Impact of introducing a minimum alcohol tax share in retail prices on alcohol-attributable mortality in the WHO European Region: A modelling study

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Summary

Background Alcohol use and its burden constitute one of the largest public health challenges in the WHO European Region. Raising alcohol taxes is a cost-effective "best buy" measure to reduce alcohol consumption, but its implementation remains uneven. This paper provides an overview of existing tax structures in 50 countries and subregions of the Region, estimates their proportions of tax on retail prices of beer, wine, and spirits, and quantifies the number of deaths that could be averted annually if these tax shares were raised to a minimum level.

Methods Review of databases and statistical reports on taxes and mean retail prices of alcohol beverages in the Region. Affordability was calculated based on alcohol prices, adjusted for differences in purchasing power. Consumption changes and averted mortality were modelled assuming two scenarios. In Scenario 1, a minimum excise tax share level of 25% of the beverage-specific retail price was assumed for all countries. In Scenario 2, in addition to a minimum excise tax share level of 15% it was assumed that per unit of ethanol minimal retail prices were the same irrespective of alcoholic beverages (equalisation). Sensitivity analyses were conducted for different price elasticities.

Findings Alcohol is very affordable in the Region and alcohol taxes have clearly been under-utilized as a public health measure, constituting on average only 5·7%, 14·0% and 31·3% of the retail prices of wine, beer, and spirits, respectively. Tax shares were higher in the eastern part of the Region compared to the EU, where various countries did not have excise taxes on wine. Annually, the introduction of a minimum tax share of 25% (Scenario 1) could avert 40,033 (95% CI: 38,054-46,097) deaths in the WHO European Region (with 753,454,300 inhabitants older than 15 years of age). If a 15% tax share with equalisation were implemented (Scenario 2), 132,906 (95% CI: (124,691-151,674) deaths could be averted. All sensitivity analyses with different elasticities yielded outcomes close to those of the main analyses.

Interpretation Similar to tobacco taxes, increasing alcohol taxes should be considered to be a health-based measure aimed at saving lives. Many countries have hesitated to apply higher taxes to alcohol, but the present results show a clear health benefit as a result of implementing a minimum tax share.

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Research in context panel

Evidence before this study

Alcohol taxation has been identified as one of the "best buys" of alcohol control policy by the World Health Organization. Despite demonstrated effectiveness and cost-effectiveness, reviews demonstrate that governments' attitudes towards alcohol taxation remain mixed, leaving significant scope for a wider use of policies that would reduce the affordability of alcohol, and alcohol-related harm, in the WHO European Region.

Added value of this study

We examine the current forms of alcohol taxation, and the excise tax share of alcohol prices in the WHO European Region. Overall, the tax share in this region is low, especially for wine. Increasing the tax share to a minimum of 25%, which corresponds to one third of the WHO-recommended tax share of cigarettes, could avert 40,000 deaths (point estimate: 40,033; 95% confidence interval: 38,054-46,097) in one calendar year. A minimum excise tax share level of 15% and ensuring that the price per unit of ethanol (e.g., for a standard drink) could avert more than 130,000 deaths annually (point estimate: 132,906; 95% confidence interval: 124,691-151,674). Sensitivity analyses with different price elasticities corroborated the overall potential of taxation policies to improve public health.

Implications of all the available evidence

Increasing alcohol taxes would bring significant public health benefits. The share of excise taxes on the price of alcoholic beverages should be regularly monitored and the WHO European Region should promote alcohol taxation reforms that would increase tax share, and provide guidance regarding a minimum tax share and an appropriate tax design for maximising public health impact.

Introduction

Alcohol use has been identified as one of the most important risk factors for burden of disease and injury in all comparative risk assessments to date.[1-3] Despite some reductions in recent decades, the WHO European Region has the highest alcohol consumption level of all WHO Regions, and reduction of alcohol-attributable burden is one of its priorities.[4] To reduce alcohol-attributable burden, the World Health Organization has recommended a number of alcohol control measures, and highlighted three of them as the so-called "best-buys": restricting alcohol availability, increasing the price of alcoholic beverages, and banning advertising.[5] We will focus the discussion on the control policies related to alcohol taxation, as this "best buy" has been shown to be the most cost-effective both in low- and middle-income and high-income countries.[6]

As mentioned above, there is strong and compelling evidence that increasing the price of alcoholic beverages through taxation is one of the most effective and cost-effective policies used to lower alcohol consumption and alcohol-attributable harm.[6,7] Through taxation, governments can influence the price of alcoholic beverages, and higher prices *ceteris paribus* lead to lower levels of alcohol consumption and attributable harm.[8] The exact impact of alcohol taxation on harm will depend on a number of factors, the most important one being the level of taxation in relation to the disposable income of consumers, usually denoted by the term affordability. It has been shown that a reduced affordability is key to reducing harm.[9]

Given the high costs to European societies due to alcohol consumption,[10] part of the economic rationale for the taxation of alcohol has been to compensate for negative externalities.[8] Therefore, a further important aspect of alcohol taxation is fiscal revenue generation, which will be discussed in further detail below.

All Member States of the WHO European Region have established some form of excise taxation on alcohol, which is added to general consumption taxes (mostly value-added taxes) charged on traded products, including beverages.[4] However, despite the overwhelming evidence on its potential to improve public health, reduce burden, and generate revenue, many countries underutilise alcohol taxation measures—globally and in the WHO European Region in particular. Out of all available interventions, pricing policies were found to be the least frequently implemented alcohol control measures, as revealed by the latest WHO report on the implementation of alcohol control policy measures in the Region ([4]; see Appendix Text T1 for the underlying

methodology; for detailed results, see Appendix Figure A1). The report also suggests, in line with previous findings, that alcohol has become more affordable over time because the majority of countries neither increase nor adjust their alcohol tax levels to reflect fluctuations in inflation or disposable income. In addition, countries of the European Union (EU) have traditionally had very low shares of taxes included in the final consumer price of alcoholic beverages.[11] Thus, the real values of excise duties in the EU, as well as alcohol prices in general, have steadily decreased since the mid-1990s in most EU countries.[12] At the same time, more country-specific trends in alcohol affordability have been observed in the eastern and non-EU countries of the Region, where alcohol control policies affecting the price of alcoholic beverages have been more consistently applied.[13,14]

The present contribution aims to document the current state of alcohol taxation structures and the proportion of excise tax in the retail prices of alcoholic beverages in all countries and subregions (political unions across the Region) of the WHO European Region, with the subregional analysis focusing on the following political unions: the Commonwealth of Independent States (CIS); the Eurasian Economic Union (EAEU) and the European Union (EU). It also provides an estimate of how many lives could theoretically be saved each year if countries in the Region were to adopt a minimum level of excise tax shares on their retail prices of beer, wine, and spirits, following the example of tobacco, where a minimum level recommended by WHO exists.[15] In addition to introducing a minimum tax share for all alcoholic beverages, we modelled a minimum tax share where the average price of one unit of alcohol would be the same irrespective of beverage type.[16,17] This equalisation of price per unit of alcohol leads to much higher tax shares on average given a minimum tax share.

To our knowledge, this is the first comprehensive overview of the alcohol price levels and structures for the entire Region, which goes beyond EU countries, and the first modelling study that estimates the effects of an introduced minimum excise tax share for alcoholic beverages.

Methods

Determining the tax share of alcohol prices in the WHO European Region

For an overview of the current share of alcohol excise tax in all Member States of the WHO European Region, a comprehensive search was carried out between November and December of 2020 by two independent researchers in order to obtain (a) the tax structure (i.e., specific, unitary, or *ad valorem*; for definitions, see [8,11]), b) the level of taxation, and (c) the mean retail prices (off-premise) per litre of the finished product for beer,

wine, and spirits for each country. Taxes not specific to alcohol such as value-added taxes were excluded from the tax share indicator.

In a first step, databases covering tax or price information for the year 2020 for multiple countries were searched, namely the excise tax regulation of the European Commission,[18] the OECD Consumption Tax Trend 2020,[19] and the Statista webpage.[20] For the remaining countries, webpages of national statistical offices or other government agencies were searched; and finally, local experts were consulted. Data were then cross-checked using secondary information such as the pricing update report [21] from the WHO Regional Office for Europe. A comprehensive overview of sources by country is provided in the Appendix Table A1. Data was identified for all Member States of the WHO European Region except for Andorra, Monaco, and San Marino, and can be found in the Appendix 2 spreadsheets.

Comparing affordability of alcohol in Europe

To generate an indicator for comparing affordability, the prices of alcoholic beverages, weighted by the relative share of the three main beverage types consumed in a country,[22] was put into relation with the Gross Domestic Product Purchasing Power Parity (GDP PPP) *per capita*.[23] Concretely, we divided the monthly GDP-PPP *per capita* by the price of 100g ethanol (pure alcohol). For GDP-PPP *per capita*, the year 2019 was used as it was the last year data was available from The World Bank. The higher this indicator, i.e., the more ethanol that could be bought with the average GDP PPP of a country, the more affordable the alcoholic beverages were considered to be.

Methodology for translating taxation increases into changes in alcohol consumption

To quantify the deaths which could be averted in the WHO European Region assuming a new scenario in which all countries have a minimum tax share of alcohol prices (defined as the proportion of alcohol excise taxes in the final price), the following steps were taken (see Appendix Text T2 for a detailed description of the methodology, including formulas):

- Defining the new minimum tax share of alcohol prices (Scenario 1: 25%), and an alternative scenario of 15% tax share with equalisation of the price per unit of ethanol (pure alcohol; Scenario 2). Prices which already exceeded the minimum tax share were not changed;
- Modelling the impact of the new prices on consumption;
- Modelling the impact of consumption on alcohol-attributable mortality.

In Scenario 1, the model set the minimum tax share for alcohol prices at 25%, which is one third of the recommended tax share for tobacco. In this scenario, no equalisation of the excise taxes across beverage types was applied.. In addition, as indicated above, we followed best practice recommendations for taxation to achieve the same price per unit of ethanol, irrespective of beverage type.[16,17] In Scenario 2, national taxes per unit of ethanol were calculated on the basis of a minimum tax share of 15% for the beverage which had the highest price per unit of alcohol independent of taxation (i.e., for production, transport, trade and profit), In most countries (n = 40), this was wine. Then, the excise taxes for the remaining beverage types (in the overwhelming majority of countries, these are beer and spirits) were calculated in such a way that the final price per unit of alcohol was the same. The final share of alcohol excise taxes corresponds to the share of these newly obtained alcohol excise taxes in the consumer price, which includes excise taxes plus other taxes plus production/distribution/sales costs plus profits for the economic operators. We chose rather low tax shares for our analyses despite the fact that, for tobacco, another psychoactive substance, which in many counties has incurred similar costs to society (e.g. [24]), much higher tax shares had been implemented in the Region (see Appendix Table A2). However, since governments in the European Region have traditionally been reluctant to increase excise taxation on alcohol, a stepwise increase seems to be more realistic. The resulting tax shares for each country and the WHO European Region can be found in Appendix Tables 3a and 3b.

The increase in taxes were translated into an increase in the prices of alcoholic beverages, assuming that 100% of the taxes were passed through to the price. However, there may be some under- or over-shifting meaning that either the producers increased or decreased the prices overproportionally, depending on the beverage type and the market situation ([25]; see Appendix T2 for references justifying this procedure). The impact of the price increases on consumption (based on recorded alcohol statistics) were modelled using price elasticities based on meta-analyses with two specific considerations: we assumed that the more-preferred beverage types were less elastic than less-preferred types,[26,27] and we assumed higher inelasticity for heavy drinkers and people with alcohol use dependence (based on a meta-analysis [28]). We also assumed that heavy episodic drinking, a drinking pattern which impacts on some disease categories over and above average volume of drinking,[29] would decrease proportionally with the average consumption level. The resulting price elasticities were −0·36 (95% CI: −0·48, −0·24) for the most preferred beverage type (beer, wine or spirits) in a country; −0·6 (95% CI: −0·72, −0·48) for the middle preference, and −1·2 (95% CI: −1·44, −0·96) for the least preferred beverage type. However, for all

heavy drinkers, the price elasticity was set lower at −0·28 (95% CI: −0·37, −0·19), irrespective of beverage type.[26-28,30] As detailed below, we conducted sensitivity analyses where elasticities were only based on beverage type, irrespective of the country.

Finally, the changes in consumption level were then translated into estimates of alcohol-attributable mortality using comparative risk assessment methodology.[2] While the exact formulas can be found in the Appendix Text T2, we describe here the logic of the stepwise procedure we undertook for diseases not fully attributable to alcohol: first, we estimated the alcohol-attributable fractions on sex, age, and cause-specific numbers of death, given the current exposure based on the distribution of consumption and the associated Relative Risks for each consumption level.[31] We then repeated this procedure with the new distribution of alcohol consumption resulting from the tax increases. The difference between these calculations is the number of deaths averted.

Data sources for population size, mortality, and alcohol exposure

Mortality and population data were taken from the Global Burden of Disease 2019 Study for the year 2019.[32] Recorded *per capita* consumption data were obtained from Manthey et al. (2019).[22]

Sensitivity analyses

We conducted two sensitivity analyses with different price elasticities based on the comprehensive meta-analyses of Wagenaar and colleagues [28] and Nelson[30] to test the stability of our results with respect to different assumptions of stability. Also, as all meta-analyses on price elasticities of alcoholic beverages are fairly old, it is not clear to what degree they correspond to the current price elasticities. These two meta-analyses were selected as they constitute, to our knowledge, the most cited [28] and the most conservative meta-analyses in the field.[30] Appendix Table A4 gives details of the price elasticities we used for these sensitivity analyses.

Role of the funding source

The funding source had no role in the study design; in the collection, analysis, and interpretation of data; in the writing of the report; or in the decision to submit the paper for publication.

Results

There are three main tax structures in place in the Member States of the WHO European Region: unitary taxation, where the alcohol duty is levied on the basis of the volume of a product—for instance, per litre of finished product; specific taxation, where alcohol duty is
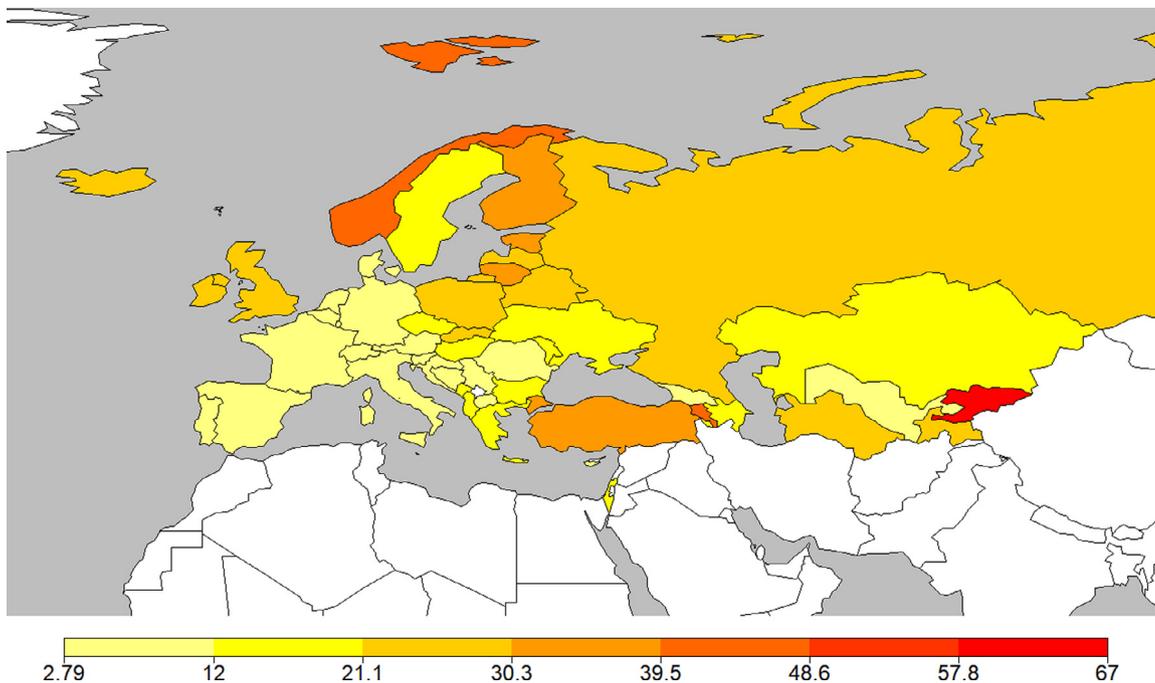
Figure 1. Tax share as % of the retail prices for alcoholic beverages in the WHO European Region in 2020 (weighted average for beer, wine, and spirits)

levied on the basis of the alcohol content of a product; and, *ad valorem* taxation, where alcohol duty is levied on the basis of the value of a product, usually determined by the price. The different tax structures and the proportion of tax in the mean final retail price by alcoholic beverage for all Member States of the WHO European Region are presented in Appendix Table A2 and Appendix Figure A2.

For beer and wine, most countries outside the EU have a unitary tax in place, while in the EU alcohol taxation rules require beer excise duties to be a distinct tax. For wine, the EU imposes no minimum tax rate per litre of the finished product, and 15 countries in the EU impose no excise taxes on wine (22 in the WHO European Region as a whole). For spirits, most of the countries have specific taxation rates in place, which involve higher taxation on spirits having higher alcohol levels by volume.

An overview of the different tax shares in the final retail prices for beer, wine, and spirits are presented in Appendix Figures A3-A5. Figure 1 presents the average tax shares of alcohol prices over all three beverage types (weighted by proportion of use). Overall, the proportion of tax in the final consumer prices varied across countries, with countries in the northern and eastern part of the Region having generally higher tax shares included in their final retail prices of alcoholic beverages. The median (mean) tax shares of alcohol prices for beer, wine, and spirits for the WHO European Region were 10·8% (14·0%), 0·8% (5·7%), and 30·6% (31·3%),

respectively. These are very low, especially for wine, with 22 out of all the countries having no alcohol excise taxes at all, and the majority of them located in the EU.

A subregional analysis of the tax share of alcohol prices corroborates the differences of the visual inspection of Figure 2. There are significant differences with the EU having lower tax shares than the other subregions, namely the 10 countries of the Commonwealth of the Independent States (CIS), and the five countries of the Eurasian Economic Union (EAEU), which are also part of the CIS (t-tests EU vs· CIS: -2·5941; df= 36; p = 0·0136; EU vs· EAUA: -3·8063; df=31; p = 0·000624; for distribution, see boxplots Figure 2; separate figures for beer, wine, and spirits can be found in Appendix Figures A6−A8).

The mean tax share of alcohol prices for the WHO European Region was 14·27%, with the EU being the subregion with the lowest mean share at 10·86%.

Comparing affordability
Overall affordability as measured by the GDP PPP *per capita* divided by the price of 100 g ethanol did not vary as much as the tax share of alcohol prices. The following countries showed the highest affordability for alcohol: Luxembourg, Germany, Czech Republic, Slovakia, and Austria. The countries with the least affordability were: Tajikistan, Georgia, Turkey, Kyrgyzstan, and Albania (for details, see Appendix Figure A9).
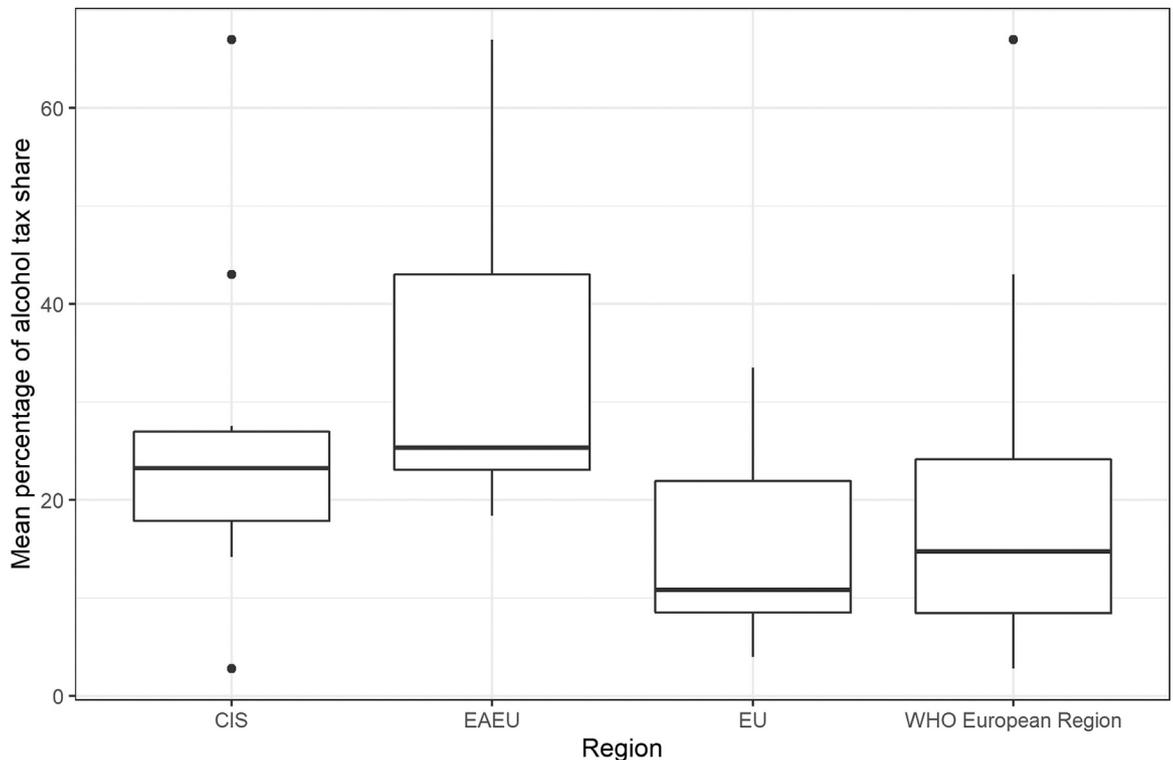
Figure 2. Boxplots of tax share in % of the retail prices for selected subregions of the WHO European Region in 2020
Legend: CIS: Commonwealth of Independent States; EAEU: Eurasian Economic Union; EU: European Union

Mortality averted by introducing a minimum tax share on alcohol prices

In total, 40,033 (95% confidence interval CI: 38,054-46,097) and 132,906 (95% CI: (124,691-151,674) deaths could be saved in one year in the WHO European Region by implementing the proposed scenario 1 (a minimum tax share of 24% with no equalisation) and Scenario 2 (a minimum tax share of 15% and no equalisation per unit of ethanol, irrespective of alcoholic beverage). Appendix Tables A5 and A6 provide the details by country, both in number of deaths averted, and in their proportion of all alcohol-attributable deaths. Tables 1a and 1b show the details by subregion.

The 40,033 and 132,906 potentially averted deaths in Scenarios 1 and 2 correspond to 7·29% (95% CI: 6·87-8·19%) and 24·19% (95% CI: 22·34-27·06%) of the total number of alcohol-attributable deaths, respectively. The number of deaths averted, and in their proportion of all alcohol-attributable deaths under Scenario 2 can be found in Appendix Tables A7 and A8. The difference between the two scenarios is that equalisation results in much higher tax shares overall. A minimum tax share of 25% without equalisation increases the tax shares of all beverage types to 25% in most countries, resulting in an average tax share of 29.06% (the difference to 25% is due to instances where some countries had already had higher tax shares for some beverage types).

However, if the price per unit of pure alcohol is equalised for all beverage types, a minimum tax share of 15% leads to an average tax share of 45.28%. The reason for this is the higher non-tax components for wine (i.e., higher production, transport, and trading costs) compared to other beverages, especially spirits.

In all jurisdictions, the category with the highest numbers of deaths averted was either the rest category of "other disease", mainly made up of alcohol use disorders, or cardiovascular disease (including alcoholic cardiomyopathy), but the ranking of the other categories differed by region. The five largest groups of causes of alcohol-attributable deaths made up more than 90% of the causes averted in each region: cancers, cardiovascular deaths, gastrointestinal deaths (mainly liver cirrhosis), injuries, and alcohol use disorders. Of these, liver cirrhosis and alcohol use disorders have the highest alcohol-attributable fractions, whereas alcohol use is one of many-contributing causes in the larger cause-of-death categories of cancer and cardiovascular disease.

Sensitivity analyses

Finally, in the sensitivity analyses for Scenario 1 using the price elasticities from Nelson[30] and Wagenaar and colleagues[28], 31,867 (95% CI: 30,429-36,149) and 48,813 (95% CI: 45,769-55,209) deaths were averted for

	Infectious Diseases	Cancers	Cardiovascular Diseases	Gastrointestinal Diseases	Injuries	Other Diseases (including Alcohol Use Disorders)	Total Deaths Averted	Rates per 100,000 Population[#]
Scenario 1 (25% tax share, no equalisation)								
EU (429,130,200 inhabitants*)	750	3,434	7,774	2,416	2,443	3,229	20,046	4·67
	(244-1,292)	(2,963-3,965)	(7,168-10,763)	(2,251-2,733)	(1,847-2,968)	(3,021-3,616)	(19,163-23,571)	(4·47-5·49)
CIS (188,827,700 inhabitants*)	359	567	5,335	1,570	1,887	4,315	14,034	7·43
	(196-518)	(463-682)	(4,613-7,172)	(1,346-1,822)	(1,412-2,250)	(3,653-5,499)	(12,257-17,223)	(6·49-9·12)
EAEU (145,091,800 inhabitants*)	300	503	5,074	1,078	1,710	4,101	12,766	8·80
	(168-427)	(408-620)	(4,348-6,861)	(889-1,300)	(1,274-2,038)	(3,449-5,286)	(10,986-15,970)	(7·57-11·01)
WHO European Region	1,265	4,447	15,719	4,699	4,922	8,982	40,033	5·31
(753,454,300 inhabitants*)	(569-1,978)	(3,887-5,073)	(14,916-20,233)	(4,355-5,162)	(3,711-5,836)	(8,341-10,308)	(38,054-46,097)	(5·05-6·12)
Scenario 2 (15% tax share, equalisation per alcohol unit)								
EU (429,130,200 inhabitants*)	2,149	9,042	18,850	7,494	7,020	8,958	53,513	12·47
	(715-3,792)	(7,874-10,623)	(17,534-26,422)	(7,010-8,513)	(5,239-8,596)	(8,496-9,930)	(50,534-62,323)	(11·78-14·52)
CIS (188,827,700 inhabitants*)	1,746	2,830	22,599	7,870	9,471	18,541	63,056	33·39
	(869-2,560)	(2,250-3,548)	(19,743-28,903)	(6,649-9,384)	(6,926-11,852)	(16,079-22,081)	(55,411-74,247)	(29·34-39·32)
EAEU (145,091,800 inhabitants*)	1,551	2,648	21,753	6,246	8,887	17,722	58,807	40·53
	(789-2,252)	(2,094-3,360)	(18,899-27,984)	(5,111-7,748)	(6,495-11,158)	(15,250-21,281)	(50,885-69,703)	(35·07-48·04)
WHO European Region	4,359	13,143	48,227	17,735	18,302	31,142	132,906	17·64
(753,454,300 inhabitants*)	(1,936-6,892)	(11,476-15,360)	(45,185-61,778)	(16,205-19,887)	(13,697-22,110)	(28,630-35,038)	(124,691-151,674)	(16·55-20·13)

Table 1a: **Number of annual deaths averted by introducing a minimum tax share of alcohol prices of 25% (Scenario 1) or by introducing a tax share of 15% with equalisation of price per unit of pure alcohol (based on 2019)**

Legend: CIS: Commonwealth of Independent States; EAEU: Eurasian Economic Union; EU: European Union; numbers in parentheses denote 95% confidence intervals

[#] Rates were calculated for the population 15 years and older.

* Inhabitants are for 2019 for the population 15 years and older, and exclude countries for which we had no *per capita* consumption and/or taxation data (for Andorra, Monaco, and San Marino).

Articles

	Infectious Diseases	Cancers	Cardiovascular Diseases	Gastrointestinal Diseases	Injuries	Other Diseases (including Alcohol Use Disorders)	Total Deaths Averted
Scenario 1 (25% tax share, no equalisation)							
EU	5·31	5·44	12·98	3·30	4·91	12·36	7·01
	(4·88-5·82)	(5·12-5·93)	(10·56-15·50)	(2·97-3·87)	(4·43-5·50)	(11·65-13·85)	(6·64-7·97)
CIS	4·97	3·36	11·33	3·70	3·83	12·29	7·09
	(3·85-6·13)	(2·80-4·08)	(9·43-14·53)	(3·17-4·52)	(3·12-4·62)	(10·49-15·52)	(6·13-8·77)
EAEU	4·65	3·11	11·25	3·06	3·65	12·12	6·95
	(3·28-5·94)	(2·55-3·86)	(9·27-14·56)	(2·47-3·92)	(2·91-4·47)	(10·28-15·42)	(5·91-8·78)
WHO EUR	5·27	5·02	12·62	3·58	4·46	12·73	7·29
	(4·58-5·77)	(4·73-5·42)	(10·62-14·73)	(3·28-4·06)	(3·93-5·03)	(11·79-14·56)	(6·87-8·19)
Scenario 2 (15% tax share, equalisation per alcohol unit)							
EU	15·21	14·33	31·48	10·25	14·12	34·30	18·71
	(14·15-16·71)	(13·58-15·56)	(26·50-35·98)	(9·34-11·84)	(12·79-15·94)	(32·67-37·94)	(17·79-20·83)
CIS	24·17	16·79	47·99	18·55	19·23	52·81	31·85
	(19·46-29·96)	(13·59-20·83)	(40·34-57·29)	(15·76-22·42)	(15·63-23·21)	(45·73-62·34)	(27·31-37·86)
EAEU	24·04	16·35	48·25	17·73	18·97	52·37	32·02
	(18·77-30·38)	(13·07-20·69)	(40·36-58·00)	(14·42-22·28)	(15·20-23·21)	(44·99-62·23)	(27·20-38·46)
WHO European Region	18·18	14·83	38·72	13·49	16·59	44·12	24·19
	(16·59-20·48)	(14·02-16·07)	(32·54-43·55)	(12·39-15·20)	(14·48-19·01)	(40·57-49·62)	(22·34-27·06)

Table 1b: Proportion of annual deaths averted by introducing a minimum tax share of alcohol prices of 25% (Scenario 1) or by introducing a tax share of 15% with equalisation of price per unit of pure alcohol (based on 2019)

Legend: EAEU: Eurasian Economic Union; CIS: Commonwealth of Independent States; EU: European Union; numbers in parentheses denote 95% confidence intervals

the same minimum tax share of 25%. Details of these results can be found in Appendix Tables A9 and A10. Proportionally similar, the sensitivity analyses for Scenario 2 yielded results of 136,546 (95% CI: 127,866-152,333) and 203,856 (95% CI: 186,382-224,808; detailed results in Tables A11 and A12).

Overall, the sensitivity analyses showed that under all assumptions—even assuming the most conservative estimates for price elasticity found in the literature—the numbers of alcohol-attributable deaths averted by all scenarios are considerable, with proportions of avoidable alcohol-attributable deaths minimally amounting to 6% out of all alcohol-attributable deaths.

Discussion

The present contribution is the first comprehensive overview of the current state of alcohol taxation implementation for the WHO European Region, highlighting the untapped potential of tax measures to benefit public health. Despite the fact that alcohol is a psychoactive substance and a known carcinogen, which causes substantial harms to drinkers, their families, communities, as well as societies and economies in general,[3,10] it is far less regulated than tobacco or any other psychoactive substance.[33,34] This includes the regulations on the level of taxation. For instance, the WHO recommends that for tobacco the proportion of tax should represent at least 75% of the retail price of the most popular brand of cigarettes. In the WHO European Region, more than half of the Member States follow this recommendation.[15] However, no such WHO recommendation exists for alcohol and the modelling exercises suggest that alcohol taxation should be considered a priority for public health given the substantial number of lives potentially saved, especially given that pricing policies remain the most under-utilized of all available policy options to reduce alcohol consumption and harms (Appendix Figure A1).

Before we move on to further interpretation of results, some limitations need to be addressed. While we tried to find the best data sources available for prices and taxation levels, and double-checked all the sources, we cannot exclude the existence of better sources. The WHO should formalize data collection of the mean retail prices to provide more standardized indicators in the future. With respect to the modelling of the mortality avoided, we used price elasticities derived from meta-analyses which were applied to countries with variations between countries solely derived from preferences for particular alcoholic beverage types. In other words, the prices of less preferred types of alcoholic beverages were assumed to be more elastic. However, acknowledging considerable differences in the results of different meta-analyses on price elasticities for different beverage types,[26-28,30] we conducted two sensitivity analyses based on the most frequently cited[28] and the

most conservative meta-analyses.[30] The results were reassuring in the sense that, independent of the meta-analyses used, the overall conclusion of significant public health impact persisted, indicated by the considerable number of averted deaths they estimated. However, future work may add sex-, age- and/or country-specific elasticities based on empirical studies, once they become available. Also, future investigations may include potential cross-elasticities with other psychoactive drug use. The alcohol-attributable fraction methodology is based on risk functions, which are largely not country-specific (for an exception, see[35]). This may introduce some bias, as different countries may show different risk functions based on interactions with other risk factors. This may especially be relevant for countries with patterns of irregular heavy drinking, which seems to particularly affect cardiovascular diseases.[36] Another limitation, which generally applies to all mortality studies based on cause of death categories: there is misspecification, especially in older age groups, when often large and unspecific codes, such as heart failure, are used. While this problem cannot be fully overcome, use of data corrected for unspecific codes, as those underlying our analyses were, at least improves reliability.[37] A final limitation may be that for equalisation we set the price per unit of pure alcohol to be equal for all beverage types (per country). In countries with high degrees of alcohol poisoning and violence, outcomes more closely related to spirits consumption (by setting proportionally higher prices for spirits via higher tax shares) may be worth considering.[34] To give flexibility to the countries, a tax share of 25% on average, based on the distribution of beverage in the respective country, may be advisable.

Despite these limitations, comparisons of cases of alcohol taxation increases in the WHO European Region countries such the increases in Lithuania in 2017,[9] or in Russia in the years 2010-2013[38] showed much larger effects than would be predicted by the calculation methodology used here. It should be noted that in both Lithuania and in Russia, there were multiple alcohol control measures put in place within relatively short time spans, and the effects may be synergetic, thus outperforming predictions mainly based on single measures which were the basis of the meta-analyses.

One argument against increasing taxation frequently mentioned by the alcohol industry[39] is that it may result in an increase in unrecorded consumption. However, a recent review did not find much evidence for such increases associated with taxation increases in the Region.[40] In any case, there are effective countermeasures against unrecorded consumption, which may be considered in countries where unrecorded consumption is a potential threat.[39,40] As already mentioned, the WHO European Region has the highest prevalence of drinkers globally, the highest drinking levels, and the highest proportion of all-cause mortality caused by

alcohol.[3,41] At the same time, drinking levels, frequency of heavy episodic drinking, and alcohol-attributable fractions for mortality and disability vary strongly by country. Countries in the eastern part of the Region—particularly in Eastern European countries of the former Soviet Union—experience greater alcohol-attributable harm than countries in the western part despite similar or lower levels of drinking.[4] Nonetheless, these Eastern European countries were the main drivers of the overall regional reduction in alcohol *per capita* consumption in recent years as they have substantially reduced both drinking and alcohol-attributable harm.[42] The introduction of various alcohol control policies, which included not only taxation measures to increase prices but also comprehensive marketing and availability restrictions, contributed to this development, although improved access to healthcare and quality of care as well as other factors were also at play.[14] Moreover, it is sometimes difficult to evaluate the impact of single measures like taxation increases or marketing restrictions because of their interacting effects, and because different measures are usually implemented at the same time as part of a broader policy package.[4,9]

It is noteworthy that the WHO European Region is also where the majority of international alcohol producers are located, which may explain its low alcohol taxation share. Raising alcohol taxes is a powerful tool to counteract mortality harm caused by alcohol use, as the provided analyses have shown, and is a tool which has clearly not been used to its full potential in the WHO European Region. For example, the absence of any tax rate for wine in almost half of the countries (most of them EU countries), and the median tax share of <1% for wine for the entire Region, is unacceptable from a public health standpoint. This is exacerbated by the EU's longstanding financial support for the wine industry, where it is estimated that from 2007 to 2012 every litre of wine produced in the EU was supported by 0.15 EUR.[43]

Excise taxation is not only potentially relevant for public health, it also has the potential to increase state revenue. For instance, the recent substantial increase of excise taxation in Lithuania by more than 100% for beer and wine, and over 20% for spirits, resulted not only in decreases in both consumption and mortality,[9] but also in an increase in tax revenue.[44] Similarly, we found increases in revenues for almost all major taxation increases for psychoactive substances.[45] Also, a recent review showed that taxation increases in several countries—despite warnings from the alcohol industry—did not result in increases in unrecorded consumption, or a net increase in overall alcohol use, or in alcohol-attributable harm.[40] However, if a minimum excise tax share for alcoholic beverages were to be implemented, this should be done in conjunction with measures against unrecorded consumption in countries where such increases are anticipated.[40]

The gap in regulation and risk awareness between alcohol and tobacco is enormous. With the adoption of the World Health Organization Framework Convention on Tobacco Control (WHO FCTC) in May 2003, the tobacco epidemic was globally recognized as a health, economic, and development issue and subsequent measures similar to this legally binding treaty have followed, decreasing tobacco use and its burden worldwide. Compared to the tax share of tobacco, the average tax share of alcohol prices for the Region is about four times lower, as shown in the Appendix Table A2. While tobacco taxes are clearly seen as health taxes to be levied on products that have negative public health impacts, alcohol taxes have historically[45] been seen as a fiscal measure first and foremost, even in countries that have considerably increased their alcohol tax rates in the past years.[13]

A paradigm shift for alcohol taxation is clearly warranted and needed. Alcohol taxes should be a public health prerogative, to be implemented as part of a comprehensive policy intervention package and within a global framework convention [33] to overcome the known implementation challenges at the national level. Alcohol taxes should be considered to be health taxes, and thus viewed as an investment, not a burden. Investing in health was not only critical during the recent COVID pandemic, it will be even more important as part of a "building back better" approach for a sustainable and more resilient economic recovery.

Conclusion

Alcohol is very affordable in the WHO European Region, and in many of its countries, taxation has a limited impact on retail prices. There is significant scope for alcohol taxes to play a larger role in raising the prices of alcohol beverages and thereby moderating drinking behaviours and mitigating attributable harm. Alcohol, like tobacco, is not an ordinary commodity, and thus it should be treated differently from other commodities in public policies.[7] This includes taxation based on public health goals. Developing and establishing a minimum recommended level of tax in the final consumer price of alcohol, following the example of tobacco, is an important step in establishing an implementation framework for alcohol taxes based on these principles. The full potential of taxation increases to reduce alcohol use and alcohol-attributable burden is far from being realized in the WHO European Region.

Contributors
MN, CFB and JR conceived the study and provided overall guidance. MN and JR prepared the first draft. MN

Data sharing statement

Data collected for the study are made available to others in the Appendices. The code used in the statistical analyses will be made available upon request sent to the corresponding author.

Editor note

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Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.lanepe.2022.100325.

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