Are the "Best Buys" for Alcohol Control Still Valid? An Update on the Comparative Cost-Effectiveness of Alcohol Control Strategies at the Global Level

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ABSTRACT. Objective: Evidence on the comparative cost-effectiveness of alcohol control strategies is a relevant input into public policy and resource allocation. At the global level, this evidence has been used to identify so-called best buys for noncommunicable disease prevention and control. This article uses global evidence on alcohol use exposures and risk relations, as well as on intervention costs and impacts, to re-examine the comparative cost-effectiveness of a range of alcohol control strategies. **Method:** A "generalized" approach to cost-effectiveness analysis was adopted. A new modeling tool (OneHealth) was used to estimate the population-level effects of interventions. Interventions that reduce the harmful use of alcohol included brief psychosocial interventions, excise taxes, and the enactment as well as enforcement of restrictions on alcohol marketing, availability, and drink-driving laws. Costs were estimated in international dollars for the year 2010 and effects expressed in healthy life years gained. Analysis was carried out for 16 countries spanning low-, middle-, and high-income settings. **Results:** Increasing excise taxes has a low cost (<I$0.10 per capita) and a highly favorable ratio of costs to effects (<I$100 per healthy life year gained in both low- and high-income settings). Availability and marketing restrictions are also highly cost effective (<I$100 in low-income settings and <I$500 in high-income settings). Enforcement of drink-driving laws and blood alcohol concentration limits via sobriety checkpoints had cost-effectiveness ratios in the range of I$1,500–3,000. Brief psychosocial treatments were <I$150 and <I$1,500 in low- and high-income settings, respectively. **Conclusions:** More than a decade after an initial global analysis, the findings of this study indicate pricing policies and restrictions to alcohol availability and marketing continue to represent a highly cost-effective use of resources. (*J. Stud. Alcohol Drugs, 79,* 514–522, 2018)

ALCOHOL USE HAS BEEN identified as a key risk factor for disease and injury and contributes substantially to global and regional fatal and nonfatal health losses at the population level (GBD 2016 Risk Factors Collaborators, 2017; World Health Organization [WHO], 2014). Global estimates of alcohol use were comprehensively documented in the Comparative Risk Assessment (CRA) of the Global Burden of Disease (GBD) 2000 study (Rehm et al., 2004) and have been regularly updated along with corresponding estimates of population health consequences (Rehm & Imtiaz, 2016). Since the inception of the CRA, alcohol has been a top 10 risk factor for the global burden of disease, and the most recent CRA estimates for 2017 indicate that 5.1% and 4.2% of deaths and the overall disease burden, respectively, were attributable to alcohol (GBD 2016 Risk Factors Collaborators, 2017).

As a result of—and in response to—the substantial public health burden posed by alcohol use, there is considerable national and international interest in identifying effective strategies capable of modifying or averting alcohol use and thereby mitigating its harmful consequences. The original publication *Alcohol: No Ordinary Commodity* and its subsequent update were key contributors to the generation of a global evidence base capable of informing public policy (Babor et al., 2010). The accumulated knowledge and evidence from these and other sources directly contributed to a

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global strategy to reduce the harmful use of alcohol (WHO, 2010), which focuses on 10 key areas of policy options and interventions at the national level and 4 priority areas for global action.

In addition to evidence of the health impact or effectiveness of alcohol policies (Anderson et al., 2009; Medina-Mora et al., 2015), a number of other considerations influence public policy and the decision to implement evidence-based prevention and control efforts. These considerations include budgetary implications for policy implementation (affordability), relative efficiency or cost-effectiveness, acceptability to target beneficiaries, and the equitable distribution of health benefits (Anderson et al., 2017). The relative efficiency of a range of evidence-based alcohol control strategies was first assessed at the global level via a comparative cost-effectiveness modeling analysis that used the WHO-CHOICE methodology (CHOosing Interventions that are Cost-Effective; Chisholm et al., 2004). This model has been applied and validated at the national level (Lai et al, 2007; Medina-Mora et al., 2010), used to generate country profiles in Europe (Chisholm et al., 2009), and updated to produce revised estimates for a range of geographical and/or country income groupings (Anderson et al., 2009; Chisholm & Saxena, 2012; Rehm et al., 2006).

Along with estimates of the cost and feasibility of implementation, WHO-CHOICE cost-effectiveness results have informed the selection of the WHO's so-called "best buys" for the prevention and control of noncommunicable diseases (NCDs), which formed part of the *WHO Global Action Plan for the Prevention and Control of NCDs 2013–2020* (WHO, 2013). Three interventions were designated "best buys" for reducing the harmful use of alcohol, in the sense that they were found to be highly cost effective, to be feasible to implement, and to have low implementation costs: regulating commercial and public availability; restricting or banning alcohol advertising and promotions; and using pricing policies, such as excise tax increases on alcoholic beverages.

As part of an overall update to WHO-CHOICE analyses, and as a specific input into the requested update of Appendix 3 of the *WHO Global Action Plan for the Prevention and Control of NCDs 2013–2020* (WHO, 2013) (i.e., the WHO menu of policy options and cost-effective interventions for the prevention and control of major NCDs), this article uses the latest available global data on alcohol use exposures and risk relations, as well as on intervention effectiveness, to re-examine the comparative cost, health impact, and cost-effectiveness of a range of alcohol control strategies.

Method

Analytical approach

In line with earlier WHO-CHOICE analyses (Chisholm et al., 2004; Chisholm & Saxena, 2012; Evans et al., 2012), this study adopts a generalized approach to cost-effectiveness analysis (CEA) aimed at determining an optimal set of interventions, taking into account setting-specific factors, such as the burden of disease, health system practice, and economic conditions. Generalized CEA was used because it is a consistent and comparable method and relates costs and health impacts of both existing and new interventions to a reference point of "no intervention." This is in contrast to conventional CEA and the use of current practice as the reference point, which implicitly assumes an efficient use of current resources (see Chisholm et al., 2006, for a worked example in the area of alcohol and tobacco control). Use of this "no intervention" scenario is operationally defined in terms of what would happen to population health if all interventions being provided now were stopped, and thus it neither precludes assessment of the current situation nor does it mean interventions never took place.

For the latest updates of WHO-CHOICE analyses, the new modeling tool OneHealth has been used to estimate population-level health effects of interventions. OneHealth is a software tool that has been developed by international costing experts from the WHO and other United Nations agencies to strengthen health system analysis as well as costing and financing scenarios at the country level (Stenberg & Chisholm, 2012; WHO, 2012a). Using this tool and the demographic and epidemiological data therein, the population-level effects of specified interventions were evaluated over a 100-year period relative to a "no-intervention" scenario.

Key model inputs for estimating population health gain include the current and projected demographic and mortality structure of the population in question; disease and risk factor prevalences, together with relevant relative risks of disease for selected risk factors (by age and sex); disability weights for each health state or condition; intervention effect sizes; and the current as well as target coverage of modeled interventions. A detailed description of the OneHealth tool and the NCD Spectrum module to which alcohol exposure belongs is available at http://www.avenirhealth.org/software-onehealth.php. The primary resulting effectiveness metric for this analysis was healthy life years gained; discounting and age weighting were not applied to healthy life years gained.

The output of the OneHealth tool is generated at the national level. For this study, analysis was carried out for 16 large countries spanning low-, middle-, and high-income settings across the world (upper middle- and high-income countries: China, Germany, Japan, Mexico, Russian Federation, South Africa, Thailand, Turkey, United States of America; low- and lower middle-income countries: Ethiopia, Guatemala, India, Nigeria, Philippines, Ukraine, Vietnam). Countries were selected so that more than half of the total population and health burden in each WHO region would be represented. In line with analytical methods and results for other NCDs and risk factors forming part of the Appendix 3 update to the WHO *Global Action Plan for the Prevention*

Table 1. Global alcohol-attributable fractions for diseases and injuries, by sex and major health indicators

	Deaths				Disability-adjusted life years				Years lived with disability			
	Males		Female		Males		Females		Males		Females	
Variable	Total ('000)	AAF	Total ('000)	AAF	Total ('000)	AAF	Total ('000)	AAF	Total ('000)	AAF	Total ('000)	AAF
Disease												
Alcohol use disorders	86	100%	21	100%	27,021	100%	4,986	100%	23,682	100%	4,209	100%
Epilepsy	114	16%	91	6%	11,111	15%	9,514	5%	4,681	16%	4,331	7%
Tuberculosis	609	15%	326	5%	27,663	15%	15,971	5%	4,826	18%	2,219	6%
Pancreatitis	175	32%	157	12%	4,308	33%	3,370	14%	21	34%	18	15%
Liver cirrhosis	675	53%	344	45%	24,606	53%	11,399	44%	391	34%	249	41%
Liver cancer	516	14%	223	7%	15,544	14%	5,706	7%	105	15%	44	7%
Breast cancer	0	0%	536	8%	0	0%	17,684	8%	0	0%	938	9%
Colorectal cancer	390	13%	333	7%	9,777	13%	7,707	7%	325	13%	272	7%
Laryngeal cancer	68	25%	9	9%	1,957	26%	256	9%	59	27%	7	9%
Esophageal cancer	285	27%	120	9%	7,427	28%	2,854	9%	58	28%	23	9%
Oral cavity and pharyngeal cancer	216	37%	82	12%	7,030	38%	2,552	12%	129	40%	52	13%
Ischemic stroke	1,358	5%	1,718	3%	26,864	5%	27,612	3%	1,826	3%	1,764	0%
Hemorrhagic stroke	1,800	14%	1,784	7%	45,970	14%	40,696	8%	532	16%	475	-5%
Hypertension	494	14%	645	4%	11,255	15%	12,117	5%	197	13%	233	5%
Injuries												
Road traffic injuries	913	19%	339	4%	57,078	17%	21,464	4%	9,298	14%	4,583	4%
Poisonings	117	26%	75	5%	6,485	21%	4,206	4%	288	15%	146	4%
Falls	372	27%	320	3%	25,435	20%	16,954	4%	11,728	14%	8,650	4%
Fire	141	17%	127	4%	9,583	12%	8,377	2%	893	13%	548	4%
Drowning	249	18%	121	3%	15,767	14%	7,444	2%	197	14%	95	4%
Other unintentional	588	23%	341	5%	35,366	19%	18,007	4%	5,451	14%	2,628	5%
Self-harm	517	31%	286	5%	25,081	30%	14,230	4%	275	14%	145	4%
Interpersonal violence	405	26%	98	7%	25,212	24%	6,179	5%	1,284	13%	336	4%

Notes: AAF = Alcohol-attributable fraction. Source: Rehm et al. (2017).

and Control of NCDs 2013–2020 (WHO, 2013), results are presented for two country income groupings: (a) low- and lower middle-income countries and (b) upper middle- and high-income countries.

Alcohol exposure data and relative risks for disease and injury outcomes

For this analysis, *hazardous and harmful* alcohol consumption was defined as consuming on average more than 20 and 40 g of pure alcohol per day for females and males, respectively (see Web Appendix 1 for prevalence rates). The cutoffs used for this analysis are conservative, as a substantial portion of alcohol-attributable harms are caused by lower levels of consumption (Shield et al., 2017).

Rates of hazardous and harmful alcohol use were generated based on data from the Global Information System on Alcohol and Health (GISAH; WHO, 2014) using an established methodology to triangulate self-reported data from surveys with adult per capita alcohol consumption derived in part from sales statistics (Rehm et al., 2010). Specifically, the prevalence of hazardous and harmful alcohol consumption (before and after the policy intervention) was derived based on modeling alcohol consumption among current drinkers using a gamma distribution based on an established methodology (Kehoe et al., 2012; Rehm et al., 2010). The gamma distribution has been observed to best describe the distribution of alcohol consumption of a population and allows for the modeling of this distribution when only the mean consumption among drinkers is known (based on the observed linear relationship between the mean and standard deviation) (Kehoe et al., 2012).

Alcohol use is a risk factor for many diseases and injuries (Rehm et al., 2017). Sex-specific relative risks for each disease and injury category were multiplied by the prevalence of hazardous and harmful alcohol use to form population-attributable fractions (PAFs). The fractions of global deaths, years lived with disability (YLDs), and disability-adjusted life years (DALYs) attributable to alcohol use are summarized in Table 1 (for these fractions by WHO subregion, see Web Appendix 2). Intervention effect sizes were attached to these alcohol PAFs to estimate health gains in the population over the lifetime of the intervention (modeled as 100 years).

Identification of interventions and their effects

Assessed alcohol control interventions were drawn from the WHO *Global Strategy to Reduce the Harmful Use of Alcohol* (WHO, 2010), along with available evidence of their effectiveness and accumulated experience of their implementation at the country level. All interventions included in the global strategy were considered, but the final analysis was restricted to those that were well-defined and have sufficient

Table 2. Impact sizes used in WHO-CHOICE analysis

Intervention	Impact	Comments on evidence
1. Increase in excise taxes on alcoholic beverages	Impact on prevalence of hazardous and harmful drinking varies according to rates of current taxes, (un)recorded use, and demand elasticity	Country-specific rates of excise taxes, unrecorded consumption, and market distribution for different beverage types were extracted from GISAH (WHO, 2014; WHO, 2016a). Beverage-specific demand elasticities for alcohol, by country income level, were based on international reviews (range: -0.3 [beer, HIC] to -0.79 [wine and spirits, LMIC]) (Fogarty, 2010; Sornpaisarn et al., 2013). A 50% increase over current tax rates was modeled.
2. Enactment and enforcement of bans or comprehensive restrictions on exposure to alcohol advertising (across multiple types of media)	1.2% reduction in prevalence	Changes in prevalences were simulated for each world region on the basis of the estimated change in total drinking volume, based on cross-sectional analyses of data from 15 LMICs, which found an inverse association between increased marketing restrictions and total drinking volume (a 3% reduction in drinking volume per additional level of restriction for beer, wine, and spirits across four types of media respectively, for a total effect size of -0.72 for a 2-point increased restriction level) (Cook et al., 2014).
3. Enactment and enforcement of restrictions on the physical availability of retailed alcohol (via reduced hours of sale)	1.8%–2.1% (male) and 4% (female) reduction in prevalence	Changes in prevalences were simulated for each world region on the basis of the estimated change in total drinking volume, based on cross-sectional analyses of data from 15 LMICs, which found an inverse association between increased restrictions on business hours for off-premises alcohol sales and total drinking volume (-0.88) (Cook et al., 2014).
4. Enactment and enforcement of drink-driving laws and blood alcohol concentration limits (via sobriety checkpoints)	15%–20% reduction in alcohol-attributable YLDs and road traffic deaths, respectively (Elvik et al., 2009)	Effect sizes applied to estimated deaths and YLDs for road traffic injuries owing to drink-driving (for which data are available at the regional and country levels from WHO Global Health estimates (WHO, 2016b).
5. Provision of brief psychosocial interventions for persons with hazardous and harmful alcohol use	Prevalence reduction (at full coverage) varies by age, sex, and region (0% [females, 15–59 years], 11%–17% [females, ≥60 years], 13-21% [males, 15–59 years], 6%–11% [males, ≥60 years]).	Intervention coverage was modeled at 50%. Changes in prevalences were simulated for each world region on the basis of the estimated change in consumption (3.6 drinks per week fewer) and heavy episodic drinking (12% less) (Jonas et al, 2012). The reduction in disability weighting was also estimated as the proportion of harmful use decreased (0.8%–2.7%).

Notes: WHO = World Health Organization; CHOICE = CHOosing Interventions that are Cost-Effective. GISAH = Global Information system on alcohol and health; HIC = high-income countries; LMIC = low- and middle-income countries; YLD = years lived with disability.

evidence of effectiveness or potential effectiveness. Specific intervention strategies assessed were as follows:

An increase in excise taxes on alcoholic beverages. The impact on consumption of a 50% increase in excise taxes on alcoholic beverages was modeled, adjusted for the observed or expected level of unrecorded use due to illicit production and smuggling (taken as a close proxy measure for untaxed consumption); numerous published studies have demonstrated that price increases lead to a decrease in demand and consumption (Elder et al., 2010; Fogarty, 2010; Sornpaisarn et al., 2013; Wagenaar et al., 2009). Prevailing tax rates on different types of alcoholic beverages, the current levels of alcohol consumption of various beverage types, and modeled elasticities are outlined for the selected countries in Web Appendix 3. A 50% increase over current rates was chosen because it represents an ambitious but feasible strategy that would bring excise taxes for alcoholic beverages more in line with those imposed on tobacco products.

Enactment and enforcement of bans or comprehensive restrictions on exposure to alcohol advertising (across multiple types of media). Based on a scale where 0 equals no restriction, 1 equals voluntary/self-regulation, 2 equals partial statutory restriction, and 3 equals a ban (Cook et al., 2014), a two-step increased level of restriction was modeled on consumption of all three main types of alcoholic beverages (beer, wine, distilled spirits) across the four main forms of media (TV, radio, billboards, and the Internet).

Enactment and enforcement of restrictions on the physical availability of retailed alcohol (via reduced hours of sale). The impact on consumption of restrictions on business hours for off-premises alcohol sales (either reduced hours in a day or reduced days in a week) was modeled (Cook et al., 2014).

Enactment and enforcement of drink-driving laws and blood alcohol concentration limits (via sobriety checkpoints). A 15% and 20% reduction in alcohol-attributable nonfatal and fatal road traffic injuries, respectively, were modeled (Elvik et al., 2009).

Provision of brief psychosocial interventions for persons with hazardous and harmful alcohol use. Reductions in consumption (3.6 drinks per week less) and heavy episodic drinking (12% less) were modeled (Jonas et al., 2012). Heavy episodic drinking was defined as consumption of 60 g or more of pure alcohol on at least one occasion in the past 30 days. Intervention coverage was modeled at 50%.

A summary of the impact of these interventions on the prevalence of hazardous and harmful alcohol use (or on the rates of road traffic injuries), together with the derivation of these impact measures, is described in Table 2. Current lev-

els of policy implementation and enforcement in the selected countries are outlined in Web Appendix 4.

The reductions in average alcohol use resulting from intervention—by sex and, where applicable, by age (for persons 15 years of age and older)—were translated into proportional changes of heavy drinking prevalence for each region/country based on sex- and age-specific drinking levels among drinkers and the prevalence of current drinkers within these sex–age strata. To calculate the reductions in alcohol use for each policy, the drinking prevalence for each population (separated by region/country, sex, and age where applicable) was modeled before and after the intervention.

Assessment of resource use and costs

For brief psychosocial interventions delivered to individuals in primary-care settings, the key categories of resources included three contacts with primary health care (for screening, assessment, intervention, and follow-up), plus outpatient (20%) and inpatient (5%) hospital care for a proportion of cases. Country-specific unit costs for these resources were obtained from the WHO-CHOICE costing database (WHO, 2017a). The resulting cost per treated person was applied to 50% of all prevalent cases of hazardous and harmful alcohol use in the first year and every fifth year thereafter (the latter to provide booster sessions aimed at sustaining treatment effects over time), whereas for all other years the cost per case was applied to one half of all incident cases.

For other (population-based) measures, key categories of resources included human resources (e.g., administrators, lawyers), training (e.g., enforcement), meetings, mass media, and law enforcement/inspection (including related equipment such as a handheld speed camera, breath alcohol analyzer, traffic cones, and police vehicle for roadside checkpoints). An adapted, updated version of the NCD costing tool (WHO, 2012b) was used to calculate resource needs and costs over the 100-year period of analysis.

Costs were expressed in international dollars (I$) for the year 2010 and were discounted over time (at a rate of 3% per year). International dollars adjust for differences in the relative price and purchasing power of countries and, thereby, facilitate comparisons across regions (www.who.int/choice/costs/ppp).

Assessment of cost-effectiveness

Estimated health gains were combined with cost estimates to derive ratios of cost per healthy life year gained. Interventions were modeled using point estimates and a predetermined band of cost, effectiveness, and cost-effectiveness to reflect the inherent uncertainty and to identify the order of magnitude of differences between interventions. These bands were developed and approved for use across all NCD analyses forming part of the NCD Global Action Plan Appendix 3 update (http://who.int/ncds/governance/technical_annex.pdf?ua=1).

Results

The cost, effectiveness, and cost-effectiveness of the five assessed alcohol control strategies for the 16 countries aggregated to low- and lower middle-income countries (n = 7) and to upper middle- and high-income countries (n = 9) are reported in Table 3. Costs are expressed in millions of international dollars per one million population (equivalent therefore to the cost per head of population); effectiveness is expressed in terms of healthy life years gained (equivalent to DALYs averted) per one million population; and cost-effectiveness is expressed as the cost (I$) per healthy life year gained or DALYs averted, relative to the current situation of no intervention.

A 50% increase over current rates of excise taxes was characterized by a low implementation cost (<I$0.10 per capita), a moderate to high level of health impact (>500 healthy life years gained per one million population), and a highly favorable ratio of costs to effects (<I$100 per healthy life year gained in both lower and higher income settings), and was the most cost effective of the intervention strategies assessed. Enactment and enforcement of availability and marketing restrictions were also found to be highly cost effective (<I$100 in lower income settings and <I$500 in higher income settings); they had similar population-level health effects (200–350 healthy life years gained per one million population) and had low costs of implementation (<I$0.10 per capita). Enactment and enforcement of drink-driving laws and blood alcohol concentration limits via sobriety checkpoints carried a moderately higher implementation cost (because of police officer time and transport/equipment needs at roadside checkpoints) and generated fewer health outcomes than the other three population-based control strategies (<100 healthy life years gained per one million population); cost-effectiveness ratios were correspondingly higher (I$1,500–I$3,000). Finally, brief psychosocial treatments for hazardous and harmful alcohol users were observed to be relatively high cost (>I$1 in higher income settings, I$0.10 in lower income settings) but also relatively high impact (in the range of 500–1,000 healthy life years gained per one million people), resulting in moderately favorable cost-effectiveness ratios of I$143 and I$1,434 in lower and higher income settings, respectively.

Discussion

More than a decade after completion of an initial global analysis of the comparative cost-effectiveness of strategies to reduce the hazardous and harmful use of alcohol (Chisholm et al., 2004), this study re-examines and updates these WHO-CHOICE estimates based on the latest available

TABLE 3. Costs, effects, and cost-effectiveness of alcohol control strategies, by country income level

Intervention	Low- and lower middle-income countries (n = 7)			Upper middle- and high-income countries (n = 9)		
	Economic Cost of implementation per year (I$ in millions per 1 million)	**Health Impact per year (healthy life years gained per 1 million)**	**Average cost-effectiveness ratio (I$/healthy life year gained)**	**Economic Cost of implementation per year (I$ in millions per 1 million)**	**Health Impact per year (healthy life years gained per 1 million)**	**Average cost-effectiveness ratio (I$/healthy life year gained)**
Increase in excise taxes on alcoholic beverages (current rate + 50%)	0.01 [<0.10]	568 [500–1,000]	22 [<100]	0.05 [<0.10]	1,128 [1,000–5,000]	41 [<100]
Enactment and enforcement of bans or comprehensive restrictions on alcohol advertising (across types of media)	0.01 [<0.10]	205 [100–500]	48 [<100]	0.03 [<0.10]	290 [100–500]	120 [100–500]
Enactment and enforcement of restrictions on the physical availability of retailed alcohol (via reduced hours of sale)	0.02 [<0.10]	251 [100–500]	77 [<100]	0.06 [<0.10]	355 [100–500]	181 [100–500]
Enactment and enforcement of drink-driving laws and blood alcohol concentration limits (via sobriety checkpoints)	0.05 [<0.10]	35 [10–100]	1,454 [1,000–5,000]	0.15 [0.10–0.50]	50 [10–100]	2,979 [1,000–5,000]
Provision of brief psychosocial interventions (3 visits) for persons with hazardous and harmful alcohol use (50% coverage).	0.10 [0.10–0.50]	692 [500–1,000]	143 [100–500]	1.39 [>1.00]	971 [500–1,000]	1,434 [1,000–5,000]

Notes: Shaded cells indicate average cost-effectiveness ratio less than I$100 per healthy life year gained. I$ = international dollars.

information on the epidemiology of alcohol consumption and the effectiveness of interventions. The findings show that little has changed in terms of key conclusions, namely that pricing policies and restrictions to alcohol availability and marketing each continue to represent a highly cost-effective use of resources, with each healthy life year gained costing less than I$100 for low- and lower middle-income countries, and for upper middle- and high-income countries too in the case of pricing policies. Together with their low costs of implementation (affordability) and the technical viability of their implementation (feasibility), the efficiency of these public health strategies continues to indicate that they are best buys for the prevention and control of NCDs (WHO, 2013).

In reaching this conclusion, we are cognizant of the limits of a global level of analysis such as this and encourage further country—or in the context of very large countries, even subnational—contextualization of model inputs using the OneHealth tool, which was primarily developed for assessing overall health system costs (and impacts) of sectoral strategies at the national level. Such contextualization studies also increase local stakeholder engagement, which in turn improves the impact of the findings. Although considerable effort has been taken to identify the best available data for the 16 countries represented in this analysis, a further appeal of country-led analysis is that key model parameters can be reviewed and revised as needed, such as estimated levels of hazardous and harmful alcohol use in the country, existing levels of intervention coverage or intensity, and expected resource use and costs. It should be noted, however, that although there is a strong evidence base as well as data availability for interventions like excise taxes (which can be accurately tailored to the specific national context), much less robust data exist for strategies such as availability and marketing restrictions at the level of individual countries. Country analysts—especially those from low- and middle-income countries—may therefore need to rely on the evidence used here, such as the cross-sectional analysis on individual-level alcohol consumption and country-level alcohol policies across 15 low- and middle-income countries by Cook and colleagues (2014).

The acceptability of interventions to targeted beneficiaries and the equity implications of their implementation were not explicitly assessed as part of this analysis. Furthermore, it should also be noted that we only assessed a subset of possible intervention strategies for alcohol control. Other interventions referred to in WHO guidance or strategy documents include minimum prices for alcohol, minimum age restrictions for purchasing or consuming alcoholic beverages, and the provision of consumer information about the harms related to alcohol (WHO, 2010). Generation of new information and evidence about the effectiveness of these interventions in low- and middle-income countries can usefully supplement the existing evidence base and inform future updates of the global analysis presented here. Furthermore, there are other important known benefits associated with interventions beyond their health effects, such as reduced damage to property and enhanced work productivity; however, it has not been possible to quantify these other positive impacts in this analysis.

As previously stated, to take a conservative approach, thresholds of 20 and 40 g of pure alcohol for women and men were used when modeling the effects of alcohol policies. Thus, the presented findings exclude alcohol-attributable harms experienced by drinkers below this threshold. Although this threshold targets drinkers who are at high risk of health consequences (as indicated by the accelerated dose–response relationships between the level of alcohol use and harm; Rehm et al., 2017), and reflects the observation that the majority of alcohol-attributable harms occur above this threshold (e.g., Rehm et al., 2013), its use nevertheless leads to an underestimate of alcohol-attributable harms and the effects of policies on health.

In terms of policy implications, even though this study shows that the best buys for alcohol control are highly cost effective, they are not applied frequently or rigorously in many countries, especially in low- and middle-income countries, where currently the main increases in alcohol use and alcohol-attributable harms can be seen (Shield et al., 2016; WHO, 2014). A number of reasons interact to create this situation: first, interventions such as alcohol excise taxes, or availability or marketing restrictions, are seen as hindering globalized markets and economies (WHO, 2017b). As a consequence, public health exemptions for goods with high risks to health are rare, with the partial exception of tobacco (Zeigler, 2009). A better understanding of existing global trade agreements is necessary to improve implementation of effective and cost-effective alcohol control policies (Friel et al., 2015; Woodward et al., 2001). Second, implementation of these effective public health strategies is actively fought by the alcohol industry, often with threats of lost jobs and/or revenue for countries (Casswell & Thamarangsi, 2009; Moodie et al., 2013). Third, the public image of alcohol remains relatively positive, often being associated with economic development and future wealth (Room et al., 2013) and without full awareness of the risks of alcohol use to human health; it has been argued that of all voluntary behaviors, there is the highest acceptability and tolerance for the mortality risk due to alcohol use (Rehm et al., 2014).

Enactment and implementation of a framework convention, as has been established for tobacco control, provides a powerful means toward more effective scale-up and monitoring among signatory countries and has accordingly been proposed for alcohol control (Casswell & Thamarangsi, 2009; Room et al., 2008). However, such a proposition has yet to receive widespread support or endorsement across countries. This leaves concerted multisectoral and multinational action far more open to undue influence being given

to nonstate actors and partial or compromised government enforcement. In particular, there is a heightened risk of health authorities agreeing to and implementing strategies that sound plausible but which have been shown to have negligible actual impact on drinking behaviors or per capita consumption (such as school education and public information campaigns, or self-regulation of alcohol marketing), or considering new strategies for which there is promising but insufficient evidence of effectiveness (such as a reduction of alcoholic strength; Rehm et al., 2016), or heavily focusing on nonregulatory strategies such as brief interventions, which do have impact but are less cost-effective options than the identified best buys for alcohol control. Ultimately, the purpose of economic evaluation in health care is to guide decision makers toward a more rational and targeted use of available resources. In this sense, this updated CEA provides a salutary reminder of where the most value and impact can be obtained for addressing the substantial and still growing burden of disease attributable to alcohol use.

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