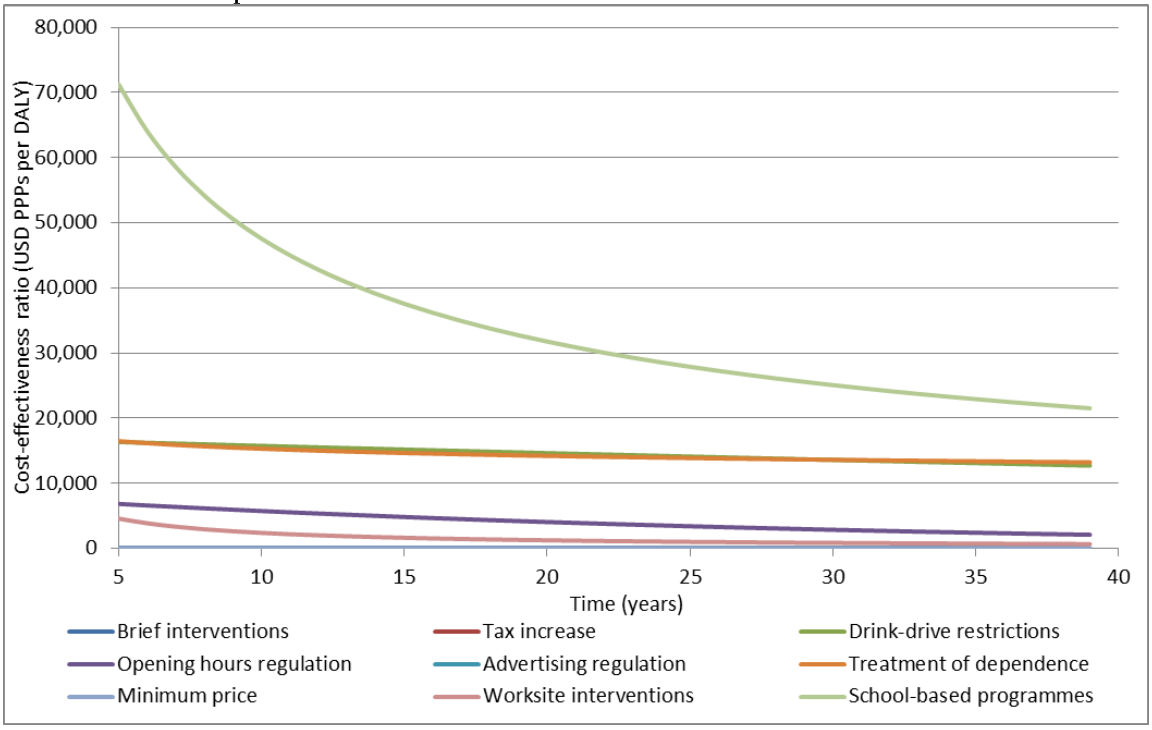
155. Figure 15 shows the cost-effectiveness ratios of the policies examined over the course of the simulation period. Interventions that do not appear in the three panels of this figure are cost saving (therefore a cost‑effectiveness ratio is not calculated). Policies that are not cost saving have generally favourable cost-effectiveness profiles throughout the simulation, relative to a USD 50 000 per year of life gained in good health, often applied as a reference standard in industrialised economies, although the cost effectiveness of school-based programmes in the Czech Republic and treatment of dependence in Germany only drops below the above threshold after 10 and 20 years, respectively. Overall, this picture strongly suggests that alcohol policies represent an efficient use of health system resources, relative to many established health care interventions and medical technologies.

Figure 15. Cost effectiveness of interventions over time

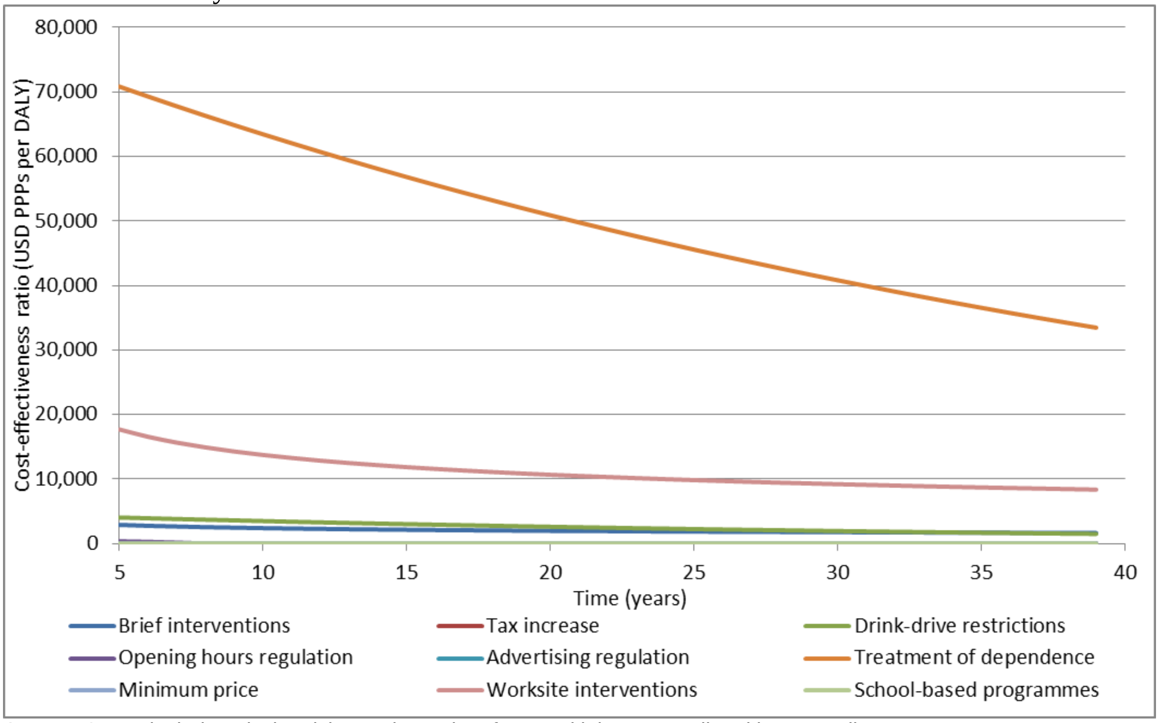
Panel a - Canada



Panel b – Czech Republic



Panel c – Germany



Source: CDP-Alcohol analysis relying on input data from multiple sources listed in Appendix A

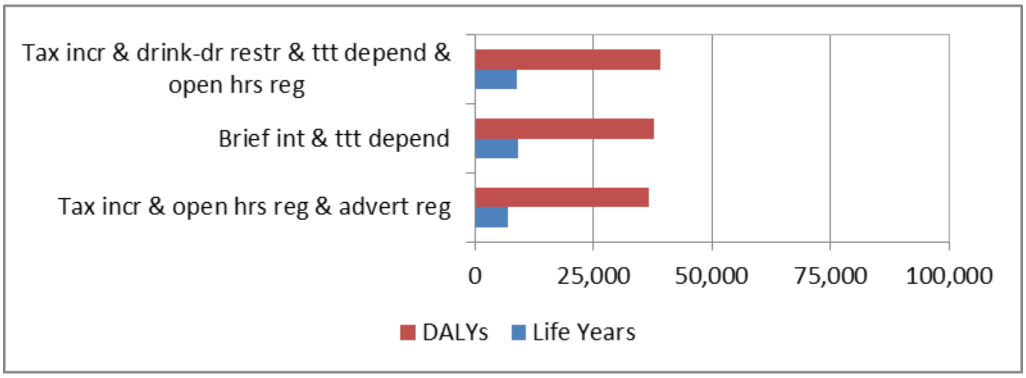
4.7. Combinations of interventions

156. As often happens in prevention, multi-faceted problems require diversified policy responses. The policies assessed in our analysis typically address different types of drinking behaviours, in different social groups, through different mechanisms. Countries that intend to address effectively the problem of harmful alcohol use cannot rely on individual policies to accomplish their goal. OECD analyses show that the combined impacts of multiple policies will be larger than those of individual policies. In addition, a multi-pronged approach may create a "critical-mass" effect that would make a change in the social norms that regulate alcohol drinking behaviours more likely.

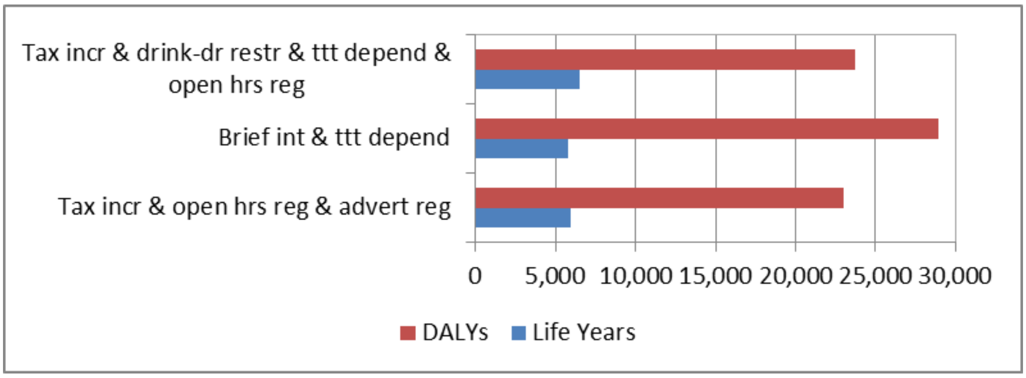
157. Combining multiple alcohol policies in a broader prevention strategy is shown to generate overall impacts that are close to the sum of the impacts of the individual component policies, in most cases. So, the end result is broadly additive, despite an assumption of less than additive impacts at the individual level, in case of simultaneous exposure to the effects of more than one policy. Figure 16 provides an illustration, showing the numbers of life years and DALYs potentially gained with three possible combinations of alcohol policies. In particular, these include a "fiscal and regulatory package", combining tax increases with regulation of advertising and off-trade outlet opening hours; a "health care package", combining brief interventions and treatment of dependence in primary care; and a "mixed package" combining tax increases with treatment of dependence, enforcement of drinking-and-driving restrictions, and limitations in outlet opening hours. The three combined strategies have relatively similar effects in each country (around 37 000 DALYs gained in Canada; 23 29 000 DALYs in the Czech Republic and 119-137 000 DALYs in Germany), with slightly larger impacts from the health care package compared with other combined strategies in the Czech Republic and Germany.

Figure 16. Health outcomes of a multiple-intervention strategy, average number per year

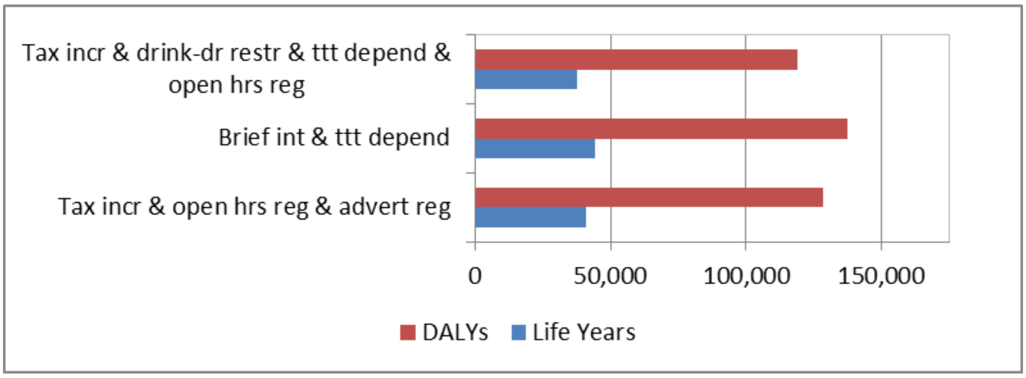
Panel a – Canada



Panel b – Czech Republic



Panel C – Germany

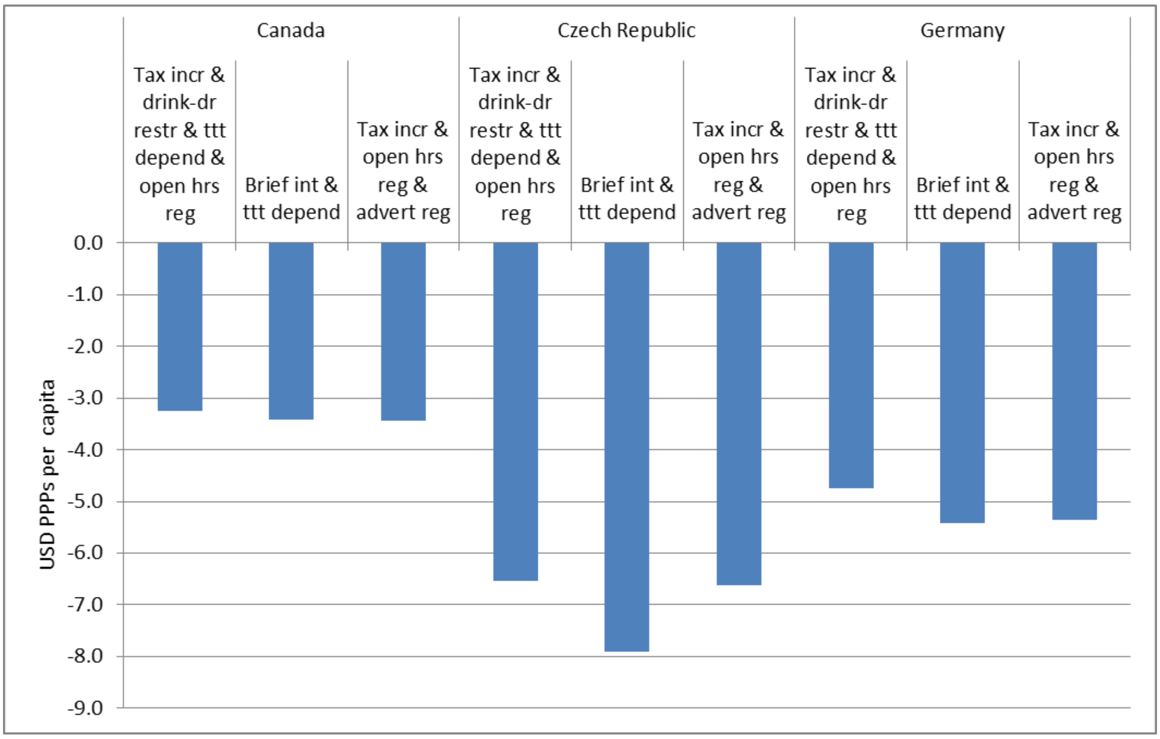


Source: CDP-Alcohol analysis relying on input data from multiple sources listed in Appendix A

158. Health care expenditure reductions potentially associated with the three combined prevention strategies can be substantial. They are largest in the Czech Republic, where the health care package can generate yearly savings exceeding USD PPP 8 per person; while the fiscal and regulatory package could save just over USD PPP 6 per person in Germany, and USD 4 in Canada, as shown in Figure 17. The implementation costs of the health care and mixed packages are larger than the reductions obtained in health care expenditure (especially those of the former), but the cost-effectiveness profile of both remains

very favourable in all three countries, with the highest cost-effectiveness ratios being USD PPP 2 800 per DALY saved for the mixed package and USD PPP 6 600 for the health care package in Canada. The fiscal and regulatory package, on the other hand, has significantly lower implementation costs, and is cost saving overall.

Figure 17. Impact on health expenditure of a multiple-intervention strategy, average per year, 2010-50



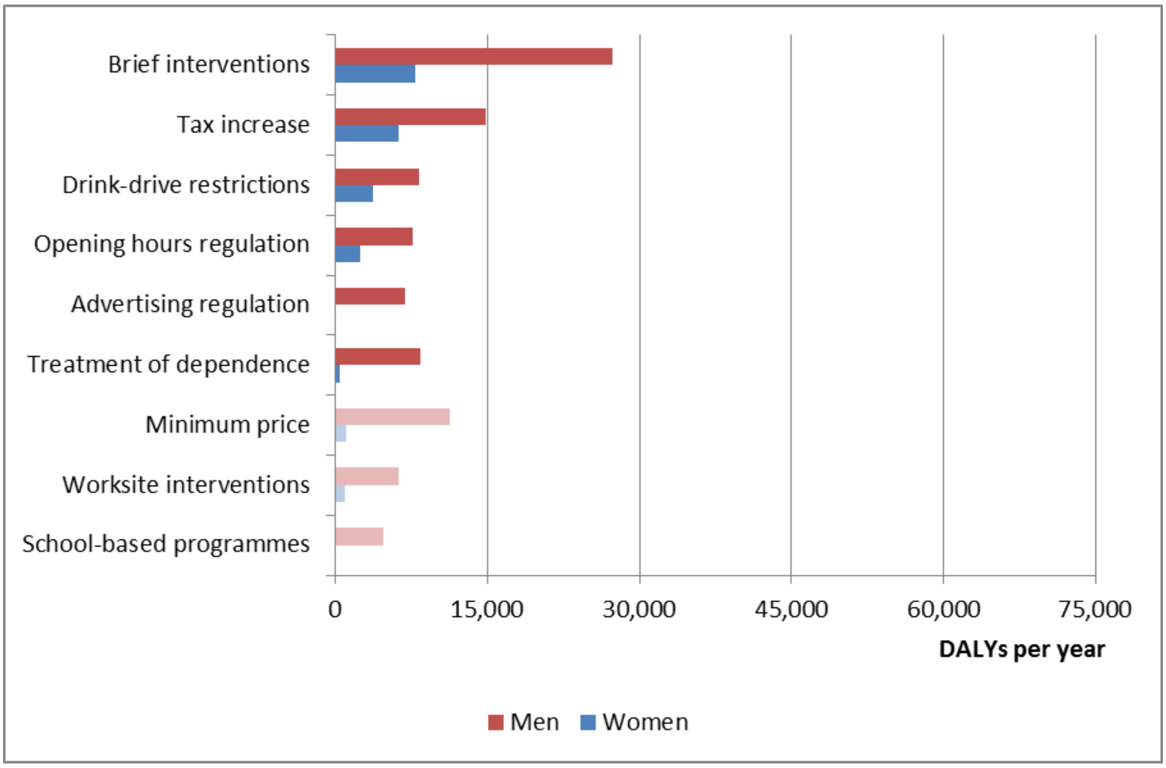
Source: CDP-Alcohol analysis relying on input data from multiple sources listed in Appendix A

4.8. Effects on different population subgroups

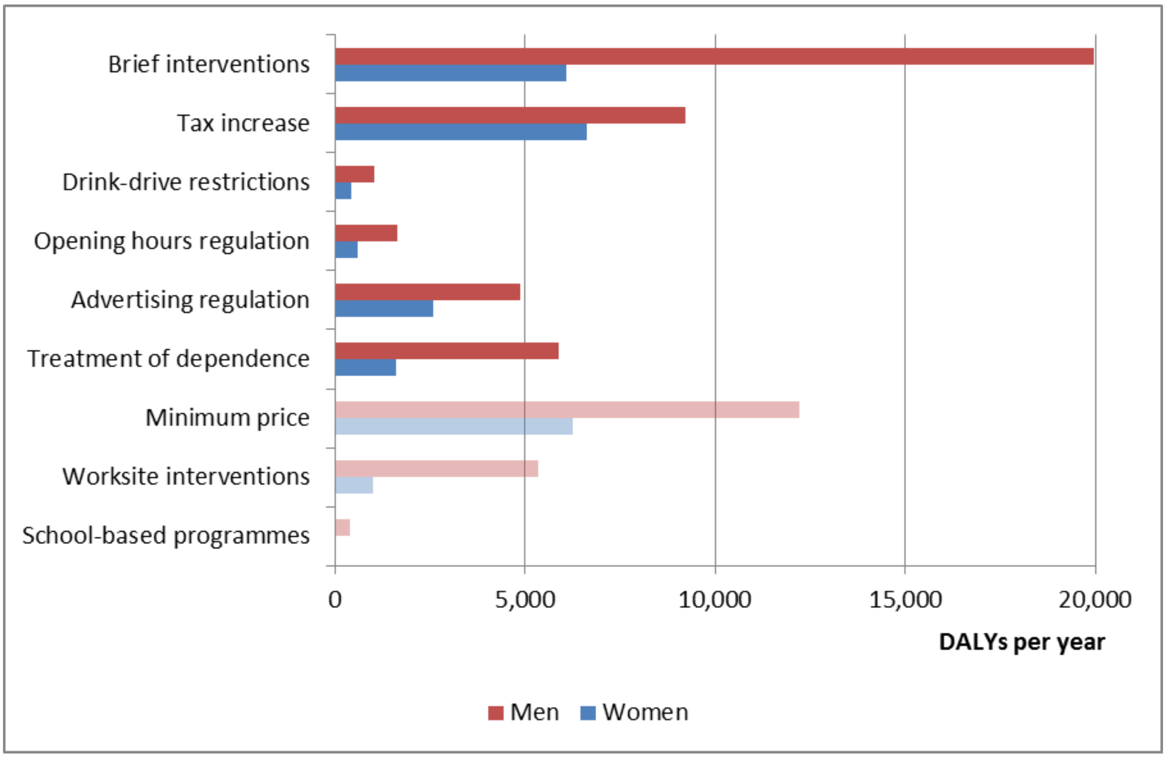
159. Unsurprisingly, the health gains generated by alcohol policies tend to be enjoyed by men more than women, mainly because of the larger prevalence of risky drinking behaviours and higher incidence of certain types of injuries in the former. Gender differences in policy impacts are especially pronounced for policies whose main effects are the prevention and treatment of alcohol dependence (typically, brief interventions and pharmacological and psychosocial treatments for dependence). A larger proportion of men requires, and is the beneficiary of, those interventions, and the gains are consequently larger for men than for women. This is shown clearly in Figure 18, in which differences in the relative effects of these interventions in the three countries reflect quite closely the differences observed in the prevalence of alcohol dependence in men and women in the same countries. Gender differences are also relatively large for policies whose main effect is to reduce alcohol-related injuries, such as enforcement of drinking-and-driving restrictions and limitations in off-trade outlet opening hours, since injuries and deaths from road traffic accidents and interpersonal violence typically occur more often in men than in women. Differences are less pronounced for other policies, but gains in men exceed those predicted for women in all instances.

Figure 18. DALYs by gender, average number per year

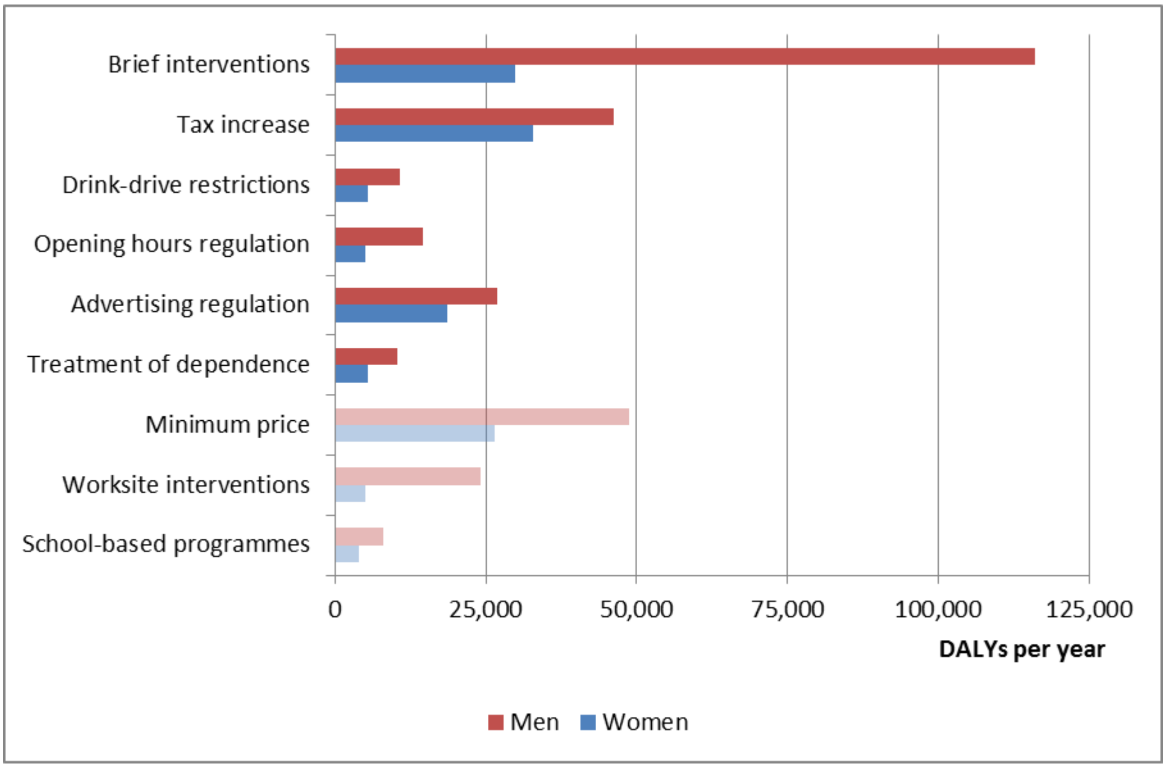
Panel a – Canada



Panel b – Czech Republic



Panel C – Germany

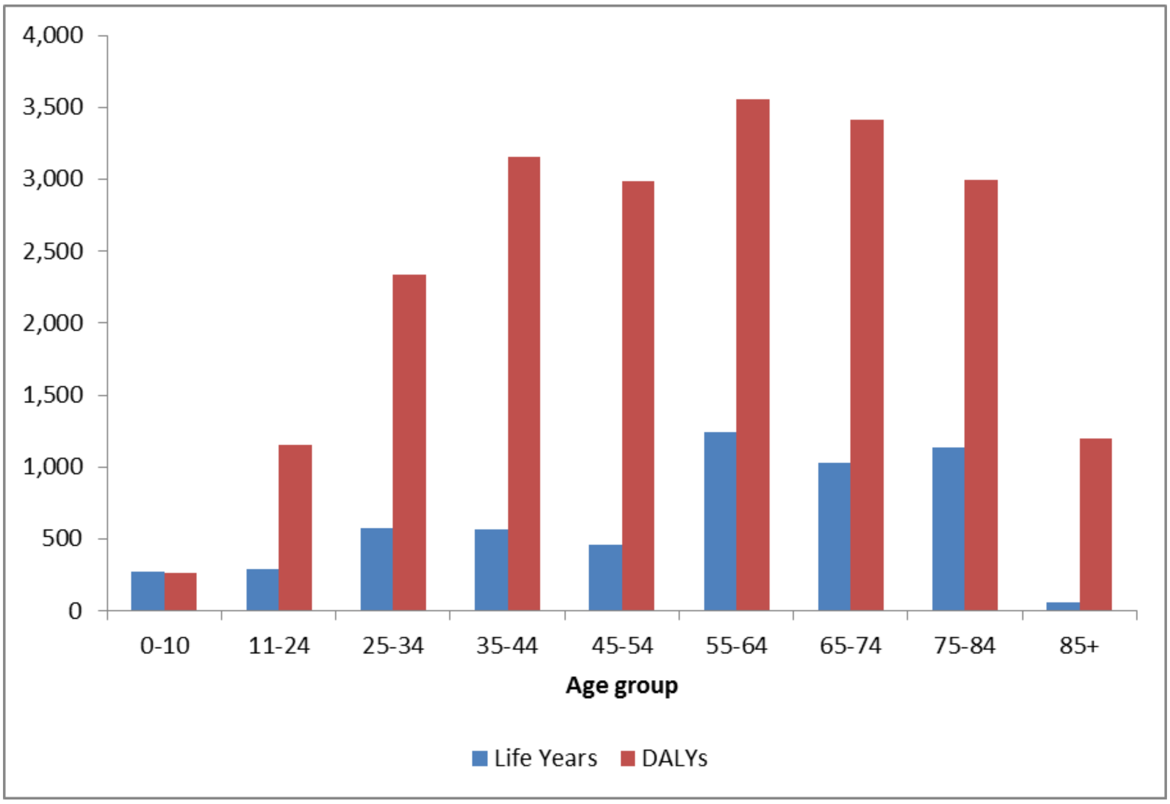


Source: CDP-Alcohol analysis relying on input data from multiple sources listed in Appendix A

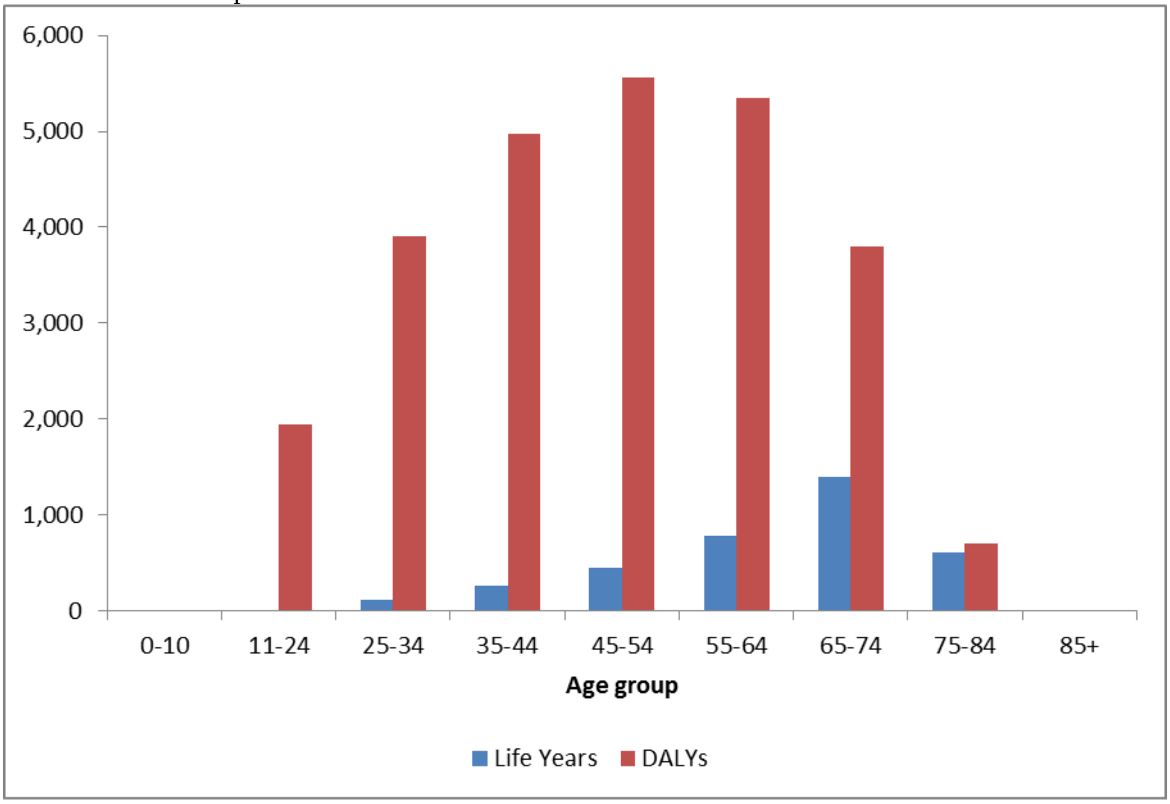
160. The health benefits of different alcohol policies follow typical age patterns, illustrated by the three examples in Figure 19. Tax increases (Panel A, Canada) have effects on mortality and morbidity in all age groups, but effects are larger in adults, especially in the 5th and 6th decades of life. The effects of brief interventions (Panel B, Czech Republic) tend to be stronger on morbidity than mortality and peak in the 4th decade of life (later for mortality). Enforcement of drinking-and-driving restrictions (Panel C, Germany) has its largest effects on morbidity in young adults (mostly in their twenties and early thirties) with smaller effect son mortality. The latter increase with age and peak in the 5th decade of life, while effects on morbidity tend to level off.

Figure 19. Effects of selected interventions in different age groups

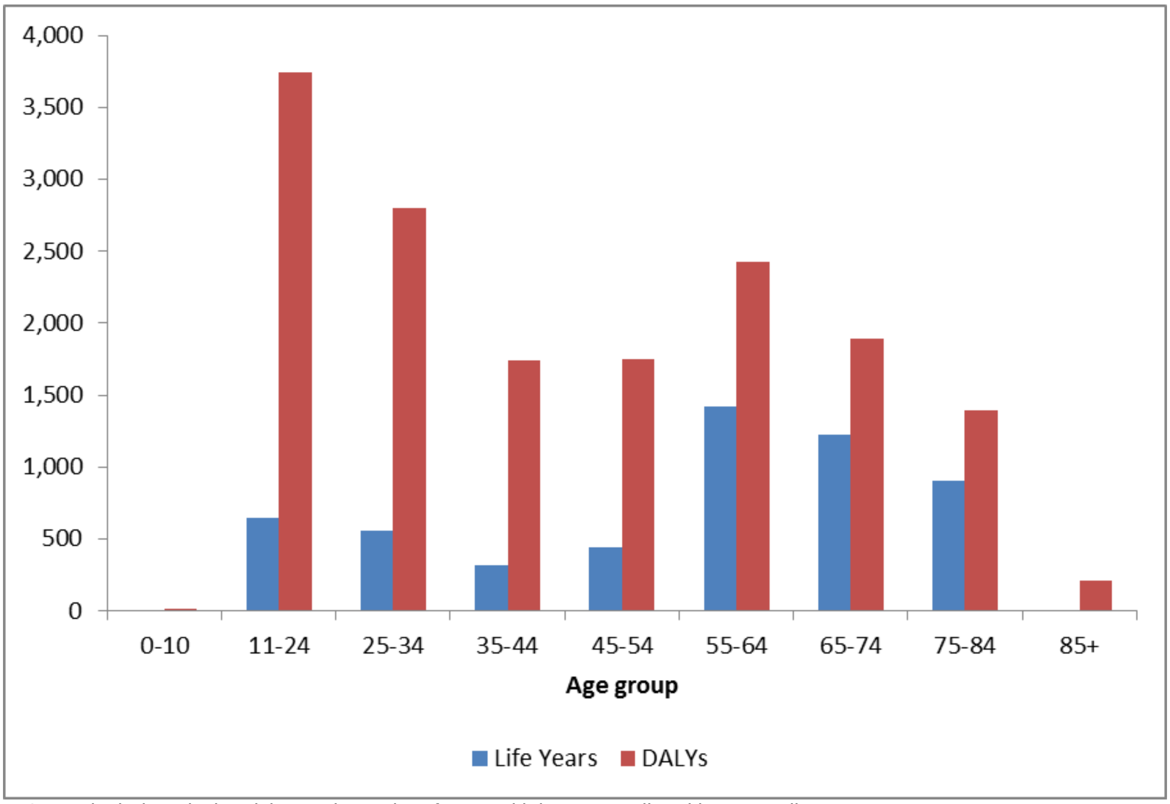
Panel a – Canada



Panel b – Czech Republic



Panel C – Germany



Source: CDP-Alcohol analysis relying on input data from multiple sources listed in Appendix A

4.9. Sensitivity analysis

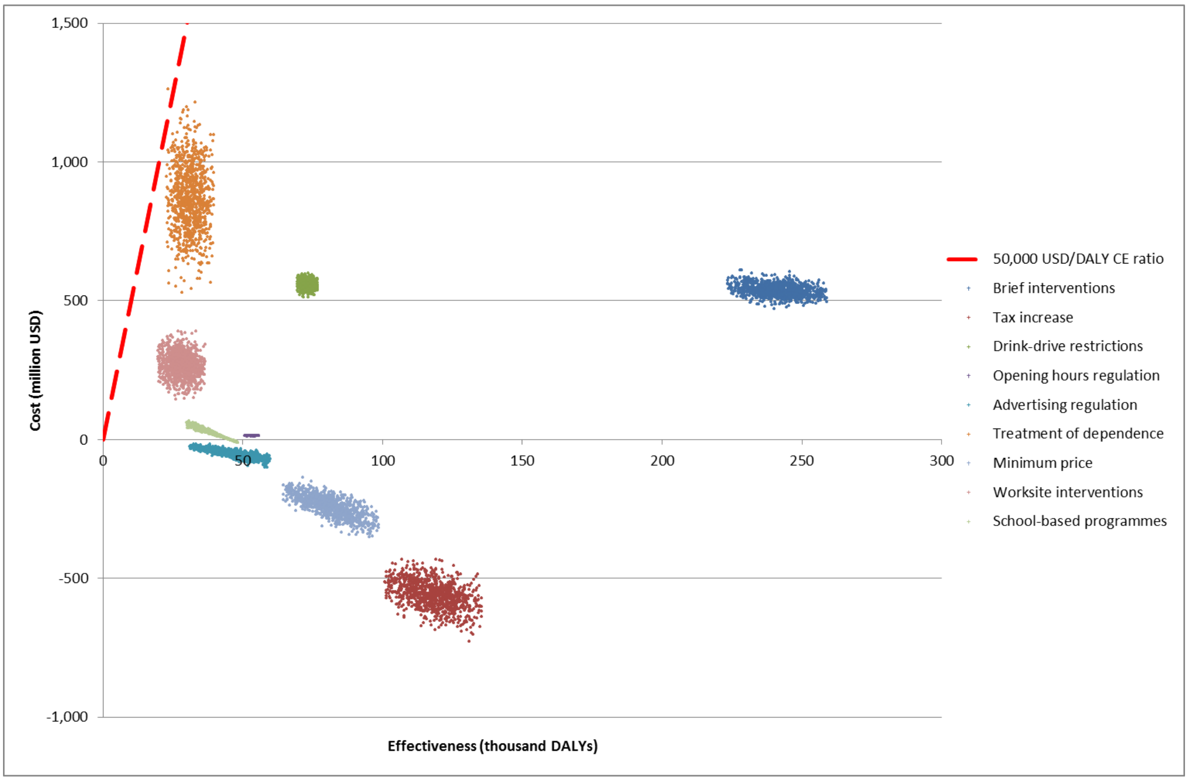
161. Models produce their outputs based on data, algorithms and assumptions. Variations in any of those elements will change model predictions. The findings reported in this chapter were tested for robustness in a range of sensitivity analyses based on the WHO software MC-League, for each intervention, at years 10 and 40 of the simulation. For both costs and effects, input parameters for the sensitivity analyses were derived from the raw output matrices of the CDP-Alcohol model. Probabilistic distributions of outputs were modelled as continuous Gaussian distributions. For health effects, the distributions were constrained (i.e. truncated) at the 95% confidence interval around the mean of CDP-Alcohol model outputs. The degree of covariance between the distributions of costs and health effects was also derived from CDP-Alcohol model outputs. Uncertainty clouds were produced using a Monte Carlo simulation approach involving 1 000 stochastic samplings (i.e. bootstraps). Alternative assumptions were also tested concerning the effects of tax increases, particularly in heavy drinkers. A final set of analyses assessed the effect of the discount rate by carrying out undiscounted analyses.

162. The sensitivity analyses confirmed the validity of the findings in a relatively broad range of potential variation of both costs and effects for each alcohol policy, with effects not stochastically robust for school-based interventions in the Czech Republic, and treatment of dependence in Germany after 10 years (but with a robustly favourable profile in the longer term). Figures 20.a to 20.f show the results of a probabilistic sensitivity analysis undertaken using the software MCLeague. The analysis identifies "clouds" of stochastic points, reflecting possible combinations of costs and effects, for each intervention. Essentially, the clouds of points shown in the figures below reflect the dispersion around the point estimates of cost-effectiveness ratios shown in Figure 15, respectively, 10 and 40 years after the initial implementation of the interventions. The points (i.e. cost-effectiveness estimates) in the clouds are generated by assuming that the costs and health effects of each intervention are drawn from the distributions specified in Section 2.7.

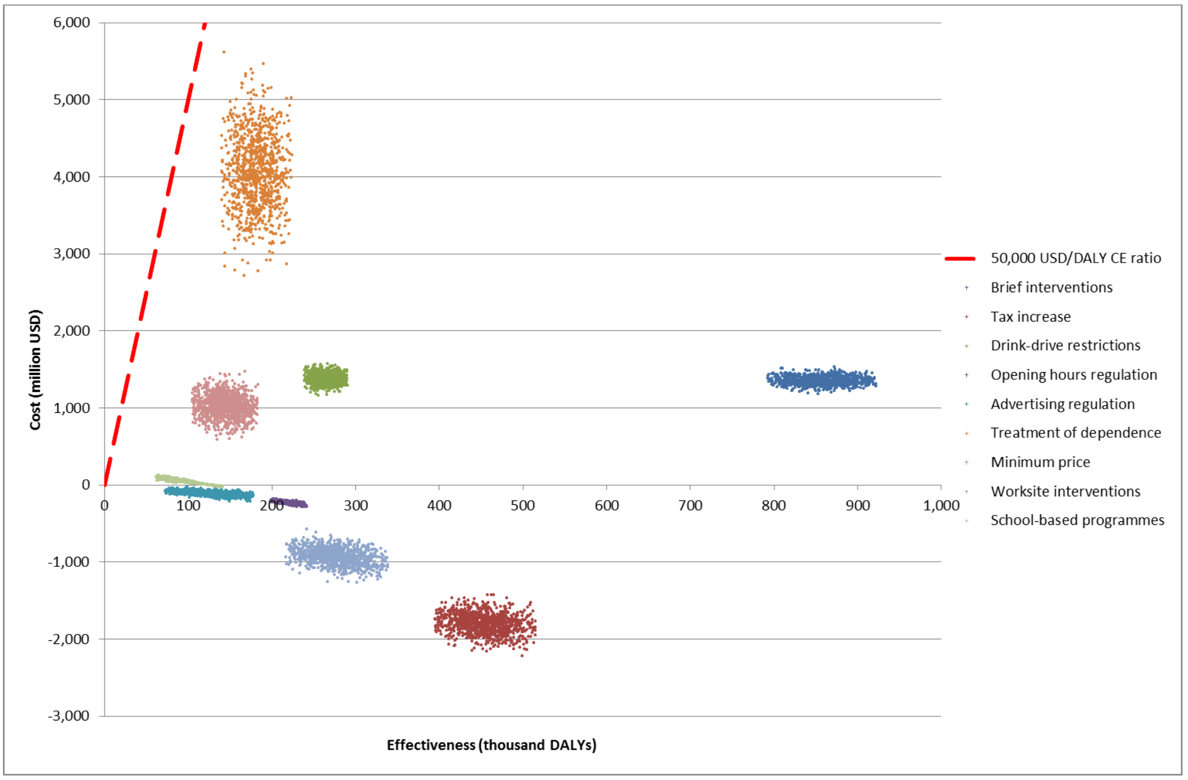
163. For instance, treatment of alcohol dependence in Canada shows a cost –effectiveness ratio at year 10 of about 29,000 USD PPP per DALY (Figure 15, panel a). This ratio derives from a cumulative cost (at the net of the impact on health expenditure) of about 1 billion USD PPP and a cumulative effectiveness of 38 000 DALYs. In calculating panel a of Figure 20, it is assumed that these values are the means of two distributions (one for costs and one for effectiveness). The diagonal line in the figures delimits the threshold of $50,000/DALY, which is often referred to as a possible value to discriminate between efficient and inefficient interventions. Clouds below the horizontal axis correspond to interventions that generate savings in health expenditures which more than offset intervention costs; clouds above the horizontal axis and lying to the right of the dotted line have a favourable cost-effectiveness ratio (i.e. below 50,000 USD PPP per DALY); while interventions lying completely to the left of the line have a higher (i.e. less favourable) cost-effectiveness ratio.

Figure 20. Probabilistic sensitivity analysis of the cost-effectiveness of alcohol policies

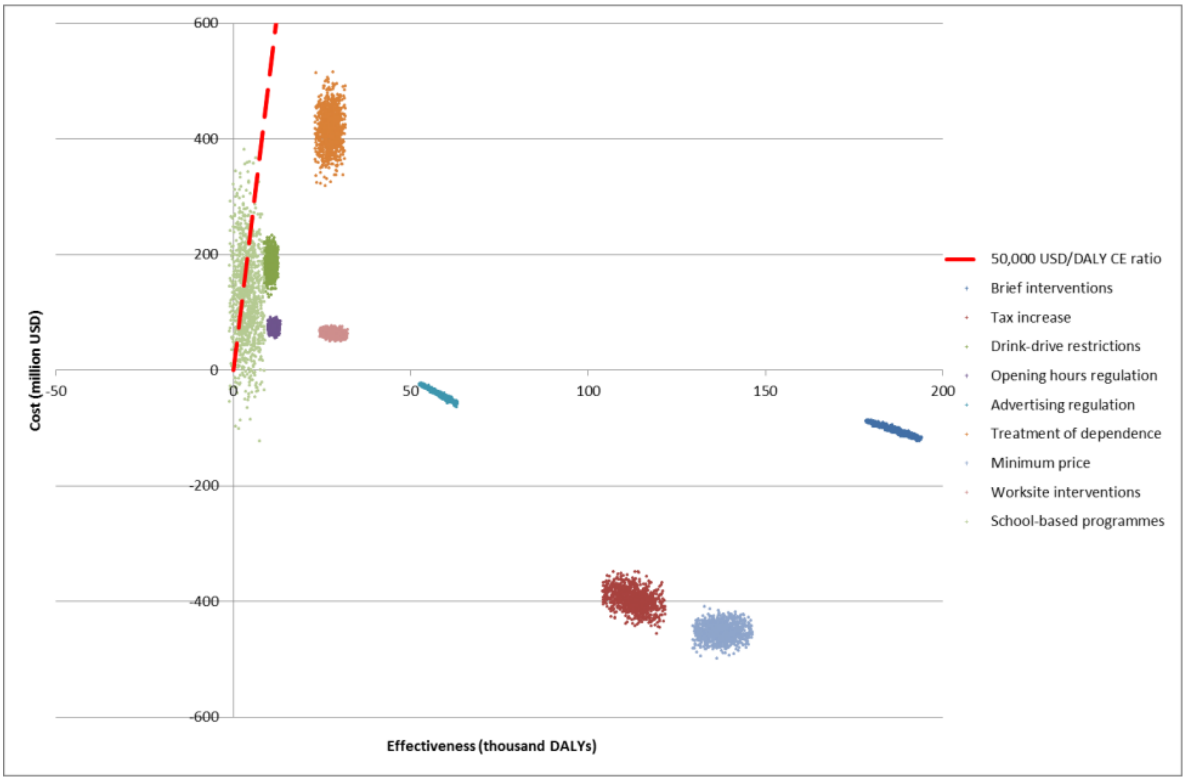
Panel a – Canada after 10 years



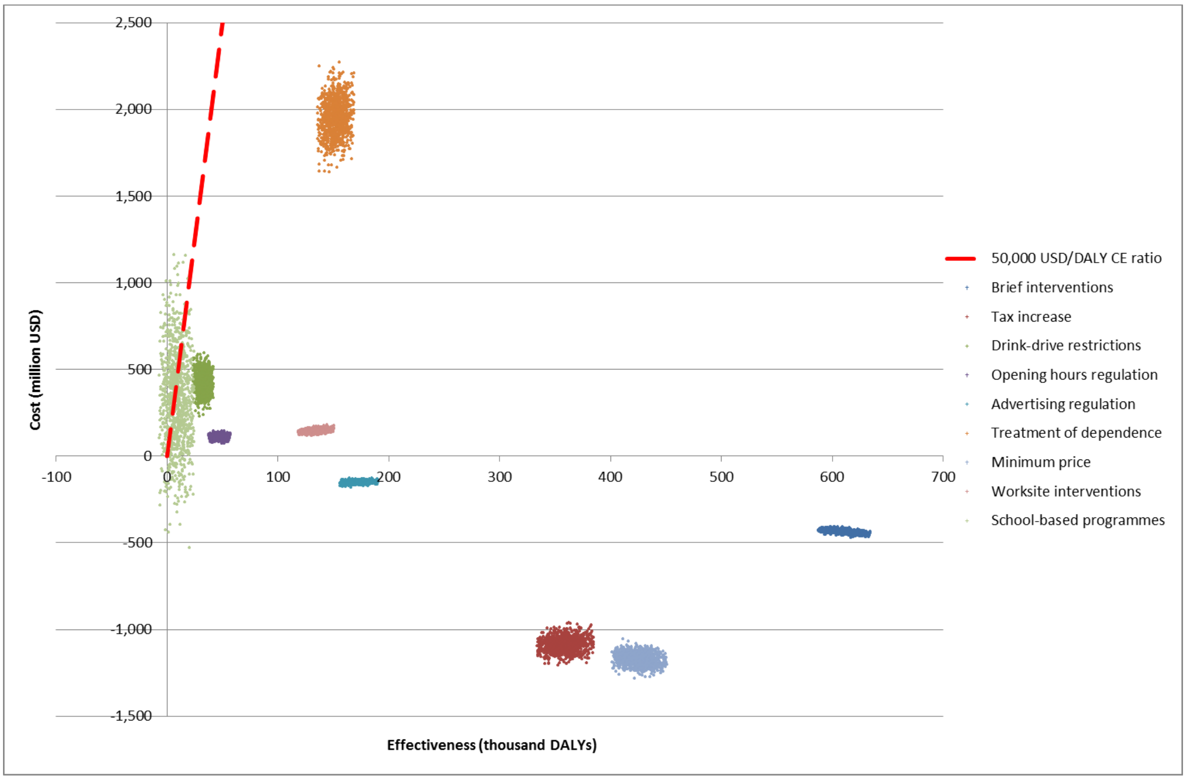
Panel b – Canada after 40 years



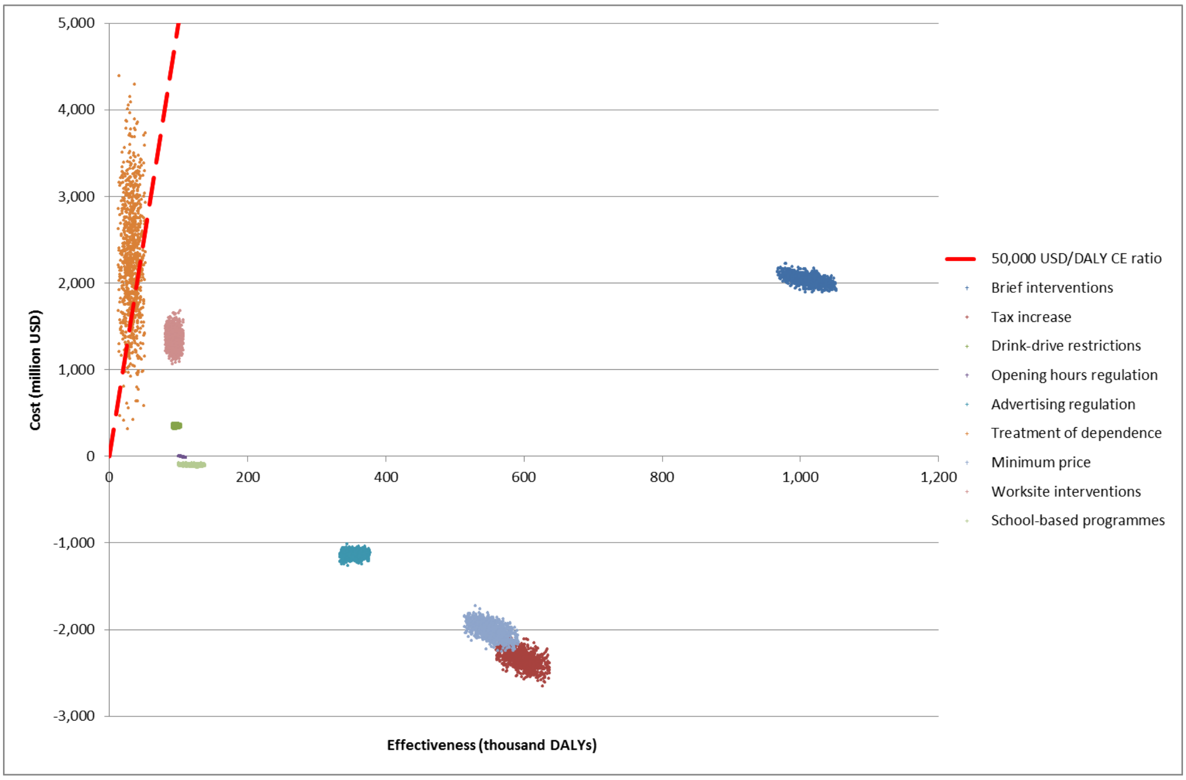
Panel c – Czech Republic after 10 years



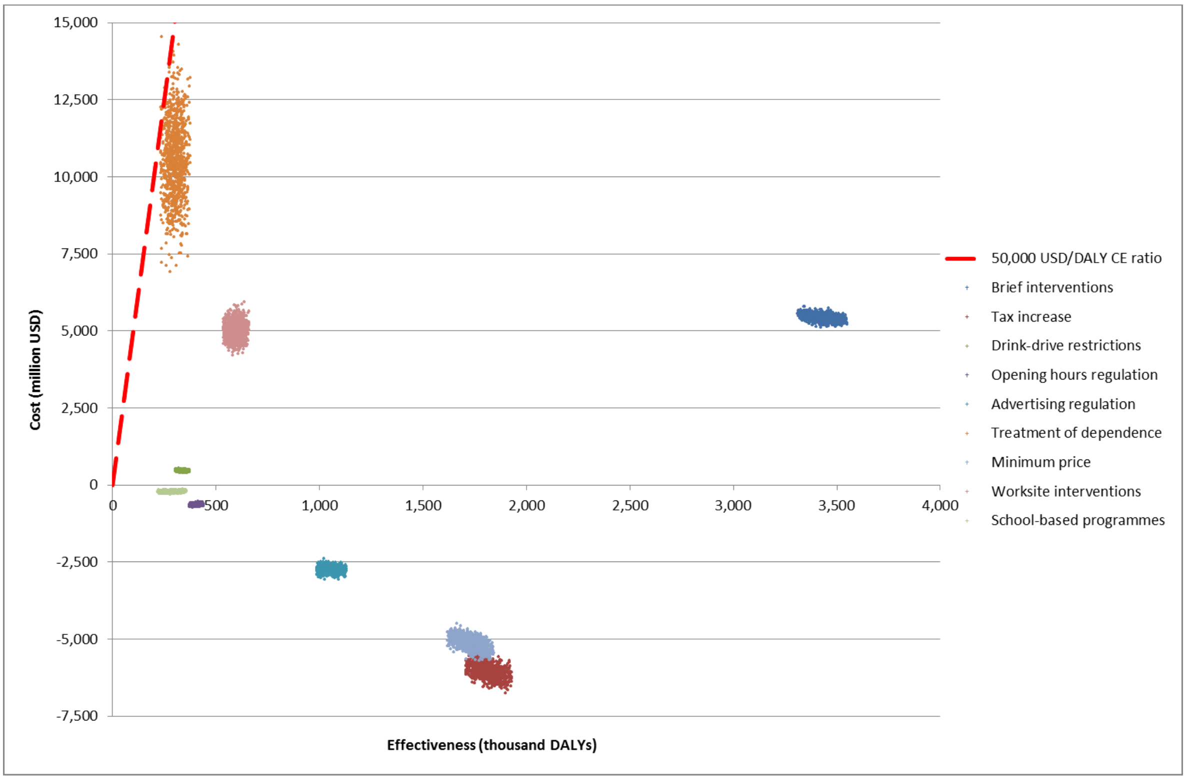
Panel d – Czech Republic after 40 years



Panel e – Germany after 10 years



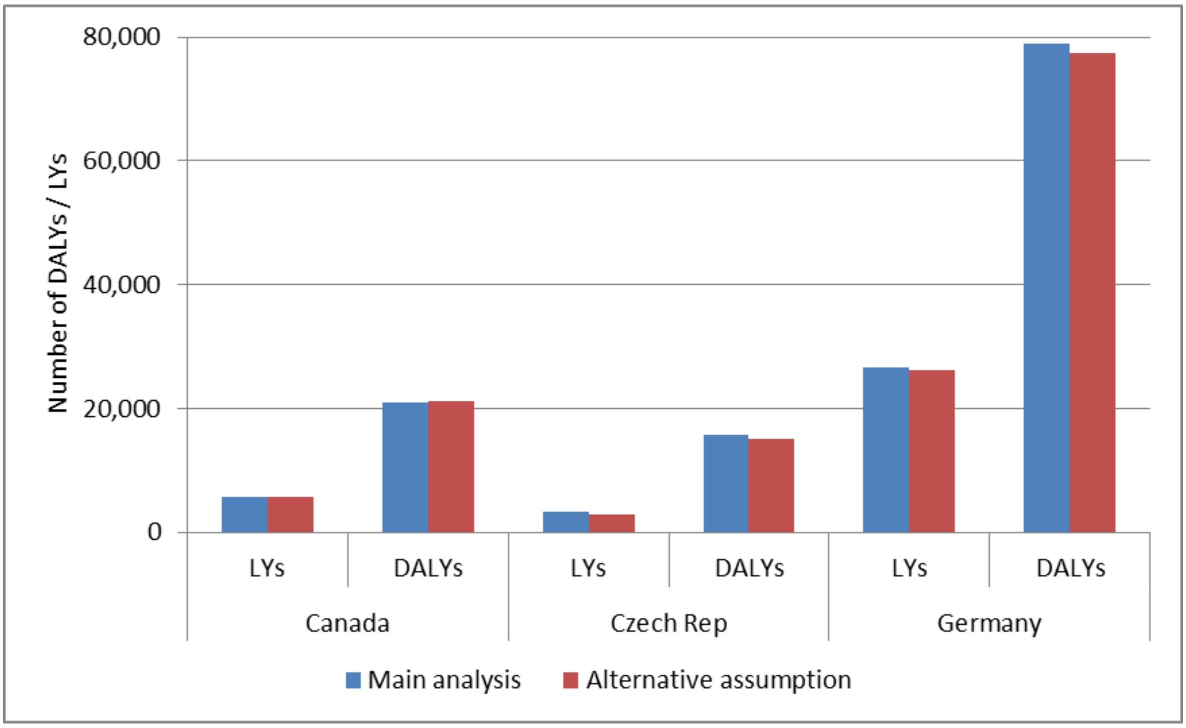
Panel f – Germany after 40 years



Source: MCLeague analysis replying on CDP-Alcohol outputs

164. Alternative assumptions were also tested concerning the effects of tax increases, particularly in heavy drinkers. This alternative scenario is based on studies that show a further reduced response of harmful drinkers to price changes (Ayyagari et al., 2013; Nelson, 2013b). Model findings in this analysis are shown in Figure 21 next to the results presented in the main analysis. The figure below shows that the health gains generated by tax increases are robust even to a dramatic cut of the alcohol price elasticity assumed for heavy drinkers, which would cause a drop in the overall numbers of life years and DALYs gained through tax increases of up to 5% in the three countries examined.

Figure 21. Sensitivity analysis (alternative price elasticities) health outcomes at the population level, average number per year



Source: CDP-Alcohol analysis relying on input data from multiple sources listed in Appendix A

165. Health gains are larger where risky drinking behaviours are more widespread, and the prevalence of different behaviours may change significantly from one country to another. Since different alcohol policies tend to target different groups of drinkers and drinking behaviours, policy makers can tailor their alcohol strategies in ways that best respond to the specific needs and priorities of their respective countries. In countries where heavy alcohol use and alcohol dependence are especially common, any alcohol strategy would benefit from the inclusion of interventions in primary care for the prevention and treatment of dependence. In countries where HED and the injuries, violence and crime associated with it are of greater concern, regulatory actions imposing restrictions on the availability and marketing of alcohol, and on driving under the influence of alcohol, as well as their enforcement, should take higher priority. Some of these regulatory policies, as well as price policies and school-based programmes, may help delaying drinking initiation.

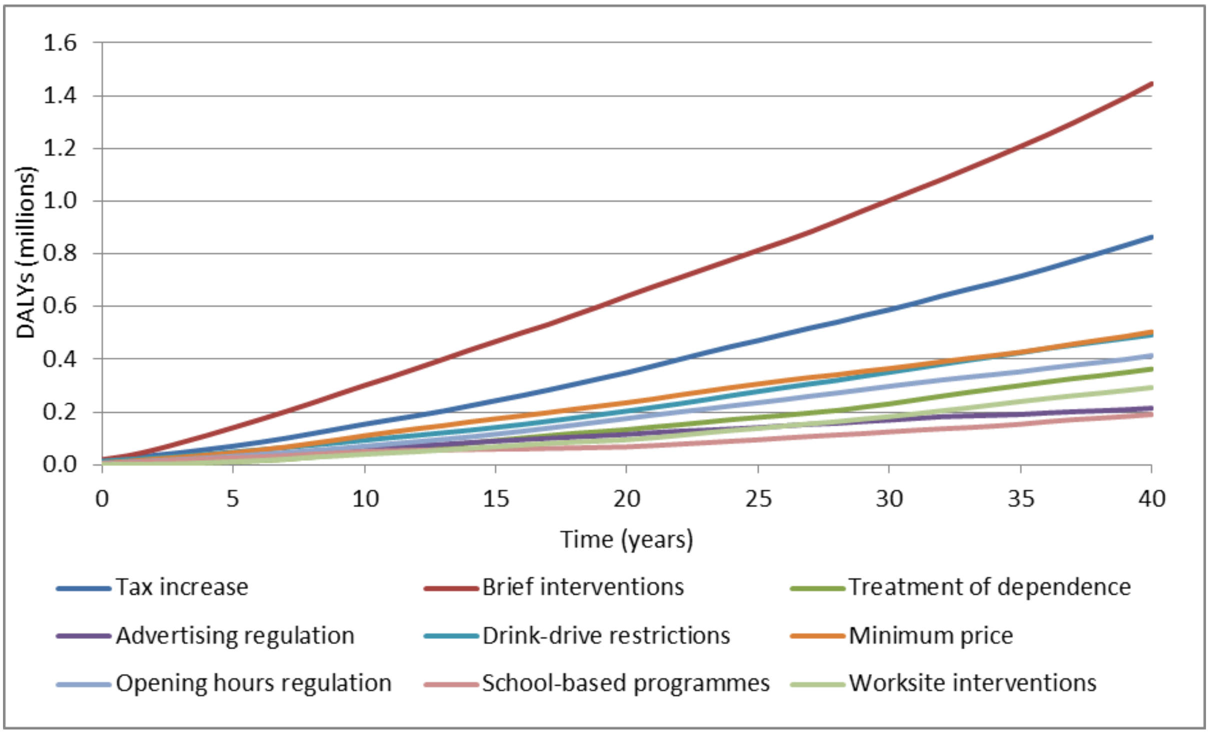
166. However, changing the prevalence of the highest-risk drinking behaviours is not the only way of achieving relatively large health gains at the population level. Reductions in alcohol consumptions in less heavy drinkers, including many moderate drinkers (especially young men and young and middle-aged women, for whom even very low quantities of alcohol increase mortality), have the potential to cut mortality and morbidity and generate health gains which may be small at the individual level, but become substantial at the population level given the large numbers of people concerned. Price policies are the best examples of approaches to reduce alcohol consumption overall. Tax increases, in particular, do not specifically target high-risk drinking behaviours. Taxation policies consistently achieve large health gains in all of the three countries examined in our analysis, despite evidence of a lesser response to price changes by heavy drinkers.

167. Figure 22 shows the effect of interventions in terms of health gains and impact on health expenditure without discounting future effects with a 3% discount rate per year. In particular, panels a, c

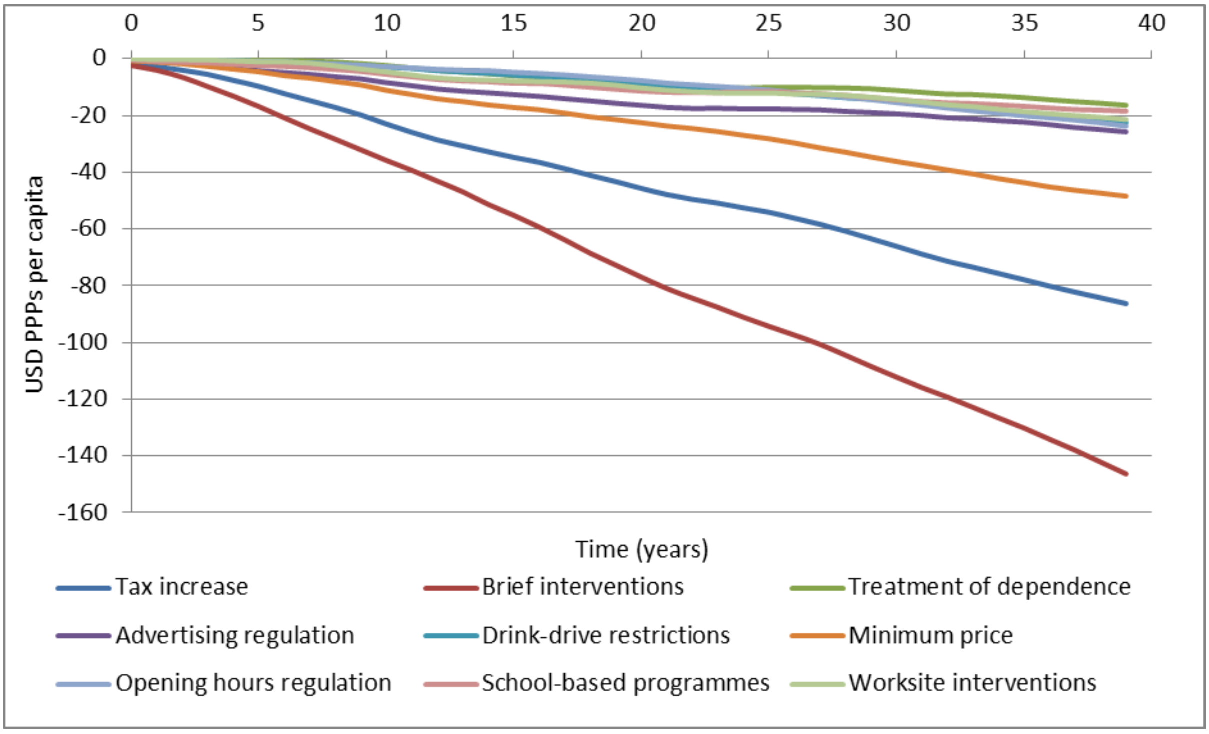
and e show the health impact for, respectively, Canada, Czech Republic and Germany. Panels b, d and f show, instead, the impact on health expenditure. Results presented in Figure 22 should be compared to the relevant results presented in Figures 10 and 14. Results presented in Figure 22 clearly show that a 3% discounting rate significantly decrease the true effect of prevention interventions. For example, over the 40 years of simulation, brief intervention in Canada was evaluated to produce almost 800 000 DALYs under a 3% discount rate which become almost 1.5 million DALYs under the undiscounted scenario. In a similar fashion, under the discounted approach, brief intervention would produce total savings for about 90 USD PPPs per person that become almost 150 USD PPPs per person under the undiscounted scenario.

Figure 22. Cumulative health impact and impact on health expenditure over time, undiscounted results

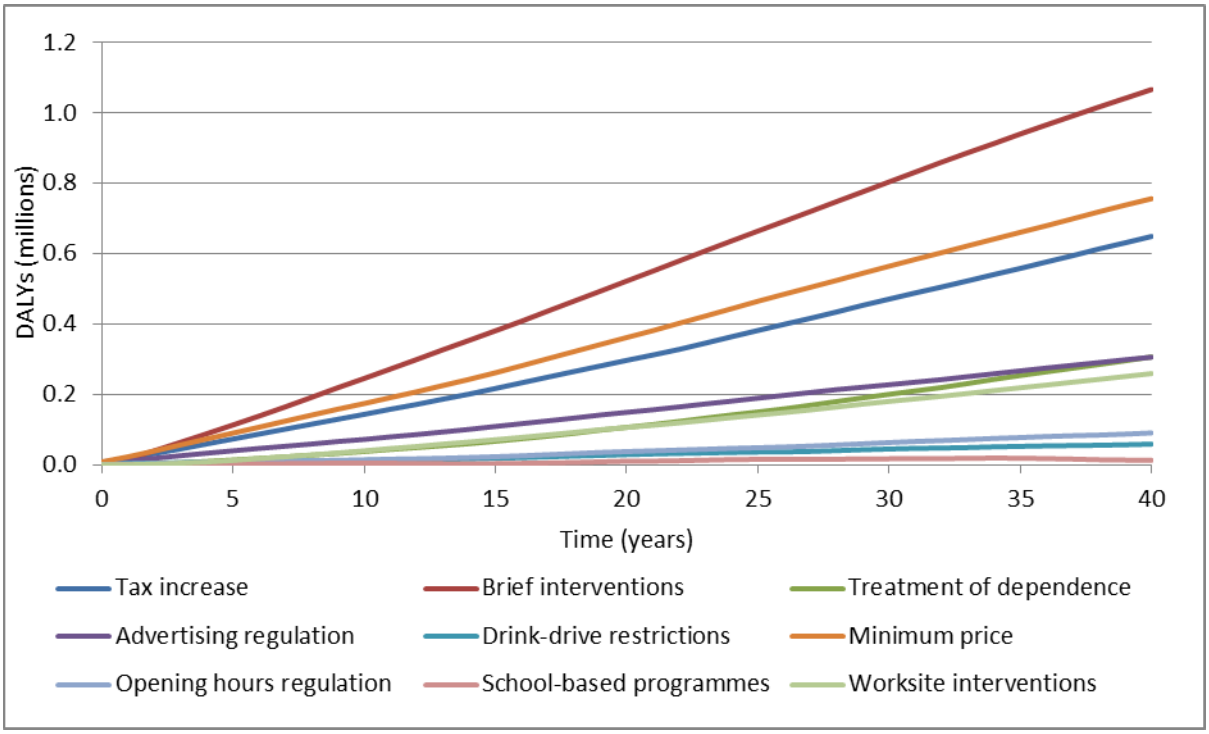
Panel a – health impact, Canada



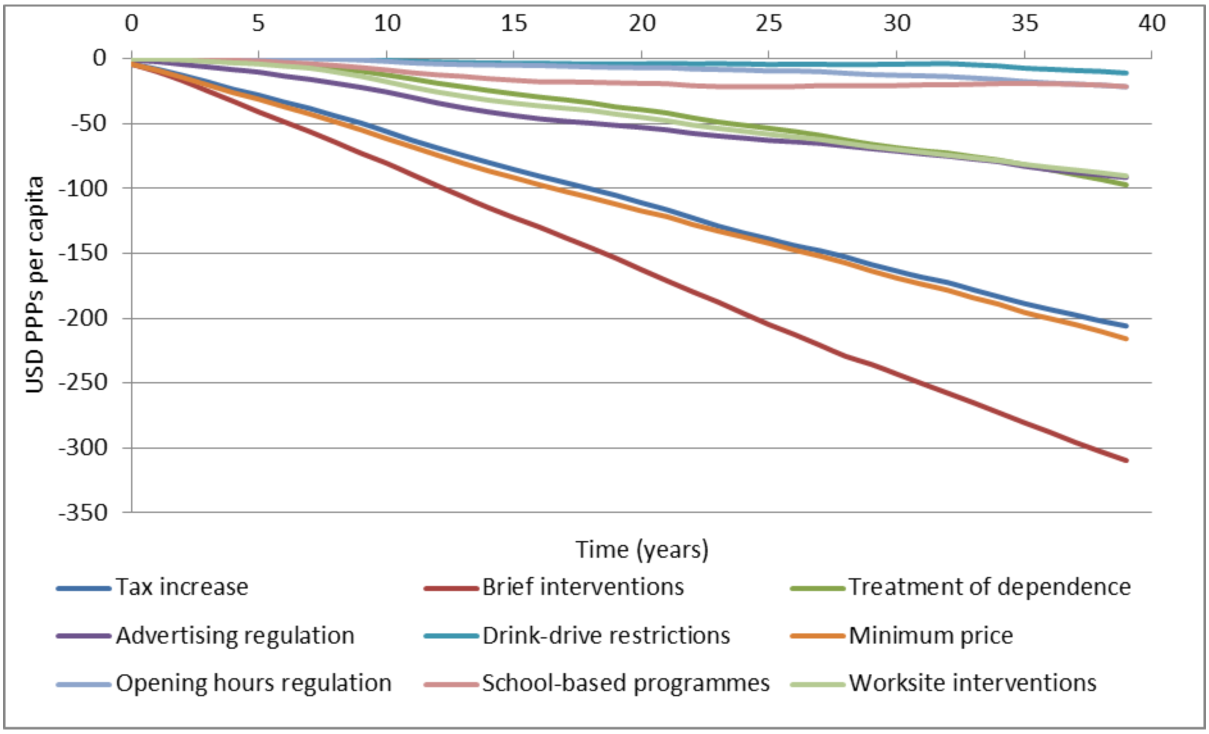
Panel b – impact on health expenditure, Canada



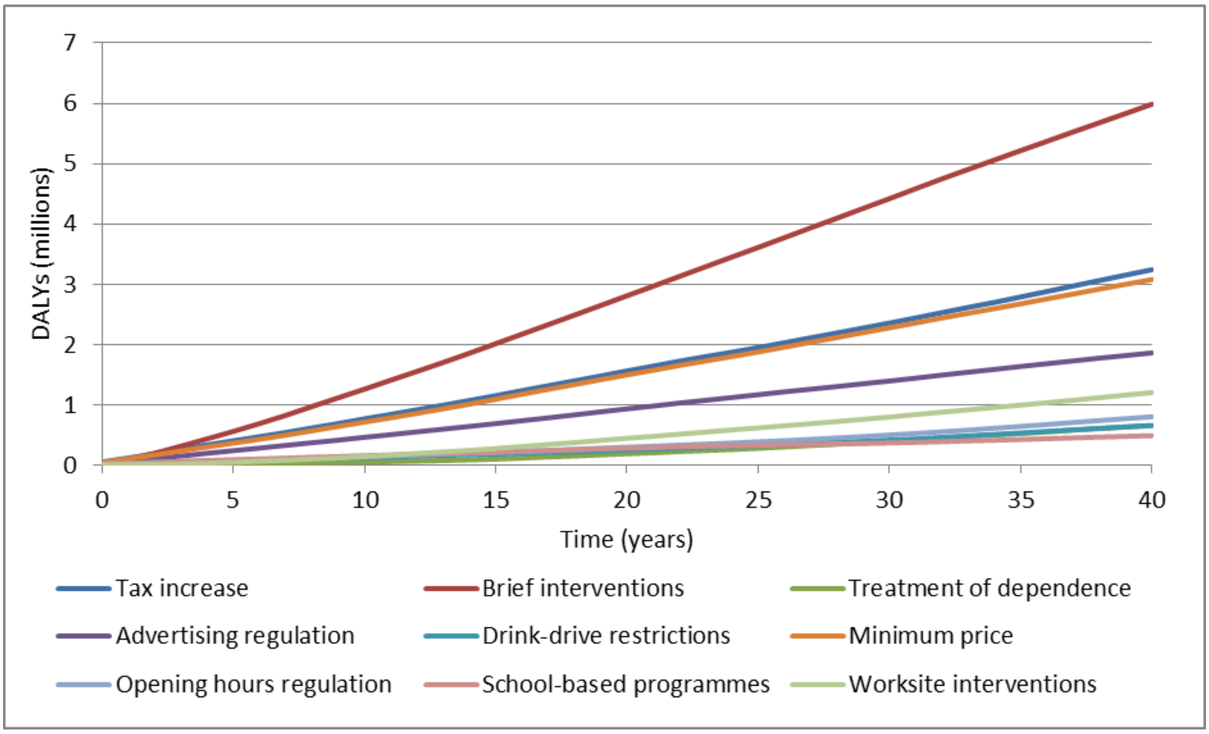
Panel c – health impact, Czech Republic



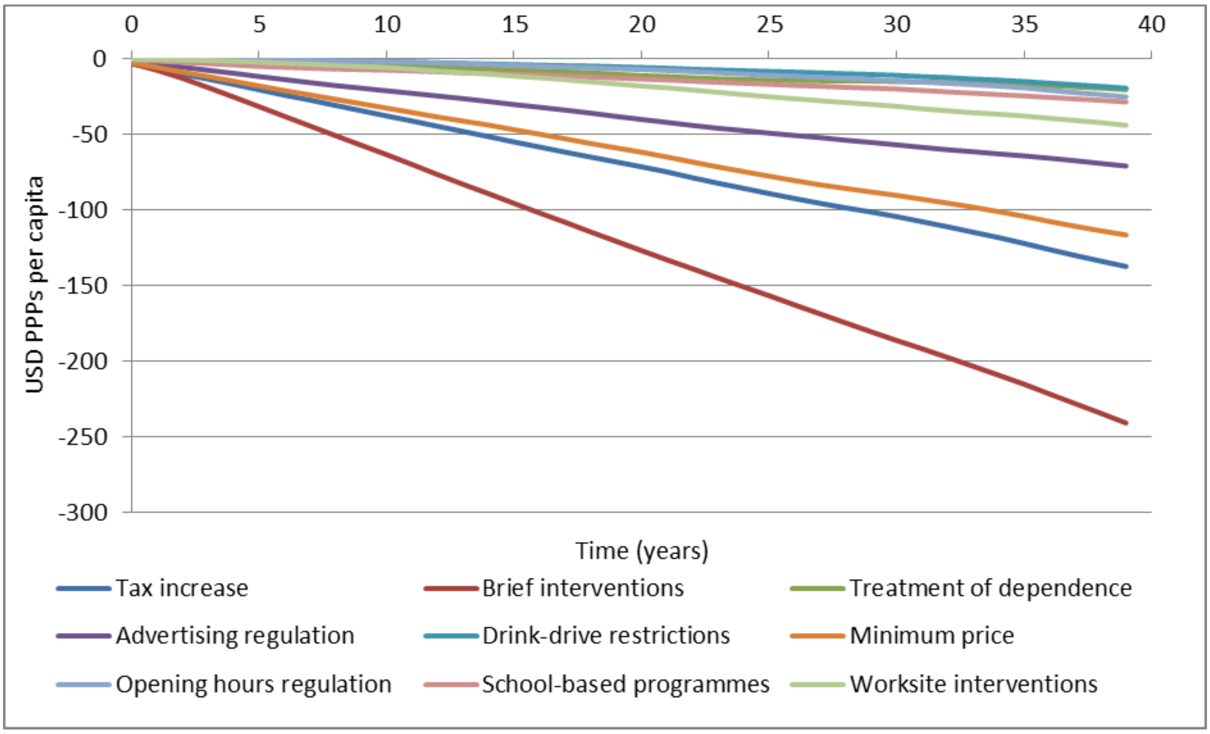
Panel d – impact on health expenditure, Czech Republic



Panel e – health impact, Germany



Panel f – impact on health expenditure, Germany



Source: CDP-Alcohol analysis relying on input data from multiple sources listed in Appendix A

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ANNEX A. INPUT DATA

The tables below (table A.1 to A.3) provide the list of the input parameters used in the model-based analyses presented in this Health Working Paper, along with references to the respective sources. References are listed next to the input parameters.

Table A.1 Input parameters used in CDP-alcohol model and relevant sources – Canada

Population distribution		United States Census Bureau. International Data Base. Available at: http://www.census.gov/population/international/data/idb/region.php. Accessed on 08/04/2013
Total mortality		Human Mortality Database. University of California, Berkeley (USA), and Max Planck Institute for Demographic Research (Germany). Available at www.mortality.org. Accessed on: 08/04/2013
Fertility rates		UN population division. On-line Population database, detailed indicators. Available at: http://esa.un.org/unpd/wpp/unpp/panel_indicators.htm. Accessed on 08/04/2013
Migration rates		OECD calculations on population distribution and mortality data
RR SES - residual mortality		Mackenbach JP, Kunst AE, Cavelaars AE, Groenhof F, Geurts JJ. Socioeconomic inequalities in morbidity and mortality in western Europe. Lancet. 1997;349(9066):1655-9. Pappas G, Queen S, Hadden W, Fisher G. The increasing disparity in mortality between socioeconomic groups in the United States, 1960 and 1986. New England Journal of Medicine. 1993;329(2):103-9.
Disability weights		Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL. Global Burden of Disease and risk factors. Oxford University Press/the World Bank. New York, 2006
alcohol consumpt.	Probability of initiation Volume Pattern	Statistics Canada. Canadian Community Health Survey. Ottawa: Statistics Canada, 2012. Available at: http://www.statcan.gc.ca/concepts/health-sante/index-eng.htm. Accessed on: 08/04/2013. Statistics Canada. National Population Health Survey. Ottawa: Statistics Canada, 2012. Available at: http://www.statcan.gc.ca/concepts/nphs-ensp/index-eng.htm. Accessed on: 08/04/2013
Cancers	Incidence Prevalence Mortality	IARC. Globocan database. Website http://globocan.iarc.fr/. Accessed on 08/04/2013
	Fatality	OECD calculations on mortality / prevalence data
	Remission/duration	OECD calculations using CDP model
	RR alcohol - incidence	Corrao G, Bagnardi V, Zambon A, La Vecchia C. A meta-analysis of alcohol consumption and the risk of 15 diseases. Preventive Medicine. 2004;38(5):613-9. Lhachimi SK, Cole KJ, Nusselder WJ, Smit HA, Baili P, Bennett K, Pomerleau J, McKee M, Charlesworth K, Kulik MC, Mackenbach JP, Boshuizen H. Health impacts of increasing alcohol prices in the European Union: a dynamic projection. Preventive Medicine. 2012;55(3):237-43
	RR SES - incidence [oropharynx, breast]	van Loon AJ, Brug J, Goldbohm RA, van den Brandt PA, Burg J. Differences in cancer incidence and mortality among socio-economic groups. Scandinavian Journal Social Medicine. 1995;23(2):110-20.
	RR SES - incidence [liver, oesophagus]	Ferraroni M, Negri E, La Vecchia C, D'Avanzo B, Franceschi S. Socioeconomic indicators, tobacco and alcohol in the aetiology of digestive tract neoplasms. International Journal of Epidemiology. 1989;18(3):556-62.
	RR cirrhosis – cancer [liver]	Ha NB, Ha NB, Ahmed A, Ayoub W, Daugherty TJ, Chang ET, Lutchman GA, Garcia G, Cooper AD, Keeffe EB, Nguyen MH. Risk factors for hepatocellular carcinoma in patients with chronic liver disease: a case-control study. Cancer Causes Control. 2012;23(3):455-62.
Ischaemic Heart Disease	Incidence	Statistics Canada. Vital statistics morbidity database. Ottawa: Statistics Canada

	Prevalence	OECD calibration on PHAC calculations using DisMod II
	Mortality	Statistics Canada. Vital statistics mortality database. Ottawa: Statistics Canada
	Fatality	OECD calculation on mortality / prevalence data
	Remission/duration	OECD calculations using CDP model
	RR alcohol - incidence	Corrao G, Bagnardi V, Zambon A, La Vecchia C. A meta-analysis of alcohol consumption and the risk of 15 diseases. Preventive Medicine. 2004;38(5):613-9. Roerecke M, Rehm J. Irregular heavy drinking occasions and risk of ischemic heart disease: a systematic review and meta-analysis. American Journal of Epidemiology. 2010;171(6):633-44.
	RR SES - incidence	Forssas EH, Keskimäki IT, Reunanen AR, Koskinen SV. Coronary heart disease among diabetic and nondiabetic people - socioeconomic differences in incidence, prognosis and mortality. Journal of Diabetes and its Complications. 2008;22(1):10-7. Salomaa V, Niemelä M, Miettinen H, Ketonen M, Immonen-Räihä P, Koskinen S, Mähönen M, Lehto S, Vuorenmaa T, Palomäki P, Mustaniemi H, Kaarsalo E, Arstila M, Torppa J, Kuulasmaa K, Puska P, Pyörälä K, Tuomilehto J. Relationship of socioeconomic status to the incidence and prehospital, 28-day, and 1-year mortality rates of acute coronary events in the FINMONICA myocardial infarction register study. Circulation. 2000;101(16):1913-8.
	RR SES - mortality	Haan M, Kaplan GA, Camacho T. Poverty and health. Prospective evidence from the Alameda County Study. American Journal of Epidemiology. 1987;125(6):989-98. Logue EE, Jarjoura D. Modeling heart disease mortality with census tract rates and social class mixtures. Social Science & Medicine. 1990;31(5):545-50. Kaplan GA, Keil JE. Socioeconomic factors and cardiovascular disease: a review of the literature. Circulation. 1993;88(4Pt1):1973-98.
Stroke	Incidence	Statistics Canada. Vital statistics morbidity database. Ottawa: Statistics Canada
	Prevalence	OECD calibration on PHAC calculations using DisMod II
	Mortality	Statistics Canada. Vital statistics mortality database. Ottawa: Statistics Canada
	Fatality	OECD calculations on mortality / prevalence data
	Remission/duration	OECD calculations using CDP model
	RR alcohol - incidence	Corrao G, Bagnardi V, Zambon A, La Vecchia C. A meta-analysis of alcohol consumption and the risk of 15 diseases. Preventive Medicine. 2004;38(5):613-9. Lhachimi SK, Cole KJ, Nusselder WJ, Smit HA, Baili P, Bennett K, Pomerleau J, McKee M, Charlesworth K, Kulik MC, Mackenbach JP, Boshuizen H. Health impacts of increasing alcohol prices in the European Union: a dynamic projection. Preventive Medicine. 2012;55(3):237-43
	RR SES - incidence	Kuper H, Adami HO, Theorell T, Weiderpass E. The socioeconomic gradient in the incidence of stroke: a prospective study in middle-aged women in Sweden. Stroke. 2007;38(1):27-33 Hart CL, Hole DJ, Smith GD. The contribution of risk factors to stroke differentials, by socioeconomic position in adulthood: the Renfrew/Paisley Study. American Journal of Public Health. 2000;90(11):1788-91.
	RR SES - mortality	Arrich J, Lalouschek W, Müllner M. Influence of socioeconomic status on mortality after stroke: retrospective cohort study. Stroke. 2005;36(2):310-4. Arrich J, Müllner M, Lalouschek W, Greisenegger S, Crevenna R, Herkner H. Influence of socioeconomic status and gender on stroke treatment and diagnostics. Stroke. 2008;39(7):2066-72. Jakovljević D, Sarti C, Sivenius J, Torppa J, Mähönen M, Immonen-Räihä P, Kaarsalo E, Alhainen K, Kuulasmaa K, Tuomilehto J, Puska P, Salomaa V. Socioeconomic status and ischemic stroke: The FINMONICA Stroke Register. Stroke. 2001;32(7):1492-8.
	Incidence	OECD calculations using DisMod II

	Prevalence	WHO. WHO Global Health Observatory Data Repository. Available at: http://apps.who.int/gho/data/view.main.58000. Accessed: 08/04/2013
	Mortality	WHO. Mortality and burden of disease for member states. Geneva: WHO, 2011 WHO. Causes of death summary tables. Geneva: WHO, 2011
	Fatality	OECD calculation on mortality / prevalence data
	Remission/duration	Hasin DS, Stinson FS, Ogburn E, Grant BF. Prevalence, correlates, disability, and comorbidity of DSM-IV alcohol abuse and dependence in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. Archives of General Psychiatry. 2007;64(7):830-42. Dawson DA, Grant BF, Stinson FS, Chou PS, Huang B, Ruan WJ. Recovery from DSM-IV alcohol dependence: United States, 2001-2002. Alcohol research and health. 2006;29(2):131-142.
	RR alcohol - incidence	Meier P. Indipendent review of the effects of alcohol pricing and promotion – part B: modeling the potential impact of pricing and promotion policies for alcohol in England: results from the Sheffield alcohol policy model. Sheffield: University of Sheffield, 2008. Dawson DA, Li TK, Grant BF. A prospective study of risk drinking: at risk for what? Drug and Alcohol Dependence. 2008;95(1-2):62-72.
Liver cirrhosis	Incidence	OECD calculations
	Prevalence	OECD calculations using DisMod II
	Mortality	WHO. Mortality and burden of disease for member states. Geneva: WHO, 2011 WHO. Causes of death summary tables. Geneva: WHO, 2011
	Fatality	OECD calculation on mortality / prevalence data
	Remission/duration	Fauci AS, Braunwald E, Kasper DL, Hauser SL, Longo DL, Jameson JL, Loscalzo J. Harrison's Manual of Medicine. London: McGraw Hill Professional, 2009.
	RR alcohol - incidence	Corrao G, Bagnardi V, Zambon A, La Vecchia C. A meta-analysis of alcohol consumption and the risk of 15 diseases. Preventive Medicine. 2004;38(5):613-9.
	RR SES - incidence	Najman JM, Williams GM, Room R. Increasing socioeconomic inequalities in male cirrhosis of the liver mortality: Australia 1981-2002. Drug and Alcohol Review. 2007;26(3):273-8. Crombie IK, Precious E. Changes in the social class gradient of cirrhosis mortality in England and Wales across the 20th century. Alcohol and Alcoholism. 2011;46(1):80-2.
Epilepsy	Incidence	OECD calculations using DisMod II
	Prevalence	Statistics Canada. CANSIM on-line database; neurological conditions, by age group and sex. Available at: http://www5.statcan.gc.ca/cansim/. Accessed on 08/04/1979.
	Mortality	WHO. Mortality and burden of disease for member states. Geneva: WHO, 2011 WHO. Causes of death summary tables. Geneva: WHO, 2011
	Fatality	OECD calculation on mortality / prevalence data
	RR alcohol - incidence	Meier P. Indipendent review of the effects of alcohol pricing and promotion – part B: modeling the potential impact of pricing and promotion policies for alcohol in England: results from the Sheffield alcohol policy model. Sheffield: University of Sheffield, 2008.
	RR SES - incidence	Heaney DC, MacDonald BK, Everitt A, Stevenson S, Leonardi GS, Wilkinson P, Sander JW. Socioeconomic variation in incidence of epilepsy: prospective community based study in south east England. British Medical Journal. 2002;325(7371):1013-6. Benn EK, Hauser WA, Shih T, Leary L, Bagiella E, Dayan P, Green R, Andrews H, Thurman DJ, Hesdorffer DC. Estimating the incidence of first unprovoked seizure and newly diagnosed epilepsy in the low-income urban community of Northern Manhattan, New York City. Epilepsia. 2008;49(8):1431-9.

Injuries	Incidence	Smartrisk. The burden of injury in Canada. Toronto: Smartrisk, 2009.
	Prevalence	OECD calculations using DisMod II
	Mortality	Statistics Canada. Mortality, summary list of causes. Ottawa: Statistics Canada, 2009
	Fatality	OECD calculations
	Remission/duration	Smartrisk. The burden of injury in Canada. Toronto: Smartrisk, 2009.
	RR alcohol - incidence	Corrao G, Bagnardi V, Zambon A, La Vecchia C. A meta-analysis of alcohol consumption and the risk of 15 diseases. Preventive Medicine. 2004;38(5):613-9.
	RR alcohol - mortality	White IR, Altmann DR, Nanchahal K. Alcohol consumption and mortality: modelling risks for men and women at different ages. British Medical Journal. 2002;325(7357):191.
	RR SES - incidence	Cubbin C, LeClere FB, Smith GS. Socioeconomic status and the occurrence of fatal and nonfatal injury in the United States. American Journal of Public Health. 2000;90(1):70-7.

Table A.2 Input parameters used in CDP-alcohol model and relevant sources – Czech Republic

	Population distribution	United States Census Bureau. International Data Base. Available at: http://www.census.gov/population/international/data/idb/region.php. Accessed on 13/12/2013
	Total mortality	UN Populavion Division. World population prospects, extended dataset. Available at: http://esa.un.org/unpd/wpp/ASCII-Data/DISK_NAVIGATION_ASCII.htm. Accessed on 13/12/2013 UN population division. On-line Population database, detailed indicators. Available at: http://esa.un.org/unpd/wpp/unpp/panel_indicators.htm. Accessed on 13/12/2013
	Fertility rates	UN population division. On-line Population database, detailed indicators. Available at: http://esa.un.org/unpd/wpp/unpp/panel_indicators.htm. Accessed on 13/12/2013
	Migration rates	OECD calculations on population distribution and mortality data
	RR SES - residual mortality	Mackenbach JP, Kunst AE, Cavelaars AE, Groenhof F, Geurts JJ. Socioeconomic inequalities in morbidity and mortality in western Europe. Lancet. 1997;349(9066):1655-9. Pappas G, Queen S, Hadden W, Fisher G. The increasing disparity in mortality between socioeconomic groups in the United States, 1960 and 1986. New England Journal of Medicine. 1993;329(2):103-9.
	Disability weights	Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL. Global Burden of Disease and risk factors. Oxford University Press/the World Bank. New York, 2006
alcohol consumption	Probability of initiation	Institute for Therapy Research. Epidemiological Survey of Substance Abuse (1995, 1997, 2000, 2003, 2006, and 2009). Available at: www.gesis.org. Accessed on 16/12/2013.
	volume pattern	Czech National Institute of Public Health own analyses on: 2012 National Survey on Tobacco smoking and Alcohol Consumption in the Czech Republic; 2005 Czech National Survey on Mental Health; 2002 GENACIS study.
Cancers	Incidence Prevalence Mortality	IARC. Globocan database. Website http://globocan.iarc.fr/. Accessed on 08/04/2013
	Fatality	OECD calculations on mortality / prevalence data
	Remission/duration	OECD calculations using CDP model
	RR alcohol - incidence	Corrao G, Bagnardi V, Zambon A, La Vecchia C. A meta-analysis of alcohol consumption and the risk of 15 diseases. Preventive Medicine. 2004;38(5):613-9. Lhachimi SK, Cole KJ, Nusselder WJ, Smit HA, Baili P, Bennett K, Pomerleau J, McKee M, Charlesworth K, Kulik MC, Mackenbach JP, Boshuizen H. Health impacts of increasing alcohol prices in the European Union: a dynamic projection. Preventive Medicine. 2012;55(3):237-43
	RR SES - incidence [oropharynx, breast]	van Loon AJ, Brug J, Goldbohm RA, van den Brandt PA, Burg J. Differences in cancer incidence and mortality among socio-economic groups. Scandinavian Journal Social Medicine. 1995;23(2):110-20.
	RR SES - incidence [liver, oesophagus]	Ferraroni M, Negri E, La Vecchia C, D'Avanzo B, Franceschi S. Socioeconomic indicators, tobacco and alcohol in the aetiology of digestive tract neoplasms. International Journal of Epidemiology. 1989;18(3):556-62.
	RR cirrhosis - cancer [liver]	Ha NB, Ha NB, Ahmed A, Ayoub W, Daugherty TJ, Chang ET, Lutchman GA, Garcia G, Cooper AD, Keeffe EB, Nguyen MH. Risk factors for hepatocellular carcinoma in patients with chronic liver disease: a case-control study. Cancer Causes Control. 2012;23(3):455-62.

Ischaemic Heart Disease	Incidence	WHO Europe. European Hospital Morbidity Database. Available at: http://data.euro.who.int/hmdb/index.php. Accessed on: 04/12/2013
	Prevalence	OECD calculations using DisMod II
	Mortality	WHO. Mortality and burden of disease for member states. Geneva: WHO, 2011 WHO. Causes of death summary tables. Geneva: WHO, 2011
	Fatality	OECD calculation on mortality / prevalence data
	Remission/duration	OECD calculations using CDP model
	RR alcohol - incidence	Corrao G, Bagnardi V, Zambon A, La Vecchia C. A meta-analysis of alcohol consumption and the risk of 15 diseases. Preventive Medicine. 2004;38(5):613-9. Roerecke M, Rehm J. Irregular heavy drinking occasions and risk of ischemic heart disease: a systematic review and meta-analysis. American Journal of Epidemiology. 2010;171(6):633-44.
	RR SES - incidence	Forssas EH, Keskimäki IT, Reunanen AR, Koskinen SV. Coronary heart disease among diabetic and nondiabetic people - socioeconomic differences in incidence, prognosis and mortality. Journal of Diabetes and its Complications. 2008;22(1):10-7. Salomaa V, Niemelä M, Miettinen H, Ketonen M, Immonen-Räihä P, Koskinen S, Mähönen M, Lehto S, Vuorenmaa T, Palomäki P, Mustaniemi H, Kaarsalo E, Arstila M, Torppa J, Kuulasmaa K, Puska P, Pyörälä K, Tuomilehto J. Relationship of socioeconomic status to the incidence and prehospital, 28-day, and 1-year mortality rates of acute coronary events in the FINMONICA myocardial infarction register study. Circulation. 2000;101(16):1913-8.
	RR SES - mortality	Haan M, Kaplan GA, Camacho T. Poverty and health. Prospective evidence from the Alameda County Study. American Journal of Epidemiology. 1987;125(6):989-98. Logue EE, Jarjoura D. Modeling heart disease mortality with census tract rates and social class mixtures. Social Science & Medicine. 1990;31(5):545-50. Kaplan GA, Keil JE. Socioeconomic factors and cardiovascular disease: a review of the literature. Circulation. 1993;88(4Pt1):1973-98.
Stroke	Incidence Prevalence	Truelsen T, Piechowski-Jóźwiak B, Bonita R, Mathers C, Bogousslavsky J, Boysen G. Stroke incidence and prevalence in Europe: a review of available data. European Journal of Neurology. 2006;13(6):581-98.
	Mortality	WHO. Mortality and burden of disease for member states. Geneva: WHO, 2011 WHO. Causes of death summary tables. Geneva: WHO, 2011
	Fatality	OECD calculations on mortality / prevalence data
	Remission/duration	OECD calculations using CDP model
	RR alcohol - incidence	Corrao G, Bagnardi V, Zambon A, La Vecchia C. A meta-analysis of alcohol consumption and the risk of 15 diseases. Preventive Medicine. 2004;38(5):613-9. Lhachimi SK, Cole KJ, Nusselder WJ, Smit HA, Baili P, Bennett K, Pomerleau J, McKee M, Charlesworth K, Kulik MC, Mackenbach JP, Boshuizen H. Health impacts of increasing alcohol prices in the European Union: a dynamic projection. Preventive Medicine. 2012;55(3):237-43
	RR SES - incidence	Kuper H, Adami HO, Theorell T, Weiderpass E. The socioeconomic gradient in the incidence of stroke: a prospective study in middle-aged women in Sweden. Stroke. 2007;38(1):27-33 Hart CL, Hole DJ, Smith GD. The contribution of risk factors to stroke differentials, by socioeconomic position in adulthood: the Renfrew/Paisley Study. American Journal of Public Health. 2000;90(11):1788-91.
	RR SES - mortality	Arrich J, Lalouschek W, Müllner M. Influence of socioeconomic status on mortality after stroke: retrospective cohort study. Stroke. 2005;36(2):310-4. Arrich J, Müllner M, Lalouschek W, Greisenegger S, Crevenna R, Herkner H. Influence of socioeconomic status and gender on stroke treatment and diagnostics. Stroke. 2008;39(7):2066-72. Jakovljević D, Sarti C, Sivenius J, Torppa J, Mähönen M, Immonen-Räihä P, Kaarsalo E, Alhainen K, Kuulasmaa K, Tuomilehto J, Puska P, Salomaa V. Socioeconomic status and ischemic stroke: The FINMONICA Stroke Register. Stroke. 2001;32(7):1492-8.

Alcohol Use Disorders	Incidence	OECD calculations using DisMod II
	Prevalence	WHO. WHO Global Health Observatory Data Repository. Available at: http://apps.who.int/gho/data/view.main.58000. Accessed: 04/12/2013
	Mortality	WHO. Mortality and burden of disease for member states. Geneva: WHO, 2011 WHO. Causes of death summary tables. Geneva: WHO, 2011
	Fatality	OECD calculation on mortality / prevalence data
	Remission/duration	Hasin DS, Stinson FS, Ogburn E, Grant BF. Prevalence, correlates, disability, and comorbidity of DSM-IV alcohol abuse and dependence in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. Archives of General Psychiatry. 2007;64(7):830-42. Dawson DA, Grant BF, Stinson FS, Chou PS, Huang B, Ruan WJ. Recovery from DSM-IV alcohol dependence: United States, 2001-2002. Alcohol research and health. 2006;29(2):131-142.
	RR alcohol - incidence	Meier P. Independent review of the effects of alcohol pricing and promotion – part B: modeling the potential impact of pricing and promotion policies for alcohol in England: results from the Sheffield alcohol policy model. Sheffield: University of Sheffield, 2008. Dawson DA, Li TK, Grant BF. A prospective study of risk drinking: at risk for what? Drug and Alcohol Dependence. 2008;95(1-2):62-72.
Liver cirrhosis	Incidence	WHO Europe. European Hospital Morbidity Database. Available at: http://data.euro.who.int/hmdb/index.php. Accessed on: 04/12/2013
	Prevalence	OECD calculations using DisMod II
	Mortality	WHO. Mortality and burden of disease for member states. Geneva: WHO, 2011 WHO. Causes of death summary tables. Geneva: WHO, 2011
	Fatality	OECD calculation on mortality / prevalence data
	Remission/duration	Fauci AS, Braunwald E, Kasper DL, Hauser SL, Longo DL, Jameson JL, Loscalzo J. Harrison's Manual of Medicine. London: McGraw Hill Professional, 2009.
	RR alcohol - incidence	Corrao G, Bagnardi V, Zambon A, La Vecchia C. A meta-analysis of alcohol consumption and the risk of 15 diseases. Preventive Medicine. 2004;38(5):613-9.
	RR SES - incidence	Najman JM, Williams GM, Room R. Increasing socioeconomic inequalities in male cirrhosis of the liver mortality: Australia 1981-2002. Drug and Alcohol Review. 2007;26(3):273-8. Crombie IK, Precious E. Changes in the social class gradient of cirrhosis mortality in England and Wales across the 20th century. Alcohol and Alcoholism. 2011;46(1):80-2.
Epilepsy	Incidence	OECD calculations using DisMod II
	Prevalence	Pugliatti M, Beghi E, Forsgren L, Ekman M, Sobocki P. Estimating the cost of epilepsy in Europe: a review with economic modeling. Epilepsia. 2007;48(12):2224-33.
	Mortality	WHO. Mortality and burden of disease for member states. Geneva: WHO, 2011 WHO. Causes of death summary tables. Geneva: WHO, 2011
	Fatality	OECD calculation on mortality / prevalence data
	RR alcohol - incidence	Meier P. Indipendent review of the effects of alcohol pricing and promotion – part B: modeling the potential impact of pricing and promotion policies for alcohol in England: results from the Sheffield alcohol policy model. Sheffield: University of Sheffield, 2008.
	RR SES - incidence	Heaney DC, MacDonald BK, Everitt A, Stevenson S, Leonardi GS, Wilkinson P, Sander JW. Socioeconomic variation in incidence of epilepsy: prospective community based study in south east England. British Medical Journal. 2002;325(7371):1013-6. Benn EK, Hauser WA, Shih T, Leary L, Bagiella E, Dayan P, Green R, Andrews H, Thurman DJ, Hesdorffer DC. Estimating the incidence of first unprovoked seizure and newly diagnosed epilepsy in the low-income urban community of Northern Manhattan, New York City. Epilepsia. 2008;49(8):1431-9.
	Incidence	EuroSafe. Injuries in the European Union, Report on injury statistics 2008-2010. Amsterdam: EuroSafe, 2013.

Prevalence	OECD calculations using DisMod II
Mortality	WHO. Mortality and burden of disease for member states. Geneva: WHO, 2011 WHO. Causes of death summary tables. Geneva: WHO, 2011
Fatality	OECD calculations
Remission/duration	Smartrisk. The burden of injury in Canada. Toronto: Smartrisk, 2009.
RR alcohol - incidence	Corrao G, Bagnardi V, Zambon A, La Vecchia C. A meta-analysis of alcohol consumption and the risk of 15 diseases. Preventive Medicine. 2004;38(5):613-9.
RR alcohol - mortality	White IR, Altmann DR, Nanchahal K. Alcohol consumption and mortality: modelling risks for men and women at different ages. British Medical Journal. 2002;325(7357):191.
RR SES - incidence	Cubbin C, LeClere FB, Smith GS. Socioeconomic status and the occurrence of fatal and nonfatal injury in the United States. American Journal of Public Health. 2000;90(1):70-7.

Table A.3 Input parameters used in CDP-alcohol model and relevant sources – Germany

	Population distribution	Statistisches Bundesamt. Bevölkerungsvorausberechnung. Available at: destatis.de. Accessed on: 13/12/2013.
	Total mortality	Statistisches Bundesamt. Bevölkerung Deutschlands bis 2060 Ergebnisse der 12. koordinierten Bevölkerungsvorausberechnung. Available at: https://www.destatis.de/DE/Publikationen/Thematisch/Bevoelkerung/VorausberechnungBevoelkerung/BevoelkerungDeutschland2060.html. Accessed on 13/12/2013
	Fertility rates	UN population division. On-line Population database, detailed indicators. Available at: http://esa.un.org/unpd/wpp/unpp/panel_indicators.htm. Accessed on 08/04/2013
	Migration rates	OECD calculations on population distribution and mortality data
	RR SES - residual mortality	Mackenbach JP, Kunst AE, Cavelaars AE, Groenhof F, Geurts JJ. Socioeconomic inequalities in morbidity and mortality in western Europe. Lancet. 1997;349(9066):1655-9. Pappas G, Queen S, Hadden W, Fisher G. The increasing disparity in mortality between socioeconomic groups in the United States, 1960 and 1986. New England Journal of Medicine. 1993;329(2):103-9.
	Disability weights	Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL. Global Burden of Disease and risk factors. Oxford University Press/the World Bank. New York, 2006
alcohol consumption	Probability of initiation volume pattern	Institute for Therapy Research. Epidemiological Survey of Substance Abuse (1995, 1997, 2000, 2003, 2006, and 2009). Available at: www.gesis.org. Accessed on 16/12/2013.
Cancers	Incidence Prevalence Mortality	IARC. Globocan database. Website http://globocan.iarc.fr/. Accessed on 08/04/2013
	Fatality	OECD calculations on mortality / prevalence data
	Remission/duration	OECD calculations using CDP model
	RR alcohol - incidence	Corrao G, Bagnardi V, Zambon A, La Vecchia C. A meta-analysis of alcohol consumption and the risk of 15 diseases. Preventive Medicine. 2004;38(5):613-9. Lhachimi SK, Cole KJ, Nusselder WJ, Smit HA, Baili P, Bennett K, Pomerleau J, McKee M, Charlesworth K, Kulik MC, Mackenbach JP, Boshuizen H. Health impacts of increasing alcohol prices in the European Union: a dynamic projection. Preventive Medicine. 2012;55(3):237-43
	RR SES - incidence [oropharynx, breast]	van Loon AJ, Brug J, Goldbohm RA, van den Brandt PA, Burg J. Differences in cancer incidence and mortality among socio-economic groups. Scandinavian Journal Social Medicine. 1995;23(2):110-20.
	RR SES - incidence [liver, oesophagus]	Ferraroni M, Negri E, La Vecchia C, D'Avanzo B, Franceschi S. Socioeconomic indicators, tobacco and alcohol in the aetiology of digestive tract neoplasms. International Journal of Epidemiology. 1989;18(3):556-62.
	RR cirrhosis - cancer [liver]	Ha NB, Ha NB, Ahmed A, Ayoub W, Daugherty TJ, Chang ET, Lutchman GA, Garcia G, Cooper AD, Keeffe EB, Nguyen MH. Risk factors for hepatocellular carcinoma in patients with chronic liver disease: a case-control study. Cancer Causes Control. 2012;23(3):455-62.

Ischaemic Heart Disease	Incidence	WHO Europe. European Hospital Morbidity Database. Available at: http://data.euro.who.int/hmdb/index.php. Accessed on: 04/12/2013
	Prevalence	Robert Koch Institute. GEDA 2010: Coronary heart disease facts and figures. Available at: http://www.rki.de/DE/Content/Gesundheitsmonitoring/Gesundheitsberichterstattung/GesundAZ/Content/K/KoronHerzKH/KoronHerzKH.html?nn=2370692. Accessed on: 04/12/2013
	Mortality	WHO. Mortality and burden of disease for member states. Geneva: WHO, 2011 WHO. Causes of death summary tables. Geneva: WHO, 2011
	Fatality	OECD calculation on mortality / prevalence data
	Remission/duration	OECD calculations using CDP model
	RR alcohol - incidence	Corrao G, Bagnardi V, Zambon A, La Vecchia C. A meta-analysis of alcohol consumption and the risk of 15 diseases. Preventive Medicine. 2004;38(5):613-9. Roerecke M, Rehm J. Irregular heavy drinking occasions and risk of ischemic heart disease: a systematic review and meta-analysis. American Journal of Epidemiology. 2010;171(6):633-44.
	RR SES - incidence	Forssas EH, Keskimäki IT, Reunanen AR, Koskinen SV. Coronary heart disease among diabetic and nondiabetic people - socioeconomic differences in incidence, prognosis and mortality. Journal of Diabetes and its Complications. 2008;22(1):10-7. Salomaa V, Niemelä M, Miettinen H, Ketonen M, Immonen-Räihä P, Koskinen S, Mähönen M, Lehto S, Vuorenmaa T, Palomäki P, Mustaniemi H, Kaarsalo E, Arstila M, Torppa J, Kuulasmaa K, Puska P, Pyörälä K, Tuomilehto J. Relationship of socioeconomic status to the incidence and prehospital, 28-day, and 1-year mortality rates of acute coronary events in the FINMONICA myocardial infarction register study. Circulation. 2000;101(16):1913-8.
	RR SES - mortality	Haan M, Kaplan GA, Camacho T. Poverty and health. Prospective evidence from the Alameda County Study. American Journal of Epidemiology. 1987;125(6):989-98. Logue EE, Jarjoura D. Modeling heart disease mortality with census tract rates and social class mixtures. Social Science & Medicine. 1990;31(5):545-50. Kaplan GA, Keil JE. Socioeconomic factors and cardiovascular disease: a review of the literature. Circulation. 1993;88(4Pt1):1973-98.
Stroke	Incidence Prevalence	Truelsen T, Piechowski-Jóźwiak B, Bonita R, Mathers C, Bogousslavsky J, Boysen G. Stroke incidence and prevalence in Europe: a review of available data. European Journal of Neurology. 2006;13(6):581-98.
	Mortality	WHO. Mortality and burden of disease for member states. Geneva: WHO, 2011 WHO. Causes of death summary tables. Geneva: WHO, 2011
	Fatality	OECD calculations on mortality / prevalence data
	Remission/duration	OECD calculations using CDP model
	RR alcohol - incidence	Corrao G, Bagnardi V, Zambon A, La Vecchia C. A meta-analysis of alcohol consumption and the risk of 15 diseases. Preventive Medicine. 2004;38(5):613-9. Lhachimi SK, Cole KJ, Nusselder WJ, Smit HA, Baili P, Bennett K, Pomerleau J, McKee M, Charlesworth K, Kulik MC, Mackenbach JP, Boshuizen H. Health impacts of increasing alcohol prices in the European Union: a dynamic projection. Preventive Medicine. 2012;55(3):237-43
	RR SES - incidence	Kuper H, Adami HO, Theorell T, Weiderpass E. The socioeconomic gradient in the incidence of stroke: a prospective study in middle-aged women in Sweden. Stroke. 2007;38(1):27-33 Hart CL, Hole DJ, Smith GD. The contribution of risk factors to stroke differentials, by socioeconomic position in adulthood: the Renfrew/Paisley Study. American Journal of Public Health. 2000;90(11):1788-91.
	RR SES - mortality	Arrich J, Lalouschek W, Müllner M. Influence of socioeconomic status on mortality after stroke: retrospective cohort study. Stroke. 2005;36(2):310-4. Arrich J, Müllner M, Lalouschek W, Greisenegger S, Crevenna R, Herkner H. Influence of socioeconomic status and gender on stroke treatment and diagnostics. Stroke. 2008;39(7):2066-72. Jakovljević D, Sarti C, Sivenius J, Torppa J, Mähönen M, Immonen-Räihä P, Kaarsalo E, Alhainen K, Kuulasmaa K, Tuomilehto J, Puska P, Salomaa V.

		Socioeconomic status and ischemic stroke: The FINMONICA Stroke Register. Stroke. 2001;32(7):1492-8.
Alcohol Use Disorders	Incidence	OECD calculations using DisMod II
	Prevalence	WHO. WHO Global Health Observatory Data Repository. Available at: http://apps.who.int/gho/data/view.main.58000. Accessed: 04/12/2013
	Mortality	WHO. Mortality and burden of disease for member states. Geneva: WHO, 2011 WHO. Causes of death summary tables. Geneva: WHO, 2011
	Fatality	OECD calculation on mortality / prevalence data
	Remission/duration	Hasin DS, Stinson FS, Ogburn E, Grant BF. Prevalence, correlates, disability, and comorbidity of DSM-IV alcohol abuse and dependence in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. Archives of General Psychiatry. 2007;64(7):830-42. Dawson DA, Grant BF, Stinson FS, Chou PS, Huang B, Ruan WJ. Recovery from DSM-IV alcohol dependence: United States, 2001-2002. Alcohol research and health. 2006;29(2):131-142.
	RR alcohol - incidence	Meier P. Indipendent review of the effects of alcohol pricing and promotion – part B: modeling the potential impact of pricing and promotion policies for alcohol in England: results from the Sheffield alcohol policy model. Sheffield: University of Sheffield, 2008. Dawson DA, Li TK, Grant BF. A prospective study of risk drinking: at risk for what? Drug and Alcohol Dependence. 2008;95(1-2):62-72.
Liver cirrhosis	Incidence	WHO Europe. European Hospital Morbidity Database. Available at: http://data.euro.who.int/hmdb/index.php. Accessed on: 04/12/2013
	Prevalence	OECD calculations using DisMod II
	Mortality	WHO. Mortality and burden of disease for member states. Geneva: WHO, 2011 WHO. Causes of death summary tables. Geneva: WHO, 2011
	Fatality	OECD calculation on mortality / prevalence data
	Remission/duration	Fauci AS, Braunwald E, Kasper DL, Hauser SL, Longo DL, Jameson JL, Loscalzo J. Harrison's Manual of Medicine. London: McGraw Hill Professional, 2009.
	RR alcohol - incidence	Corrao G, Bagnardi V, Zambon A, La Vecchia C. A meta-analysis of alcohol consumption and the risk of 15 diseases. Preventive Medicine. 2004;38(5):613-9.
	RR SES - incidence	Najman JM, Williams GM, Room R. Increasing socioeconomic inequalities in male cirrhosis of the liver mortality: Australia 1981-2002. Drug and Alcohol Review. 2007;26(3):273-8. Crombie IK, Precious E. Changes in the social class gradient of cirrhosis mortality in England and Wales across the 20th century. Alcohol and Alcoholism. 2011;46(1):80-2.
Epilepsy	Incidence	Deutsche Epilepsievereinigung. Prevalence of Epilepsy in Germany. Available at: http://www.epilepsie.sh/Haeufigkeit.319.0.html. Accessed on: 26/09/2013
	Prevalence	Kamtsiuris P, Atzpodien K, Ellert U, Schlack R, Schlaud M. Prevalence of somatic diseases in German children and adolescents. Results of the German Health Interview and Examination Survey for Children and Adolescents (KiGGS). Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz. 2007;50(5-6):686-700. Deutsche Epilepsievereinigung. Prevalence of Epilepsy in Germany. Available at: http://www.epilepsie.sh/Haeufigkeit.319.0.html. Accessed on: 26/09/2013
	Mortality	WHO. Mortality and burden of disease for member states. Geneva: WHO, 2011 WHO. Causes of death summary tables. Geneva: WHO, 2011
	Fatality	OECD calculation on mortality / prevalence data
	RR alcohol - incidence	Meier P. Indipendent review of the effects of alcohol pricing and promotion – part B: modeling the potential impact of pricing and promotion policies for alcohol in England: results from the Sheffield alcohol policy model. Sheffield: University of Sheffield, 2008.
	RR SES - incidence	Heaney DC, MacDonald BK, Everitt A, Stevenson S, Leonardi GS, Wilkinson P, Sander JW. Socioeconomic variation in incidence of epilepsy: prospective

		community based study in south east England. British Medical Journal. 2002;325(7371):1013-6. Benn EK, Hauser WA, Shih T, Leary L, Bagiella E, Dayan P, Green R, Andrews H, Thurman DJ, Hesdorffer DC. Estimating the incidence of first unprovoked seizure and newly diagnosed epilepsy in the low-income urban community of Northern Manhattan, New York City. Epilepsia. 2008;49(8):1431-9.
Injuries	Incidence	Robert Koch Institut. GEDA-10 Survey. Robert Koch Institut: Berlin; 2014. Kahl H, Dortschy R, Ellsäßer G. Verletzungen bei Kindern und Jugendlichen (1–17 Jahre) und Umsetzung von persönlichen Schutzmaßnahmen Ergebnisse des bundesweiten Kinder- und Jugendgesundheitssurveys (KiGGS). Bundesgesundheitsbl - Gesundheitsforsch – Gesundheitsschutz; 2007; 5/6:718-727. Varnaccia G, Saß AC, Rommel A (2014) Das Unfallgeschehen bei Kindern und Jugendlichen in Deutschland. Datenquellen und Ergebnisse. Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz 57:6
	Prevalence	OECD calculations using DisMod II
	Mortality	Federal Health Monitoring Database. Deaths by external causes and their sequelae. Available at: http://www.gbe-bund.de. Accessed on: 13/12/2013
	Fatality	OECD calculations
	Remission/duration	Smartrisk. The burden of injury in Canada. Toronto: Smartrisk, 2009.
	RR alcohol - incidence	Corrao G, Bagnardi V, Zambon A, La Vecchia C. A meta-analysis of alcohol consumption and the risk of 15 diseases. Preventive Medicine. 2004;38(5):613-9.
	RR alcohol - mortality	White IR, Altmann DR, Nanchahal K. Alcohol consumption and mortality: modelling risks for men and women at different ages. British Medical Journal. 2002;325(7357):191.
	RR SES - incidence	Cubbin C, LeClere FB, Smith GS. Socioeconomic status and the occurrence of fatal and nonfatal injury in the United States. American Journal of Public Health. 2000;90(1):70-7.

ANNEX B. LITERATURE TO MODEL INTERVENTIONS

The main reference s that have been used to design and model the interventions are cited in the main text and reported in the reference list. This annex reports the references to some additional papers that, although not directly used to design or model the interventions, have been analysed and resulted useful to better understand the context and the main characteristics of specific families of actions to prevent harmful consumption of alcohol.

Regulation of the marketing of alcoholic beverages

Anderson P. The impact of alcohol advertising. ELSA project report on the evidence to strengthen regulation to protect young people. Utrecht: National Foundation for Alcohol Prevention, 2007.

Anderson P, Baumberg B. Alcohol in Europe: a public health perspective – a report for the European Commission. London: Institute of Alcohol Studies; 2006.

Anderson P, Chisholm D, Fuhr DC. Effectiveness and cost-effectiveness of policies and programmes to reduce the harm caused by alcohol. Lancet. 2009;373(9682):2234-46.

Ellickson PL, Collins RL, Hambarsoomians K, McCaffrey DF. Does alcohol advertising promote adolescent drinking? Results from a longitudinal assessment. Addiction. 2005; 100(2): 235-46.

Engels RC, Hermans R, van Baaren RB, Hollenstein T, Bot SM. Alcohol portrayal on television affects actual drinking behaviour. Alcohol Alcohol. 2009; 44(3): 244-9.

Fisher LB, Miles IW, Austin SB, Camargo CA Jr, Colditz GA. Predictors of initiation of alcohol use among US adolescents: findings from a prospective cohort study. Arch Pediatr Adolesc Med. 2007; 161(10): 959-66.

Hurtz SQ, Henriksen L, Wang Y, Feighery EC, Fortmann SP. The relationship between exposure to alcohol advertising in stores, owning alcohol promotional items, and adolescent alcohol use. Alcohol Alcohol. 2007; 42(2): 143-9.

Jackson MC, Hastings G, Wheeler C, Eadie D, Mackintosh AM. Marketing alcohol to young people: implications for industry regulation and research policy. Addiction. 2000; 95 Suppl 4: S597-608.

Jones SC, Hall D, Munro G. How effective is the revised regulatory code for alcohol advertising in Australia? Drug Alcohol Rev. 2008; 27(1): 29-38.

McClure AC, Stoolmiller M, Tanski SE, Worth KA, Sargent JD. Alcohol-branded merchandise and its association with drinking attitudes and outcomes in US adolescents. Arch Pediatr Adolesc Med. 2009; 163(3): 211-7.

Nelson JP. Advertising bans, monopoly, and alcohol demand: testing for substitution effects using panel data. Pennsylvania State U, Econ. Working Paper No. 1-01-1.

Nelson JP. Alcohol advertising bans, consumption and control policies in seventeen OECD countries, 1975–2000. Applied Economics. 2010; 42: 803–823.

KPMG LLP. Review of the social responsibility standards for the production and sale of alcoholic drinks. London: KPMG; 2008

Saffer H. Alcohol advertising bans and alcohol abuse: an international perspective. NBER working paper no. 3052. 1989.

Saffer H. Alcohol consumption and alcohol advertising bans. NBER working paper 7758. 2000.

Taxation of alcoholic beverages

Anderson P, Baumberg B. Alcohol in Europe: a public health perspective – a report for the European Commission. London: Institute of Alcohol Studies; 2006.

Anderson P, Chisholm D, Fuhr DC. Effectiveness and cost-effectiveness of policies and programmes to reduce the harm caused by alcohol. Lancet. 2009;373(9682):2234-46.

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Cnossen S. Alcohol taxation and regulation in the European Union. Int Tax Public Finance. 2007; 14: 699–732.

Crawford I, Smith Z, Tanner S. Alcohol Taxes, Tax Revenues and the Single European Market. Fiscal Studies. 1999; 20(3): 287–304.

Fogarty J. The own price elasticity of alcohol: a meta-analysis. Working paper. The university of Western Australia Business School.

Herttua K, Mäkelä P, Martikainen P. An evaluation of the impact of a large reduction in alcohol prices on alcohol-related and all-cause mortality: time series analysis of a population-based natural experiment. Int J Epidemiology. 2011; 40(2): 441-54.

Johansson P, Pekkarinen T, Verho J. Cross-border health and productivity effects of alcohol policies. Working paper 2012:10. Institute for evaluation of labour market and education policies, 2012.

Kuo M, Heeb JL, Gmel G, Rehm J. Does price matter? The effect of decreased price on spirits consumption in Switzerland. Alcoholism Clinical and Experimental Research. 2003 Apr;27(4):720-5.

Mäkelä P, Osterberg E. Weakening of one more alcohol control pillar: a review of the effects of the alcohol tax cuts in Finland in 2004. Addiction. 2009; 104(4): 554-63.

Meier PS, Purshouse R, Brennan A. Policy options for alcohol price regulation: the importance of modelling population heterogeneity. Addiction. 2010; 105(3): 383-93.

Nelson JP. How Similar are Youth and Adult Alcohol Behaviors? Panel Results for Excise Taxes and Outlet Density. Atl Econ J. 2008; 36: 89-104.

Nordblom K. The complex attitudes to alcohol taxation. Applied Economics. 2011; 43: 3355–3364.

Österberg EL. Alcohol tax changes and the use of alcohol in Europe. Drug Alcohol Rev. 2011; 30(2): 124-9.

Purshouse RC, Meier PS, Brennan A, Taylor KB, Rafia R. Estimated effect of alcohol pricing policies on health and health economic outcomes in England: an epidemiological model. Lancet. 2010; 375(9723): 1355-64.

Ruopeng A, Sturm R. Does the Response to Alcohol Taxes Differ Across Racial/Ethnic Groups? Some Evidence from 1984-2009 Behavioral Risk Factor Surveillance System. J Ment Health Policy Econ. 2011; 14(1): 13–23.

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