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WORKING PAPER

The generalised cost-effectiveness analysis of alcohol interventions: A comparative measure? The Belgian alcohol policy as a starting point for a cross-country comparison

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THE GENERALISED COST-EFFECTIVENESS ANALYSIS OF ALCOHOL INTERVENTIONS: A COMPARATIVE MEASURE? THE BELGIAN ALCOHOL POLICY AS A STARTING POINT FOR A CROSS-COUNTRY COMPARISON

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Abstract

Background: Since the start of the 2000s, *Generalised* Cost-Effectiveness Analysis (GCEA) studies have been conducted to simulate the cost-effectiveness of an alcohol policy mix, and to evaluate the current alcohol policy of a country. It is hypothesised that GCEA could also be a useful tool to compare the cost-effectiveness of alcohol policies in different countries. The purpose of this study is to investigate if these GCEA studies could be used in a cross-country comparison. A Belgian GCEA on alcohol interventions is conducted in order to explore the possibility for a cross-country comparison with other GCEA studies from Australia, Estonia and Denmark.

Methods: Firstly, the cost-effectiveness of six alcohol interventions (random breath testing, mass media "drink driving" campaign, increased taxation, advertising ban, reduced hours of sale and brief intervention in primary care) was investigated for Belgium with the WHO cost-effectiveness modelling framework. Secondly, a cross-country comparison of GCEA studies on alcohol was conducted. The Belgian and Estonian cost-effectiveness ratios were discussed more in detail since both studies used the WHO framework.

Results: The combination of the six alcohol interventions in Belgium could annually save up to 17,990 DALYs and the implementation of these interventions would cost 40.3 million euros per year. Advertising ban (35 euros per DALY averted) and increased taxation (172 euros per DALY averted) are the most cost-effective interventions to reduce hazardous alcohol use. In fact, the cross-country comparison showed that these legislative interventions (e.g. increased taxation, advertising ban and reduced opening hours) are the most cost-effective strategies in Australia, Belgium, Estonia and Denmark. Furthermore, Estonia generates better cost-effectiveness ratios than Belgium, especially for random breath testing, since the prevalence of hazardous drinking and alcohol-related traffic accidents is higher in the Estonian population.

Conclusion: A cross-country comparison with GCEA studies is confronted with conceptual and methodological differences across studies. The GCEA studies should use a uniform methodology, such as the WHO framework, in order to allow comparisons on the cost-effectiveness of different alcohol policies. During the contextualisation process of a GCEA study, however, uniformity of the methodology may still be endangered by the input of parameters (such as the intervention effects, the cost calculation of the interventions, etc.).

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1. INTRODUCTION

Alcohol is responsible for 69 million disability adjusted life years (DALYs[1]) and alcohol is ranked as the third risk factor for burden of disease in the world (WHO, 2009; Lim et al., 2012). The economic impact of alcohol is as damaging to the nations as its health effects (Burke, 1988). In Europe, the social cost attached to alcohol was estimated at 1.3% of the GDP: 125 billion euros in 2003 (Anderson & Baumberg, 2006), and 156 billion euros in 2010 (Rehm, Shield, Rehm, Gmel & Frick, 2012). More particularly, Belgian data confirm an even higher impact of alcohol on society. A Belgian social cost study on alcohol found a social cost proportion of 2.5% of GDP in 1999, equivalent to 6 billion euros (Degreef, Pacolet & Bouten, 2003). Moreover, a more recent study on the public expenditures for drug control and drug problems in Belgium indicated that spending on alcohol is much higher in comparison to the spending for illegal drugs, psychoactive medication and tobacco. The drug related resources are allocated for 64.8% to alcohol policy and 75.4% of the treatment expenditures is for alcohol (Vander Laenen, De Ruyver, Christiaens & Lievens, 2011).

It is clear that this burden of alcohol poses several challenges for public management. Moreover, the governmental budgets for alcohol policy are limited due to the current economic crisis and the resulting austerity. Health economic evaluations may provide valuable information for policy makers, in order to allocate the public resources for alcohol policy in the most efficient and effective way. These studies are in keeping with the New Public Management (NPM) movement's emphasis on policy evaluation in governmental operations. This NPM provides a universal economic model of governance and organisation with a focus on efficiency (Christensen & Lægreid, 2001). Moreover, NPM has encouraged economic evaluation research, the tools and ideals of evaluation studies are as relevant to alcohol policy as they are to other government functions such as health care, education and police. For example, the cost-effectiveness of alcohol prevention and treatment models has been assessed by a number of cost-effectiveness analysis (CEA) studies (e.g. Månsdotter, Rydberg, Wallin, Lindholm & Andréasson, 2007; Raistrick, Heather & Godfrey, 2006; Tobler & Stratton, 1997). In addition, the cost-effectiveness of an alcohol policy mix has been studied with the Generalised Cost-Effectiveness Analysis (GCEA). Using this GCEA it is possible to simulate the most cost-effective alcohol policy mix of a country and to evaluate the current alcohol policy. Firstly, GCEA studies measure which mix of government interventions is likely to produce the greatest effectiveness in terms of costs and health outcome. Therefore, the intervention strategies to reduce the burden of hazardous alcohol use are evaluated by their comparative impact on population-level health. Secondly, the interventions are evaluated with respect to a counterfactual of "doing nothing" (Murray, Evans, Acharyan & Baltussen, 2000) and this null scenario provides information for decision-makers on what could be achieved if they reallocated the expenditures for alcohol policy (Edejer et al., 2003). The first GCEA for alcohol

was carried out at the level of WHO regions by Chisholm, Rehm, Van Ommeren & Monteiro (2004). Furthermore, three generalised cost-effectiveness studies (Cobiac, Vos, Doran & Wallace, 2009; Holm, Veerman, Cobiac, Ekholm & Diderichsen, 2014; Lai, Habicht, Reinap, Chisholm & Baltussen, 2007) determined if a specific country mix (Australian, Danish and Estonian) of alcohol interventions represented an efficient use of resources. The country level analyses showed that an increase in taxation and advertising bans should be the highest priority of a cost-effective alcohol policy. Chisholm et al. (2004) confirmed that these population-wide measures imply the most cost-effective response in populations with moderate or high alcohol use.

The GCEA could also be a useful tool to compare the cost-effectiveness of alcohol policies in different countries, therefore the current study investigates if GCEA studies could be used in a cross-country comparison. An analysis of different government intervention mixes may enhance the comparison of alcohol policies between countries. In fact, a cross-country comparison of the cost-effectiveness of alcohol interventions would enable to monitor alcohol interventions with benchmarking information and this may potentially improve the efficiency and effectiveness of alcohol policy (Ritter, 2007).

The current study investigates the possibility to conduct a cross-country comparison with GCEA studies. In order to identify methodological issues during a GCEA cross-country comparison, we start with an evaluation of the cost-effectiveness of the Belgian alcohol policy interventions and we illustrate a comparison across countries. Firstly, the Belgian setting is an interesting case from a public management point of view because the epidemiological[2] and economic setting of the Belgian alcohol policy indicates room for improvement. The optimal intervention mix will point out if improvements of the Belgian alcohol policy are possible by changing the weight of interventions. This will result in recommendations for health policy-makers and programme managers. Secondly, this Belgian GCEA allows us to identify methodological issues during the execution of the GCEA and to investigate the feasibility of a cross-country comparison with other countries that already executed generalised cost-effectiveness studies. The number of executed GCEA studies on alcohol is limited to three countries: Australia, Estonia or Denmark. This Belgian GCEA study expands the cross-country comparison with a country of the central-western and western European country group, by doing so, countries with different drinking traditions and patterns could be compared[3].

The paper has been organised in the following way. The first part deals with the GCEA methodology; it describes the approach that is used for selecting the interventions and collecting data for Belgium. The next section outlines the results; the cost-effectiveness of Belgian alcohol interventions is presented and compared across countries. Finally, the methodological issues concerning a cross-country comparison with GCEA studies are discussed.

2. METHODS

The GCEA, first developed by the World Health Organization CHOosing Interventions that are Cost-Effective (WHO-CHOICE) project, is a methodology that exceeds the cost-effectiveness analysis (CEA) by overcoming a number of its limitations (e.g. the evaluation is restricted to a single new intervention; Murray et al., 2000). Its application provides information of multiple interventions at country (or regional) level by generalising results from one setting to another (Edejer et al., 2003), and this enables the identification of the optimal mix of interventions. Furthermore, the method investigates to what extent the current intervention mix is cost-effective, and if the proposed new intervention is appropriate[4] (Hutubessy, Chisholm, Edejer & WHO-CHOICE, 2003). Therefore, it eliminates the effects of current alcohol policy by creating a scenario of no interventions, and the effects of (new or current) interventions are compared with this null situation (Edejer et al., 2003). These key features of the GCEA should make it a comparative measure.

The current study used the WHO-CHOICE method to simulate the cost-effectiveness of multiple interventions since it is a standardised data tool that allows cross-country comparisons. The effect of interventions on the health of the Belgian population (10 years implementation of the intervention) was derived via a multi-state population model (PopMod) and this population-level impact was expressed in disability adjusted life years (DALYs[5]). A contextualisation was conducted by collecting Belgian-specific demographic and epidemiological data, and Belgian-specific intervention costs. In addition, the effectiveness of alcohol interventions has been investigated by consulting review studies. These data were entered in the WHO-CHOICE tool and during the simulation the future intervention outcomes and costs were discounted at a rate of 3% as recommended by Edejer et al. (2003)[6]. No uncertainty analyses have been conducted since the study is limited to the calculation of the average cost-effectiveness of interventions for the cross-country comparison[7].

Data

The alcohol interventions are supposed to change incidence, prevalence and mortality of alcohol-related diseases and injuries, therefore epidemiological data was collected. The prevalence of hazardous alcohol use originated from the Belgian health interview survey 2008 (IPH, 2010). The Directorate-general Statistics and Economic information provided mortality rates from 2008[8]. Furthermore, the calculation of DALY requires disability weights, the measure for the decline of health associated with alcohol use disorders (Rehm & Frick, 2010). The study of Stouthard et al. (1997) provides a comprehensive set of disease-specific disability weights in a Western European context.

The intervention costs are assessed in Euros for the year 2008[9] and derived from the public expenditure study Drugs in Figures III (Vander Laenen et al., 2011). The missing intervention costs (e.g.

medical expenses for a brief intervention and budget for a media awareness campaign on alcohol) were collected by consulting governmental administrations. The focus lies on the public expenditures (including social security payments) and private costs (e.g. non-refundable part of medical expenses and sponsoring) that are necessary to deliver each intervention; meaning that tax revenues from alcoholic beverages are beyond the scope of this study. Moreover, this study does not take into account costs for the family or intimates, time costs of the patient to participate at the interventions and productivity losses. These costs have neither been estimated in the previous GCEA studies on alcohol (Cobiac et al., 2009; Holm et al., 2014; Lai et al., 2007)[10], possibly due to methodological problems with these cost estimates (Moller & Matic, 2010).

Interventions

The selection of interventions that reduce alcohol-attributable harm started with a comprehensive review of the literature (Anderson & Baumberg, 2006; Babor et al. 2010; Mulvihill, Taylor & Waller, 2005; Ludbrook et al., 2002; Ludbrook, 2004). The literature review resulted in a global list of 37 alcohol interventions and this list was reduced to a final selection of six interventions based upon three parameters: the effectiveness of alcohol policy, the cost-effectiveness of interventions and previous research. Firstly, an effective alcohol policy should focus on the following five domains (Anderson & Baumberg, 2006): (1) policies that regulate the alcohol market; (2) policies that reduce drinking and driving; (3) policies that support education, communication, training and public awareness; (4) policies that support the reduction of harm in drinking and surrounding environments; (5) policies that support advice and treatment for hazardous and harmful alcohol consumption and alcohol dependence. From this point of view, the optimal policy mix will only be possible if at least one intervention of each domain is selected[11]. Secondly, the study takes into account the effect of each intervention and the feasibility of adopting an intervention from a policy viewpoint. This means that interventions with a high degree of effectiveness are more likely to be selected. To this end, systematic reviews or meta-analyses were consulted. For example, the programme for drunk driving offenders by placing an interlock that prevents an impaired driver from operating the vehicle is excluded from this study since there is no review study available with evidence that alcohol locks reduce alcohol-related crashes (Marques, 2009). Thirdly, given the aim of a cross-country comparison, the selection process of interventions is also determined by previous GCEA studies, meaning that similar cost-effective interventions were selected and the selection was limited to six interventions[12].

The selection process above resulted in six interventions for the GCEA of the Belgian alcohol policy. The intervention effects from the literature are presented in terms of change in alcohol consumption[13] or road traffic crashes and injuries.

1. Random breath testing (RBT): i.e. programmes that randomly stop drivers to detect and prevent driving with a blood alcohol concentration of 0.5g/l. Different studies consider RBT as an effective strategy to reduce alcohol-related traffic crashes and injuries. In fact, review studies on RBT retrieved a 18% decline in injuries (Peek-Asa, 1999) and crashes (Shults et al., 2001). This GCEA study took into account a 18% reduction in fatal traffic injuries and a smaller reduction of 15% for non-fatal injuries[14] (Chisholm et al., 2004).

2. Mass media "drink driving" campaign: i.e. the nationwide implementation of a mass media campaign to prevent drinking and driving. A well-executed mass media campaign is effective in reducing alcohol-related crashes according to Elder et al. (2004). This systematic review of eight studies found a median decrease in injury-producing crashes of 10%.

3. Increased taxation: i.e. an increase the alcohol price by raising the excise taxation with 25% or with 50%. Alcohol consumption is determined by the price, therefore the effects of taxation are measured in terms of price elasticity[15]. The results of the meta analysis of Wagenaar, Salois & Komro (2009) were consulted: the means of reported elasticities are -0.46 for beer, -0.69 for wine and -0.80 for spirits.

4. Advertising ban: i.e. a comprehensive advertising ban (e.g. via TV, radio, billboards, etc.) on alcoholic products. This intervention is recommended since research (e.g. Tapert et al., 2003; Anderson, de Bruijn, Angus, Gordon & Hastings, 2009; Winpenny et al., 2012; Bosque-Prous et al., 2014) indicated that alcohol advertisements influence adolescents and adults with heavy drinking patterns. Moreover advertising bans are recognised as a highly cost-effective measure to reduce harmful alcohol use (Anderson, 2009). The study of Saffer and Dave (2002) used a pooled time-series analysis of data from 20 countries over a period of 26 years and showed an increase of one ban (of media or beverage type) reduces consumption by 5% to 8%.

5. Reduced hours of sale: i.e. a restriction of the purchase of alcohol by reducing hours of sale among retail outlets. Popova, Giesbrecht, Bekmuradov & Patra (2009) and Hahn et al. (2010) concluded that decreasing hours of sale (by 2 hours or more) is an effective strategy to prevent alcohol-related harm. Nevertheless these review studies were not able to report a mean effect. Therefore, the results of the study of Norström and Skog (2005) were used since it was the only study that measured the effect on the alcohol consumption for a European country. The authors showed that the Saturday opening of alcohol retail shops in Sweden increased alcohol sales and consumption with 3.7%.

6. Brief intervention in primary care: i.e. counselling for at-risk drinkers by a general practitioner. An overload of CEA studies on brief interventions is available. The meta-analyses of Bertholet, Daeppen, Wietlisbach, Fleming & Burnand (2005) and Kaner et al. (2009) reported a reduction in alcohol consumption of -38g/week[16]. Moreover, Whitlock, Polen, Green, Orleans & Klein (2004) systematically reviewed studies on behavioural counselling interventions in primary care and revealed a 13% to 34% reduction in weekly drinks. In line with these results, this GCEA study took into account an effect of

22% reduction in alcohol consumption (Moyer, Finney, Swearingen & Vergun, 2002; Chisholm et al., 2004).

3. RESULTS

Belgian optimal intervention mix

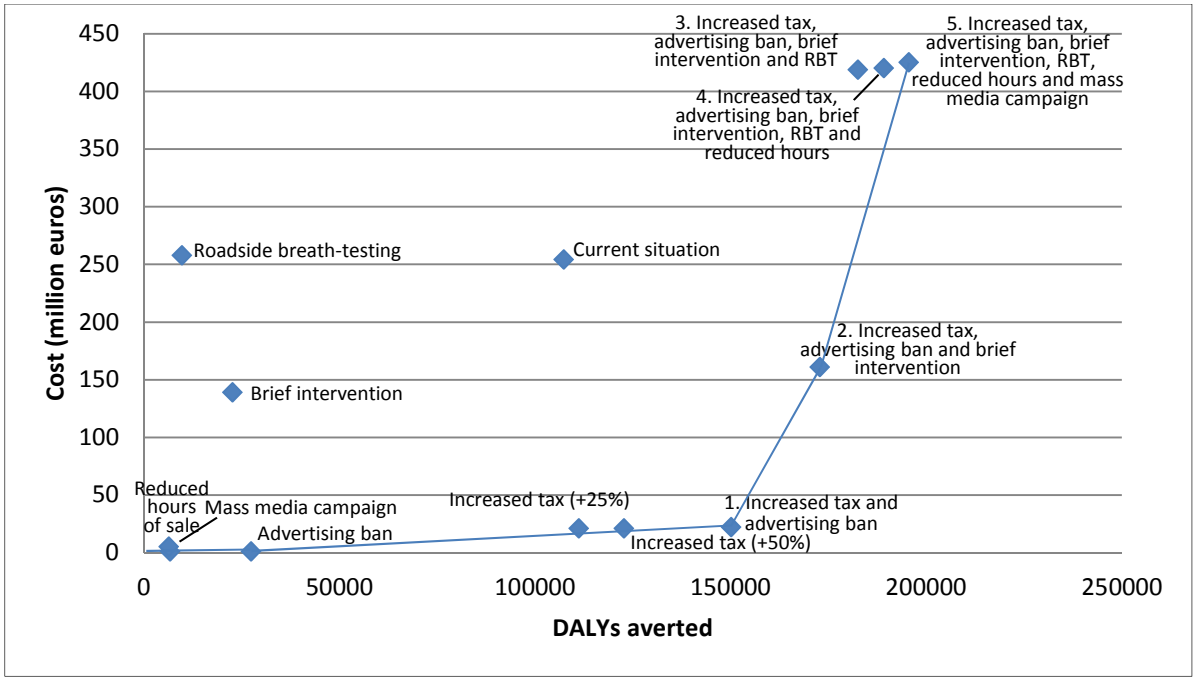
Table 1 presents the annual costs and effects of different interventions to reduce the hazardous alcohol use in Belgium. The effectiveness of the interventions (in terms of DALYs averted per year) ranges from 637 DALY for the mass media "drink driving" campaign to 12,274 DALY for increased taxation with 50% (See Table 1). There is also large variability in the yearly cost of the interventions: from 0.1 million euro for an advertising ban to 25.7 million for random breath testing. In terms of cost-effectiveness, an advertising ban is the most cost-effective intervention to reduce alcohol burden, a volumetric taxation (+50%) and a reduction of opening hours complete the top three. The cost-effectiveness of these three interventions ranges from 35 to 185 euros per DALY saved, this is in contrast with the random breath testing that costs more than 26,000 euros per DALY averted. The combination of the six interventions could annually save 17,990 DALYs[17], this would cost 40.3 million euros per year.

Table 1: Cost-effectiveness of alcohol interventions in Belgium

Intervention	DALYs averted per year (a)	Cost per year (Euros) (b)	ACER[18] (Euros per DALY saved)(b)/(a)
Current situation (2008)	10,731	254,073,150	23,677
Increased taxation (current +25%)	11,120	2,111,292	190
Increased taxation (current +50%)	12,274	2,111,292[19]	172
Random breath testing	974	25,713,598	26,400
Mass media "drink driving" campaign	637	515,745	810
Advertising ban	2,736	96,647[20]	35
Reduced hours of sale	666	123,006	185
Brief intervention in primary care	2,267	13,881,090[21]	6,123
Combination of interventions	17,990	40,319,309	2,241

Figure 1 demonstrates the optimal intervention mix for a 10-year period. From a cost-effectiveness point of view, the best combination in case of two policy options is increased taxation and advertising ban; and the brief intervention in primary care should be implemented as a third policy intervention. The figure also illustrates the cost-effectiveness of the current situation (2008) and shows the potential improvements (in terms of averted DALYs) by implementing the combination of the six studied interventions.

Figure 1: Cost-effectiveness of alcohol interventions in Belgium (over 10 years)



Comparison with Australia, Estonia and Denmark

First of all, the four countries (Belgium, Australia, Estonia and Denmark) that conducted a GCEA study on alcohol listed volumetric taxation, advertising ban and reduced opening hours[22] as the most cost-effective strategies. Additionally, the cost-effectiveness of the interventions was examined more in detail by looking at the costs, averted DALYs and ACER. Table 2 only presents the data for Belgium and Estonia, since it is not possible to compare with the figures of Denmark or Australia due to conceptual and *methodological* differences[23].

Table 2: Cross-country comparison for Belgium and Estonia[24]

Intervention	Annual intervention effect (DALYs per 1 million population)		Annual intervention cost (euros, per capita)		ACER (Euros per DALY saved)	
	Belgium	Estonia	Belgium	Estonia	Belgium	Estonia
Increased taxation (current +50%)	1,151	2,260	0.20	0.11	172	47
Random breath testing	91	1,423	2.41	0.55	26,400	387
Advertising ban	256	756	0.01	0.07	35	93
Reduced hours of sale	62	736	0.01	0.08	185	114
Brief intervention in primary care	213	755	1.30	0.56	6,123	747

Firstly, the Estonian interventions accomplish more gain in health than the Belgian interventions (e.g. random breath testing is ten times more efficient). This could be explained by higher prevalence of hazardous drinking and alcohol-related traffic accidents for Estonia. Actually, the 12-month prevalence of alcohol use disorders was 10.2% for Estonia and 5.8% for Belgium in 2010. The alcohol-attributable fractions for road traffic accidents are also much higher for Estonia (44.9% for males, 44.3% for females) than for Belgium (19.5% for males, 7.8% for females) (WHO, 2014). Secondly, the intervention costs per capita are higher for Belgium, except for advertising ban and reduced hours of sale, and this may stem from economic differences between the countries. The eastern European countries have a lower economic power in terms of GDP than western European countries (Shield, Kehoe, Gmel, Rehm & Rehm, 2012). Moreover there is an eight-year *time lapse between* the two studies, consequently it was expected that Belgium would report higher costs due to inflation.

The higher effects and lower costs for Estonian alcohol interventions logically lead to better cost-effectiveness ratios. Nevertheless, both countries have the highest cost-effective rates for the three legislative interventions in comparison to random breath testing and brief intervention. As for these other interventions, we notice that brief intervention is the more favourable cost-effective option for Belgium, whereas random breath testing is the most cost-effective strategy for Estonia. As mentioned before, the alcohol related traffic accidents are an important contributor to burden of disease in Estonia and thus the effect of random breath testing is much higher.

4. DISCUSSION

This study contributes to the discussion to what extent the GCEA approach can be applied to develop comparisons on the cost-effectiveness of alcohol policies between countries. Therefore, it starts with an evaluation of the Belgian alcohol interventions in terms of cost-effectiveness. This Belgian contextualisation of the GCEA is conducted in order to provide decision-makers with information on what could be achieved if they could start again to design the alcohol policy and reallocate all resources (Edejer et al., 2003).

The results show that the Belgian policy makers should ideally adapt legislative interventions (advertising ban, volumetric taxation and a reduction of opening hours) in order to develop the most cost-effective alcohol policy. These legislative interventions are environmental prevention measures with a universal form, therefore these results are in line with the "prevention paradox". The paradox states that interventions targeted to the whole population (universal prevention) are more likely to reduce population levels of alcohol-related harm than are those addressing high-risk groups (Stockwell et al., 2004).

During the recent years, the Belgian government adopted these legislative interventions to a limited extent. A code of conduct on advertising for alcoholic beverages have been developed in 2013, nevertheless this code does allow promotion be it under specific terms (e.g. advertising may not suggest that alcohol is needed to create a festive atmosphere). Moreover, the Belgian alcohol excise duties have been raised in 2013 (e.g. for still wine with 8%: 4.22 euros/HL). Still the taxation rates are lower than those in other countries. For instance it would take a 50% increase of Belgian excise wine duties for 2008 to make the taxation wine rates similar to the ones in the Netherlands (European commission, 2008). Despite the implementation of these alcohol policy strategies in recent years, the examples show that there is still room for improvement for the Belgian alcohol policy. As for the personal interventions, the Belgian policymakers should prefer investments in brief intervention above random breath tests. However, the recent coalition agreement of the Federal government (2014) aims for an increase of the yearly drink driving tests (target population of one in three drivers)[25].

In conclusion, this GCEA identifies the optimal intervention mix for alcohol control in Belgium and reveals a number of factors that could improve the cost-effectiveness of the alcohol policy. Ideally, this leads to an evidence-based policy, where the financial resources are assigned to the most cost-effective interventions (Wood et al., 2010). Despite the high number of DALYs that could be averted by universal prevention strategies (e.g. advertising ban, volumetric taxation and a reduction of opening hours), it should be stated that more targeted strategies for addressing harm related to hazardous alcohol users (e.g. brief intervention) are also required (Stockwell et al., 2004). In addition, policy makers need to keep in the mind that alcohol policy should focus on multiple domains

(Anderson & Baumberg, 2006), therefore the roadside breath-testing may remain important for Belgium as a specific intervention in the policy domain to reduce drinking and driving. Moreover, the alcohol policy is considered as a cross-cutting issue, meaning that the management is not limited to one single sector, it encompasses the central government and the other public sector agencies who are involved (Butler, 2009). This policy making process for alcohol is even more complex since the extensive lobbying by the alcohol industry may obstruct the implementation of the most effective policies and initiatives (Caswell & Maxwell, 2005). In Belgium, the National Alcohol plan 2014-2018, that proposed evidence-based alcohol policy interventions, could not be implemented due to a lack of political consensus for the proposed measures related to the supply side of alcohol. As is the case in the UK (McCambridge, Hawkins & Holden, 2014), corporate lobbying had an important impact on the failure to the Alcohol plan politically approved.

This GCEA allows us to evaluate multiple alcohol interventions for one country or region, and in doing so, it provides a framework for future policy directions. Moreover, a GCEA cross-country comparison may provide important insight into the dynamics of alcohol policy by exploring the cost-effectiveness of various policy options. Country profiles providing information on alcohol policy and its impact on DALYs could be compiled and used as an economic evaluation tool to find the most cost-effective way of organising alcohol interventions in different settings. It is unknown if this GCEA approach can be applied to develop comparisons between countries (Ritter, 2007). Therefore, the main goal of this study was to investigate if the GCEA could be used as a comparative measure. A cross-country comparison have been conducted for Estonia and Belgium. The results of this cross-country comparison are limited to an evaluation of alcohol intervention effects and their costs, no statements can be made about the quality of the interventions in the different countries. The main conclusion is that the legislative interventions are the most cost-effective strategies, furthermore we notice better cost-effectiveness ratios (for each intervention except advertising ban) for Estonia. Chisholm et al. (2004) indicated that this variation in cost-effectiveness ratios could be explained by the country specific prevalence of hazardous drinking and alcohol-related traffic accidents.

The current study could not draw conclusions on a cross-country level with Australia and Denmark because the variations could be attributed to methodological differences. Moreover, the results of the comparison between the Belgian and Estonian GCEA should be interpreted with caution. During the data collection of this GCEA study, we were confronted with a couple of methodological limitations, and these limitations may lead to distorted figures or could endanger the cross-country comparison.
Firstly, the effect of each intervention was limited to the measurement in terms of reduced hazardous alcohol use and reduction of road traffic accidents (for RBT and drink diving campaign) in the current study, as was the case in the studies of Lai et al. (2007) and Chisholm et al. (2012). Whereas Cobiac et

al. (2009) and Holm et al. (2014) evaluated the effect on multiple alcohol-related diseases (e.g. ischaemic heart disease, cirrhosis, cancer, etc.) and injuries (e.g. road traffic accidents, falls, fires, etc.). It is clear that the latter studies have a broader scope and, consequently, the effect of alcohol interventions in terms of DALYs is higher. The GCEA studies should use a common conceptual framework, such as the WHO cost-effectiveness modelling framework, in order to facilitate cross-country comparisons. The WHO framework allows us to evaluate all interventions in a consistent and comparable manner since it provides a theoretical framework of analysis, the definition of interventions, the concept of the counterfactual, the intervention implementation period, etc. (Edejer et al., 2003). If GCEA studies opt for a broader scope than the WHO framework, it is recommendable to present the results for hazardous alcohol use separately from those for alcohol-related diseases and injuries.

Secondly, each intervention effect derives from scientific research, but the results of different outcome studies (e.g. CEA) may conflict. These studies cannot produce the absolute truth, because the effectiveness of a particular intervention will be determined by multiple factors. For example, in contrast with Saffer and Dave (2002), other studies (Nelson & Young, 2001; Nelson, 2010) state that advertising bans do not reduce alcohol consumption. Nelson & Young (2001) even state that advertising bans may lead to a consumption increase because suppliers compete for market share by price falls. Consequently, a GCEA is determined by the intervention effects that are derived from outcome studies. This problem can partially be overcome by taking into account the effectiveness of alcohol interventions published in systematic review or meta-analysis studies. The extrapolation of intervention effects may still be difficult because these review studies are also confronted with different sociocultural settings (e.g. regional patterns of drinking may influence the effect of an intervention; Chisholm et al., 2004). Therefore, GCEA studies conduct an uncertainty or sensitivity analysis in order to incorporate the sustainability of intervention health effects over time or to take into account the best and worst case scenario of the effectiveness of interventions. However, the current GCEA study was limited to point estimates of effectiveness ratios (without taking into account the ranges of intervention effects) and compares the average cost-effectiveness in the cross-country comparison. Ideally, GCEA studies should consult meta-analysis[26] that investigate the effectiveness of alcohol interventions by regions and they should conduct a sensitivity analysis.

The GCEA studies are confronted with additional limitations concerning the interventions effects. The GCEA only takes into account the primary purpose of alcohol interventions (namely the reduction of alcohol consumption and road traffic accidents); other effects like productivity gain or reduced violence are not considered. For instance, a reduction in violence is an important effect of the intervention that restricts opening hours (Duailibi et al., 2007). The effect of preventive interventions may also be underestimated since the impact *of prevention* on drinking behaviour is difficult to

measure and the effect depends on intermediary variables (Birckmayer, Holder, Yacoubin & Friend, 2004). Furthermore, limited information about the interaction of interventions, and how this affects the effectiveness of intervention combinations, is available for the GCEA studies (Holm et al., 2014). It is clear that the effect of interventions on alcohol consumption should be interpreted carefully since the effectiveness of interventions are imbued with a degree of uncertainty (Hutubessy et al., 2003). Further research is necessary to strengthen the evidence on interventions effects, moreover the combined effect of multiple interventions should be investigated.

Thirdly, the cost calculation of interventions is determined by multiple factors such as the coverage rate of interventions (e.g. random breath testing for 40% of the drivers versus 20% of the drivers) and the data sources. For instance, intervention costs for health interventions have been calculated for Belgium (year 2005) in the study of Chisholm, Rehm, Frick & Anderson (2009)[27], and a comparison with the current GCEA study (year 2008) shows us large differences between intervention costs: e.g. the cost for brief intervention (with coverage rate of 30%) was estimated to cost 43.9 million euros in the study of Chisholm et al. (2009) and 13.9 million euro in the current study. The differences in cost calculation could be attributed to the data source, since Chisholm et al. (2009) obtained cost information by regional costing experts (data source WHO CHOICE: Johns, Baltussen & Hutubessy, 2003) and the current study collected country-specific costs from the governmental administrations. Consequently, a cross-country comparison should take into account GCEA studies with similar data sources. The data from governmental administrations is recommend since these actors dispose of more complete data on public authorities funding.

Fourthly, each GCEA study uses disability weights to calculate DALYs. However, it is not possible for the GCEA studies, in terms of research time, to establish an expert panel to investigate the country-related disability weights. Scientific research has to be consulted, for example Lai et al. (2007) use data from an Estonian burden of disease study (Lai et al., 2003) and Chisholm et al. (2009) refer to the Dutch disability weight study (Stouthard et al., 2000). Methodological differences (e.g. valuation method) occur between these disability weight studies, this may influence the DALYs in the GCEA studies and the cross-country comparison in a next phase[28]. Moreover, the disability weights in the Netherlands (Stouthard et al., 1997) and global burden of disease study (Murray & Lopez, 1996) are calculated for different stages of a disease. No Belgian incidence or prevalence data are available on this detailed level (problem drinking versus manifest alcoholism), therefore the average disability weight for alcohol disorders is used. This may result in less accurate figures.

These limitations confirm that the GCEA must be regarded as an approximation because it is built mainly on various assumptions. In order to have the most realistic estimation it is important to collect accurate demographic and epidemiological information. In fact, the quality of the data is a crucial

factor for a GCEA, since they determine the success of a GCEA study. Moreover, a uniform methodology is necessary to compare the cost-effectiveness of different alcohol policies. In this respect, the initiative of the WHO to develop a guide to GCEA is a step in the good direction. During the contextualisation process of a GCEA study, it is still very likely that the uniformity of the methodology will be endangered by the input of parameters (such as target coverage rate of the interventions, the choice of the intervention effect, the cost calculation of the interventions, etc.), and this may disturb the possibility to conduct a cross-country comparison. From a methodological point of view, the GCEA is not the best way to compare alcohol policies between countries. Methodological problems have also been acknowledged in other types of studies that compared alcohol policies, namely public expenditure and social cost studies (Lievens et al., 2012; Ritter, 2007). In conclusion, the challenge continues: finding a way to overcome the methodological and conceptual problems in a cross-country comparison of alcohol policies.

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6. ENDNOTES

[1] DALY is a metric to determine the burden of disease. Therefore, it takes into account the years of potential life lost (YLL) due to premature mortality and the years of productive life lost (YLD) due to disability.

[2] In a 2008 Belgian health survey 10.3% of the participants reported a problematic alcohol consumption (Gisle et al., 2010). Additionally, it can be noticed that 41% of the Belgian students reported heavy episodic drinking during the past 30 days (Hibell et al., 2009).

[3] Denmark represents a Nordic country and Estonia belongs to the central-eastern and eastern country group. These geographical areas are based upon drinking traditions and patterns (WHO, 2013).

[4] The traditional CEA is limited to evaluations of new interventions in comparison with the current mix.

[5] DALY is the sum of years of potential life lost (YLL) due to premature mortality and the years of productive life lost (YLD) due to disability.

[6] Age-weighting, which is also available in the WHO-CHOICE tool, has not been conducted for the cross-country comparison (the Estonian study did not use age-weighting either). Age-weighting is used in GCEA studies to take into account the lower value of life at young and older ages than people in middle-age (Edejer et al., 2003).

[7] No uncertainty or sensitivity analysis have been conducted, since the mean intervention effects and costs are compared in the cross-country comparison. Moreover, Holm et al. (2014) states that the sensitivity analyses in GCEA studies only affect the results marginally.

[8] The prevalence, mortality and remission for alcohol disorders are provided as inputs in DISMOD II. This software tool is used to calculate the incidence and case-fatality for alcohol disorders.

[9] Nevertheless, a cost calculation over 10 years is conducted in order to simulate an intervention implementation period of 10 years. We took into account that some costs (e.g. campaign for alcohol advertising ban) are only made in the first year of the intervention.

[10] Except for the study of Cobiac et al. (2009) that measured the time and travel cost for the patients.

[11] There is no intervention selected in the fourth domain (e.g. interventions with focus on responsible beverage service or safer bar environment), because the effect on alcohol consumption or road traffic accidents could not be confirmed by a systematic review or meta-analysis. Three interventions (increased taxation, advertising ban and reduced hours of sale) belong to the first domain of regulating the alcohol market.

[12] Other GCEA studies took into account five to eight interventions. The study of Estonia (Lai et al., 2007), which is included in the cross-country comparison, refers to five interventions: increased taxation, roadside breath-testing, reduced access to retail outlets, advertising ban and brief advice in primary care. The current study also takes into account the mass media campaign in order to evaluate an intervention of the fifth policy domain that supports education, communication, training and public awareness.

[13] The intervention effects in terms of alcohol consumption are used to estimate the effect on incidence or prevalence of hazardous alcohol use. For example, a 4% reduction in the incidence of hazardous alcohol use for advertising ban is simulated based upon the results of Saffer and Dave (2002) (Chisholm et al., 2004).

[14] The 15% reduction of non-fatal injuries via RBT is retrieved from studies that analysed the alcohol-attributable fractions for road traffic injury (Ridolfo & Stevenson, 2001; Rehm et al., 2004).

[15] In alignment with Chisholm et al. (2004), the effect of elasticity on consumption is taken into account for two-thirds, because heavy drinkers are less responsive to price changes.

[16] A decrease of 38g/week in alcohol consumption is similar to a reduction of 22% in case of a weekly alcohol consumption of 176g (weekly alcohol overconsumption for women from 150-180 grams and for men from 220-264grams).

[17] It is assumed that the effect of interventions decreases if they are combined. Therefore, the combination of six interventions averts only 92% of the sum of the individual interventions effects (DALYs).

[18] Average cost-effectiveness ratio

[19] The intervention cost for increased taxation does not change, since it is assumed that the cost for the taxation control system will not rise if the excise taxation increases.

[20] The intervention costs for advertising ban and reduced hours of sale include the yearly costs for enforcement and the cost for a media awareness campaign in the first year (150.000 euros distributed over ten years).

[21] The cost of brief intervention is based upon the assumption of four visits to the general practitioner (Chisholm et al. 2004), meaning an average cost of 73.56 euros per patient per year (30% of these medical expenses is non-refundable for patients in Belgium).

[22] Except for Australia that did not evaluate reduced opening hours. The intervention of "minimum legal drink age to 21" was listed as third cost-effective strategy.

[23] The Australian and Danish study evaluated the intervention effects on multiple alcohol-related diseases and injuries whereas the Estonian and Belgian study measured the effect on hazardous alcohol use and the number of road traffic accidents.

[24] The cost-effectiveness of mass media "drink driving" campaign is missing since Lai et al. (2007) did not analysed this intervention for Estonia.

[25] In the analysis, a duplication of the target population for brief intervention (from 15% to 30% of the hazardous drinkers) and for random breath testing (from 20% to 40% of the drivers) has been simulated.

[26] The meta-analyses are preferred since these studies employ statistical methods to synthesize the effects from several studies into a single quantitative estimate (Petticrew & Roberts, 2006). Unfortunately, the current study retrieved the intervention effects mainly from systematic reviews, except for the meta-analyses of Moyer et al. (2002), Bertholet et al. (2005), Kaner et al. (2009) and Wagenaar et al. (2009).

[27] The WHO CHOICE tool developed guidelines to estimate the costs of the interventions (Chisholm et al., 2004); this tool has been used to evaluate the cost-effectiveness of interventions in reducing alcohol-related harm for 22 European countries (IAS, 2009).

[28] There is a cross-national agreement available on disability weights, but it is only calculated for 15 diseases (Schwarzinger et al. 2003). This study also indicates a high level of agreement on disability weights in Western European countries (method: visual analogue scale (VAS) and time trade-off technique).