Alcohol and Global Health 2

Effectiveness and cost-effectiveness of policies and programmes to reduce the harm caused by alcohol

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This is the second in a **Series** of three papers about alcohol and global health

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This paper reviews the evidence for the effectiveness and cost-effectiveness of policies and programmes to reduce the harm caused by alcohol, in the areas of education and information, the health sector, community action, driving while under the influence of alcohol (drink-driving), availability, marketing, pricing, harm reduction, and illegally and informally produced alcohol. Systematic reviews and meta-analyses show that policies regulating the environment in which alcohol is marketed (particularly its price and availability) are effective in reducing alcohol-related harm. Enforced legislative measures to reduce drink-driving and individually directed interventions to already at-risk drinkers are also effective. However, school-based education does not reduce alcohol-related harm, although public information and education-type programmes have a role in providing information and in increasing attention and acceptance of alcohol on political and public agendas. Making alcohol more expensive and less available, and banning alcohol advertising, are highly cost-effective strategies to reduce harm. In settings with high amounts of unrecorded production and consumption, increasing the proportion of alcohol that is taxed could be a more effective pricing policy than a simple increase in tax.

Introduction

The first paper in this Series[1] summarised the global burden of ill health and the economic cost attributable to alcohol use and alcohol-use disorders, noting that 4·6% of all ill health and premature death worldwide is due to alcohol, with poorer populations and lower-income countries having a greater disease burden per litre of alcohol than higher-income populations and countries. This second paper in the Series reviews the evidence for the effectiveness of policies and programmes to reduce the avoidable harm caused by alcohol, largely on the basis of an analysis of published systematic reviews and meta-analyses, which were identified through searches of the Cochrane library, Medline, Web of Science, and Web of Knowledge with specific search terms for each target policy area. Reference sections of identified papers were cross-checked to identify other relevant studies contributing to this review. This paper briefly summarises the harm to be reduced, and reviews the evidence for effective policies and programmes and estimates their cost-effectiveness. It concludes with a short overview of the implications for policy development and implementation. Since most countries do not have adequate programmes in place, the third paper in the Series will describe how policies and programmes need to be scaled up, concluding with a global call to action.[2]

Key messages

- A substantive evidence base of systematic reviews and meta-analyses inform alcohol policy
- Making alcohol more expensive and less available are highly cost-effective strategies to reduce harm
- Banning of alcohol advertising, drink-driving countermeasures, and individually-directed interventions to drinkers already at risk are also cost-effective approaches
- School-based education does not reduce harm, but public information and education programmes can increase attention to alcohol on public and political agendas
- If more stringent alcohol policies are not put into place, global alcohol-related harm is likely to continue to increase

Harm caused by alcohol

Alcohol is an intoxicant that affects a wide range of structures and processes in the CNS. By interacting with personality characteristics, associated behaviours, and sociocultural expectations, it is a causal factor for intentional and unintentional injuries and harm to people other than the drinker,[3] including reduced job performance[4] and absenteeism,[5] family deprivation,[6] interpersonal violence,[7] suicide,[8] homicide,[9] crime,[10] and fatalities caused by driving while under the influence of alcohol (drink-driving).[11] Furthermore, it is a contributory factor for risky sexual behaviour,[12] sexually transmitted diseases,[13] and HIV infection.[14] Alcohol is a potent teratogen with a range of negative outcomes to the fetus, including low birthweight, cognitive deficiencies, and fetal alcohol disorders.[15] Alcohol is neurotoxic to brain development, leading to structural hippocampal changes in adolescence,[16] and to reduced brain volume in middle age.[17] Alcohol is a dependence-producing drug, similar to other substances under international control, through its reinforcing properties and neuro-adaptation in the brain.[18] It is an immunosuppressant, increasing the risk of communicable diseases,[19] including tuberculosis.[20] Alcoholic beverages are classified as carcinogenic by the International Agency for Research on Cancer, increasing

	Evidence of effect	Level of evidence
Education and information		
School-based education	Some positive effects on increased knowledge and improved attitudes but no sustained effect on behaviour. An SR of 14 SRs identified 59 high-quality programmes, of which only six were able to show any evidence for effectiveness[42]	1
Parenting programmes	An SR of 14 parenting programmes noted reductions in alcohol use in six parenting programmes[43]	2
Social marketing programmes	An SR of 15 programmes noted eight of 13 studies with some significant effects on alcohol use in the short term (up to 12 months), four of seven studies with some effect at 1–2 years, and two of four studies with some effect over 2 years.[44] (Some of the described programmes are not strictly social marketing programmes, and other reviews have concluded the same programmes as ineffective[42])	2
Public information campaigns	Little scientific research; individual studies generally ineffective[45]	5
Counteradvertising	Little scientific research; inconclusive results[45]	5
Drinking guidelines	No scientifically published assessment[45]	6
Health warnings	SR of the experience in the USA noted some effect on intentions to change drinking behaviour, but no effect on actual behaviour change itself[46]	2
Health-sector response		
Brief advice	An MA of the effectiveness of brief interventions for hazardous and harmful alcohol consumption noted a positive effect of brief interventions on alcohol consumption, mortality, morbidity, alcohol-related injuries, alcohol-related social consequences, health-care resource use, and laboratory indicators of harmful alcohol use.[47] An SR of 12 studies noted that a combination of educational and office support programmes increased rates of screening and advice giving of primary health-care providers from 32% to 45%[48]	1 2
Cognitive-behavioural therapies for alcohol dependence	Effective—an SR of 17 studies of behavioural self-control training found a combined effect size of 0·33 (SE 0·08) for reduced alcohol consumption and alcohol-related difficulties[49]	1
Benzodiazepines for alcohol withdrawal	Effective—an SR of 57 trials recorded an RR of 0·16 (95% CI 0·04–0·69) for seizures compared with placebo[50]	1
Glutamate inhibitors for alcohol dependence	Effective—an SR of 17 RCTs reported an RR of point prevalence abstinence of 1·40 (95% CI 1·24–1·59) at 6 months and 1·62 (1·37–1·92) at 12 months[51]	1
Opiate antagonists for alcohol dependence	Effective—an SR of 29 RCTs reported a significant reduction in relapse, at least in the short term (3 months) (RR 0·64 [95% CI 0·51–0·82])[52]	1
Community programmes		
Media advocacy	Little scientific research; but advocacy in media aimed at uptake of specific policies can lead to increased attention to alcohol on political and public agendas[45]	5
Community interventions	Evidence of effectiveness of systematic approaches to coordinate community resources to implement effective policies, when backed up by enforcement measures[53]	5
Workplace policies	An SR noted little evidence of effect in changing drinking norms and reducing harmful drinking[54]	2
Drink-driving policies and countermeasures		
Introduction and/or reduction of alcohol concentration in the blood	Effective in reducing drink-driving causalities—an MA of nine studies in the USA reported implementation of a legal concentration of 0·8 g/L alcohol in the blood resulted in 7% decrease in alcohol-related motor vehicle fatalities[55]	1
Sobriety checkpoints and unrestrictive (random) breath testing	Effective in reducing alcohol-related injuries and fatalities—an MA of 23 studies noted that alcohol-related fatal crashes reduced by 23% after introduction of sobriety checkpoints and by 22% after introduction of random breath testing[56]	1
Restrictions on young or inexperienced drivers (eg, lower concentrations of alcohol in blood for novice drivers)	Some evidence—an SR of three studies of lower alcohol concentrations in the blood detected reductions in fatal crashes of 9%, 17%, and 24%[56]	2
Mandatory treatment	Evidence for effectiveness—an MA of 215 assessments of remedial programmes noted that they reduced recurrence of alcohol-impaired driving offences and alcohol-related accidents by 8–9%[57]	2
Alcohol locks	Some evidence—an SR of one RCT and 13 controlled trials noted that interlock participants had lower recurrence of offences than did controls, an effect that did not extend once the interlock was removed[58]	2
Designated driver and safe-ride programmes	No evidence for effectiveness. An SR of nine studies was unable to draw any conclusions about effectiveness[59]	2
Addressing the availability of alcohol		
Government monopolies	Effective—privatisation followed by higher density of outlets, longer hours or more days of sale, changes in price, and an increase in consumption[60]	2
Minimum purchase age	Effective—a review of 132 studies published between 1960 and 1999 noted that changes in minimum drinking age laws can reduce youth drinking and alcohol-related harm, including road traffic accidents[61]	2
Outlet density	Effective—an SR reported consistent evidence for the effect of outlet density on violence, harm to others, and drink-driving fatalities[62]	2
Days and hours of sale	Effective—reviews noted consistent evidence that increases in days and hours of sale increase consumption and harm, and that reductions in days and hours of sale reduce consumption and harm[45,63]	3
Addressing the marketing of alcohol beverages		
Volume of advertising	Effective—an SR of 13 studies noted an effect of advertising on youth initiation and heavier drinking among current users.[64] An MA of 322 estimated advertising expenditure elasticities detected a positive effect of advertising on consumption (coefficient 0·029)[65]	1
Self-regulation of alcohol marketing	No evidence for effectiveness. Studies show that self-regulation does not prevent types of marketing that can affect young people[66]	5

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	Evidence of effect	Level of evidence
(Continued from previous page)		
Pricing policies		
Alcohol taxes	Effective—an MA of 132 studies noted a median price elasticity for all beverage types of –0·52 in the short term and –0·82 in the long term, elasticities being lower for beer than for wine or spirits.[65] An MA of 112 studies noted mean price elasticities of –0·46 for beer, –0·69 for wine, and –0·80 for spirits.[67] Increasing taxes reduce acute and chronic alcohol-related harms.[68] Setting minimum prices can reduce acute and chronic harms[69]	1
Harm reduction		
Training of bar staff, responsible serving practices, security staff in bars, and safety-oriented design of the premise	Little effectiveness. An SR detected little effect unless backed up by police enforcement and licence inspectors[70]	2
Reducing the public health effect of illegally and informally produced alcohol		
Informal and surrogate alcohols	Some experience from reducing alcohol-related harm, by, for example, not allowing methanol to be used as denaturing agent[29]	5
Strict tax labelling	Some evidence of effectiveness drawn from other psychoactive substances (tobacco)[71]	5

Levels of evidence: 1=more than one systematic review; 2=one systematic review; 3=two or more randomised controlled trials; 4=one randomised controlled trial; 5=observational evidence; 6=not assessed. SR=systematic review. MA=meta-analysis. RR=risk ratio. RCT=randomised controlled trial.

Table 1: **Summary of effect of policy measures, with level of evidence ranked according to availability of evidence**

the risk of cancers of the oral cavity and pharynx, oesophagus, stomach, colon, rectum, and breast in a linear dose-response relation,[21] with acetaldehyde as a potential pathway.[22] Alcohol has a biform relation with coronary heart disease. In low and apparently regular doses (as little as 10 g every other day), alcohol is cardioprotective,[23] although doubt remains about the effect of confounders.[24] At high doses, especially when consumed irregularly, it is cardiotoxic.[25]

The risk of a lifetime attributable death from a chronic alcohol-related disease increases linearly from zero consumption in a dose-response manner with the volume of alcohol consumed;[26] death from an acute alcohol-related disease increases from zero consumption in a dose-response manner with frequency of drinking, and rises exponentially with the amount drunk on an occasion.[27] Surrogate[28] and illegal[29] alcohols can bring an extra health risk from high ethanol concentrations and toxic contaminants, compounded by social marginalisation.[30]

Ecologically there is a very close link between a country's total alcohol per head consumption and its prevalence of alcohol-related harm[31] and alcohol dependence,[32] implying that when alcohol consumption increases, so does alcohol-related harm and the proportion of people with alcohol dependence and vice versa. Heavy episodic drinking patterns are more common in poorer than in richer drinking populations, and are largely responsible, for example, for alcohol's contribution to the differences in life expectancy between eastern and western Europe.[33]

As noted in the first paper in this Series, less than half the world's adult population drinks alcohol, with abstention rates being highest in low-income countries and populations.[1,34] Much of the variation in per head alcohol consumption between countries and regions of the world indicates differences in abstention rates; among drinkers there is less variation in alcohol consumption. The effect of the present economic recession on alcohol-related harm is uncertain. On the one hand, if income falls,[35] particularly for the lower-middle class, then alcohol consumption and thus alcohol-related harm is likely to decrease; on the other hand, social dislocation[36] as a result of the economic recession is likely to increase alcohol-related harm, independent of changes in overall consumption. If, in the long term, affluence increases, especially in some of the most populous areas of the world in southeast Asia and the western Pacific, global alcohol-related harm will increase, compounded by the fact that, independently, the major diseases that are alcohol-related are rising.[37]

Effectiveness of alcohol policies

Alcohol policies have been defined as sets of measures aimed at keeping the health and social harms from the use of alcohol to a minimum.[38] There are also a variety of other policies that can reduce or increase alcohol-related problems, but which are not normally described as alcohol policies, since they are not implemented specifically to reduce alcohol-related harm as a primary aim—eg, general road safety measures. Much of the published work to establish the effectiveness of alcohol policies has been done in high-income societies, although some policies have been assessed in low-income countries.[39]

The general principles on which particular strategies for alcohol policy work are fairly well understood, and these principles can often be applied across societies. For example, measures to counter drink-driving are premised on a general deterrence effect, and taxes on alcoholic beverages are premised on affecting consumer demand by increasing the cost relative to alternative spending choices. Thus, the fact that there is a conceptual framework and theory of action underlying alcohol policies, and that these principles generally operate

across societies, suggest that research findings from one society will have applicability in another.[38]

Although alcohol policy measures can substantially affect alcohol consumption and alcohol-related harm, several other contextual factors also have a role. For example, in the southern European Mediterranean countries there were large decreases in wine consumption that predated alcohol policies and prevention programmes. These decreases were largely consequent on urbanisation, shifts to factory and service work, and changes in family structure and destructuring of meals, supported in more recent years by increased health consciousness and alcohol policies.[40] Conversely, alcohol consumption has increased in several low-income countries in southeast Asia, where abstention rates have been traditionally high and where a rise in alcohol consumption has implied an increase in the proportion of the population that are drinkers. The rising consumption in these countries is probably an indicator of economic and social development and increases in consumers' purchasing power, as well as increases in the marketing of branded alcoholic beverages.[38]

This paper reviews the effect of alcohol policy for the nine policy target areas included in the report by WHO to the 2008 World Health Assembly,[41] which are summarised in table 1.

Target area 1: information and education

Provision of information and education is important to raise awareness and impart knowledge; however, in an environment in which many competing messages are received in the form of marketing and social norms supporting drinking, and in which alcohol is readily accessible, it does not lead to sustained changes in behaviour. Many systematic reviews have assessed school-based education and concluded that classroom-based education is not an effective intervention to reduce alcohol-related harm.[42] Although some evidence suggests a positive effect on increased knowledge about alcohol and on improved alcohol-related attitudes, evidence for a sustained effect on behaviour is scarce. Parenting[43] and social marketing[44] programmes have mixed effects. The little research that is available has shown that industry-funded educational programmes tend to lead to positive views about alcohol and the alcohol industry.[72,73]

Generally, public information campaigns are ineffective in reducing alcohol-related harm.[45] The effects of counter-advertising—a variant of public information campaigns that provides information about a product, its effects, and the industry that promotes it, to decrease its appeal and use—are inconclusive.[45] No rigorous assessments of whether or not publicising drinking guidelines have any effect on alcohol-related harm have been done.

Assessment of the effect of mandated health warnings on alcohol product containers does not show that exposure produces a change in drinking behaviour, although some intervening variables are affected, such as intention to change drinking patterns.[46] These results contrast with those for tobacco, for which evidence does suggest an effect; however, this evidence could be an indicator of the nature of the warning labels, since the introduction of more graphic and larger warnings for cigarettes, with alternating messages, has affected behaviour.[74] Nevertheless, warning labels are important to help establish a social understanding that alcohol is a hazardous commodity.

Target area 2: health-sector response

Brief advice is the most effective evidence-based treatment method. Extensive evidence from systematic reviews and meta-analyses from a range of health-care settings in different countries has shown the effectiveness of early identification and brief advice for people with hazardous and harmful alcohol use but who are not severely dependent. Furthermore, evidence suggests that more intensive brief interventions are no more effective than are less intensive interventions.[47] Such evidence-based technologies are being implemented and assessed in demonstration programmes in both high-income and low-income countries, with an increasing evidence base for effective implementation strategies.[48]

For individuals with severe alcohol dependence and related problems, many specialised treatment approaches have been assessed, with evidence of an effect for reducing the harm of alcohol withdrawal,[50] behavioural therapies,[49] and pharmacological therapies including glutamate inhibitors[51] and opiate antagonists.[52] Babor and Del Boca[75] have shown that matching individuals with alcohol-use disorders to specified treatments does not improve outcomes.

Target area 3: community programmes

Community-based programmes include education and information campaigns, media advocacy, counter-advertising and health promotion, controls on selling and consumption venues, and other regulations reducing access to alcohol, enhanced law enforcement and surveillance, and community organisation and coalition development.[76] Evidence suggests that media advocacy can lead to reframing the solution to alcohol-related problems in terms of a coordinated approach by relevant sectors, such as health, enforcement, non-governmental organisations, and municipal authorities, resulting in increased attention to alcohol on political and public agendas.[45]

Interventions that have controlled access, which have included the environmental contexts of selling and distribution and which have involved enforcement, are effective in reducing alcohol-related traffic fatalities and assault injuries.[53] A community intervention project in the Northern Territory in Australia aimed to reduce higher levels of alcohol-related harm to national levels by use of a range of strategies, including a levy on alcoholic

beverages with more than 3% alcohol to fund education, increased controls on alcohol availability, and expanded treatment and rehabilitation services. The intervention led to a significant preferential reduction in acute alcohol-related deaths and to a non-significant reduction in chronic alcohol-related deaths in the Northern Territory compared with the control areas, largely due to the tax levy.[77] Some evidence also suggests that workplace programmes can change drinking norms and reduce harmful drinking.[54]

Target area 4: drink-driving policies

Many alcohol policy measures can reduce alcohol-related road traffic fatalities, including increased prices of alcohol, minimum purchase age laws, and outlet density, supported by mass media campaigns.[78] Implementation of effective drink-driving policies can lead to public and political commitment for such measures, emphasising lessons for the progressive implementation of other policy measures to reduce the harm done by alcohol, such that implementation often leads to increased public support for the implemented policy.[79]

Establishment of a legal concentration of alcohol in the blood and lowering it is effective in reducing drink-driving casualties.[55] Intensive random breath-testing, by which police regularly stop drivers at random to check the concentration of alcohol in their blood, and sobriety checkpoints, at which all vehicles are stopped and drivers suspected of drink-driving are breath tested, reduce alcohol-related injuries and fatalities.[56] There is evidence for some effectiveness of setting low concentrations of alcohol in the blood, including a zero level, for young or novice drivers;[56] of administrative suspension of the driver's licence for a driver caught over the limit,[56] mandatory treatment,[57] and the use of an ignition interlock (a mechanical device that does not allow a car to be driven by a driver who is over the limit) for repeat drink drivers;[58] and evidence for no effect of designated driver schemes.[59]

Target area 5: addressing the availability of alcohol

Although total bans on the sale of alcohol exist in several countries with large Muslim populations, and at the community level in several indigenous communities, there are also other widely dispersed bans for the use of alcohol in particular locations, circumstances, or statuses—eg, drinking in parks or streets, hospitals, or at the workplace. Government monopolies for the sale of alcohol can reduce alcohol-related harm;[60] such systems tend to have fewer stores, which are open for shorter hours than systems of private sellers. Without government monopolies, having a licensing system for the sale of alcohol allows for control, since infringement of laws can be met by licence revocation; however, an introduction of a licensing system, with fees generated from licences, can lead to a proliferation of licensed establishments as a mechanism to generate income for jurisdictions. Implementation of laws that set a minimum age for the purchase of alcohol show clear reductions in drink-driving casualties and other alcohol-related harms;[61] the most effective means of enforcement is on sellers, who have a vested interest in retaining the right to sell alcohol.

Urban settings can also be risk factors for harmful alcohol use and harmful patterns of drinking, especially in areas of low social capital.[80] An increased density of alcohol outlets is associated with increased amounts of alcohol consumption among young people,[81] with increased numbers of assault, and with other harms such as homicide, child abuse and neglect, self-inflicted injury, and, with less consistent evidence, road traffic accidents.[62,82] Although extending times of sale can redistribute the times when many alcohol-related incidents occur, such extensions generally do not reduce rates of violent incidents and often lead to an overall increase in consumption and problems.[63] A reduction of the hours or days of sale of alcoholic beverages leads to fewer alcohol-related problems, including homicides and assaults (panel 1).[83]

Strict restrictions on availability can create an opportunity for an illicit market; but, in the absence of substantial home or illicit production, in most circumstances such restrictions can be managed with enforcement. Where a large illicit market exists, licence-enforced restrictions can increase the competitiveness of the alternative market, which needs to be considered during policy making.

Target area 6: addressing the marketing of alcoholic beverages

Alcohol is marketed through increasingly sophisticated advertising in mainstream media, and through linking alcohol brands to sports and cultural activities, through sponsorships and product placements, and through direct marketing such as the internet, podcasting, and mobile telephones. Econometric studies of the link between alcohol advertising and consumption have noted only weak interactions,[65] largely because of methodological difficulties.[84] The strongest evidence, however, comes from longitudinal studies that have shown an effect of various forms of alcohol marketing—including exposure to alcohol advertising in traditional media and promotion in the form of movie content and of alcohol-branded merchandise—on initiation of youth dinking, and on riskier patterns of youth drinking.[64] These findings are supported by those from experimental studies.[85] The effects of exposure seem cumulative and, in markets with greater availability of alcohol advertising, young people are likely to continue to increase their drinking as they move into their mid-20s, whereas drinking decreases at an earlier age in people who are less exposed to it. In some jurisdictions, alcohol marketing relies on self-regulation implemented by economic operators, including advertising, media, and alcohol producers. However, evidence from several studies shows that these voluntary systems do not prevent marketing content that affect young people.[66]

Target area 7: pricing policies

Drinkers respond to changes in the price of alcohol as they do to changes in the price of other consumer products. When other factors are held constant, such as income and the price of other goods, a rise in alcohol prices leads to less alcohol consumption and less alcohol-related harm (and vice versa) in both high-income[65,86] and low-income countries.[87,88] Demand for alcohol is fairly inelastic to price, such that an increase in price results in a drop in consumption that is smaller than the price increase (elasticity measures how much alcohol consumption changes when the price changes: price elastic means that the percentage change in price, and inelastic that the percentage change in consumption, is less than the percentage change in price). Thus, increasing alcohol taxes not only reduces alcohol consumption and related harm, but also increases government revenue at the same time, noting that alcohol taxes are generally well below their maximum revenue-producing potential and that collected revenue is usually well below the social costs of alcohol.[63] The existence of a substantial illicit market for alcohol complicates policy considerations for alcohol taxes;[88] in such circumstances, tax changes are needed to bring the illicit market under effective government control—eg, taxation policies that increase the attractiveness of lower alcohol-content forms of culturally preferred beverages, such as decreased rates of taxation on low-strength beer. Additionally, enforcement needs to be much stronger, including the closure of illegal factories and after-hours production, and the use of tax stamps to record that duty has been paid on informal products. Beverage elasticities are generally lower for the preferred beverage (beer, spirits, or wine) in a particular market than for the less-preferred beverages,[86] and tend to decrease with increased levels of consumption.[67]

Controlling for overall consumption, beverage preferences, and time period, consumer responses to changes in the price of alcoholic beverages do not vary by country.[67] If prices are raised, consumers reduce overall consumption and tend to change to cheaper beverages, with heavier drinkers tending to buy the cheaper products within their preferred beverage category. The effect of an increase in alcohol price tends to be stronger in the long rather than the short term, which is important from a public health perspective.[65] Policies that increase alcohol prices delay the start of drinking, slow young people's progression towards drinking large amounts, and reduce young people's heavy drinking and the volume of alcohol consumed per occasion.[68] Price increases reduce the harms caused by alcohol[89] and alcohol dependence.[90] Setting a minimum price per unit gram of alcohol is modelled to reduce consumption and alcohol-related harm.[69] Price increases and a set minimum price are both estimated to have a much greater effect on heavier than on lighter drinkers, with modest or only small extra financial cost to lighter drinkers.[69] Natural experiments in Europe consequent to economic treaties have shown that as alcohol taxes and prices were lowered, so sales, alcohol consumption, and alcohol-related harm have usually increased (panel 2).[35]

Target area 8: harm reduction

The relation between drinking and alcohol-related harm can be both affected and mediated by the physical and social context of drinking and by the succeeding contexts while the drinker is intoxicated.[94] Some evidence suggests that safety-oriented design of the premises[95] and the employment of security staff, partly to reduce potential violence, can reduce alcohol-related harm. Additionally, some evidence suggests that the use of drinking glasses with toughened glassware, which cannot be used as a weapon, does not reduce alcohol-related harm.[70] Although interventions modifying the behaviour of people serving alcohol and of door and security staff are ineffective on their own,[70] they can be effective with enforcement by police or liquor licence inspectors.[96] Interventions to reduce harm are important, since the problems potentially averted commonly harm people other than the drinker, including the consequences of drink-driving and violence.

Panel 1: Reduction of homicide rate in Diadema, Brazil

Homicide is one of the leading causes of death in Brazil, with one of the highest murder rates occurring in the Brazilian city of Diadema. To respond to this situation, local policy measures were introduced, including a new licensing law in 2002 prohibiting on-premises alcohol sales after 2300 h. To assess the effect on restricting alcohol availability through limiting opening hours on homicides and violence, data from the local police archives on homicides and assaults were analysed. Models were adjusted for contextual conditions, municipal efforts, and law enforcement interventions that took place before and after the closing-time law was adopted. The figure, taken from the study by Duailibi and colleagues,[83] shows the monthly rates of homicide per 1000 residents from 1995–2005 in Diadema. Introduction of a limit on opening hours substantially dropped homicide rates in Diadema and led to a 44% decrease in murders.

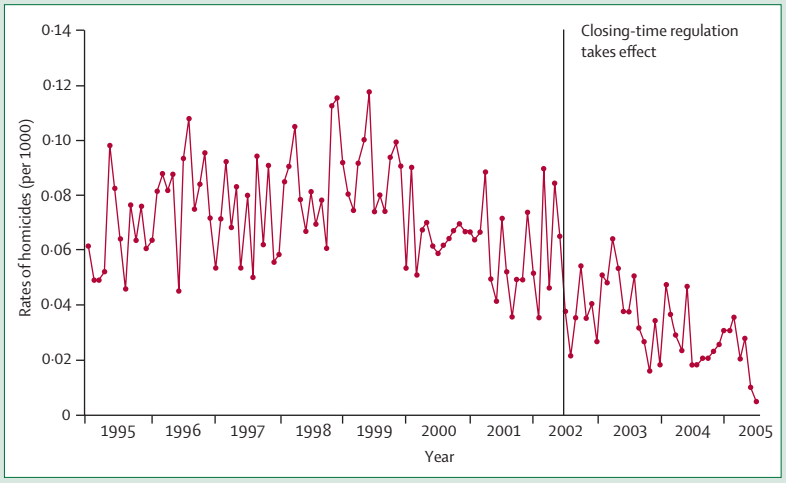

Figure: **Rate of homicide in Diadema, Brazil, between 1995 and 2005**
Homicide rate for July, 2005, is based on a half month of data. Reproduced with permission from the American Public Health Association.[83]

***Panel 2:* Alcohol taxes and cross-border trade in Europe**

The European Union (EU) introduced a single market for alcohol in 1993, resulting in substantial cross-border trade and tax competition between countries, and thus lower tax rates than would have occurred without a single market. Finland, which joined the EU in 1995, was given until 2003 to continue to restrict alcohol imports. After this time, alcohol imports were expected to increase heavily, not only because of the opening borders but also because neighbouring Estonia, well known for its low alcohol prices, was scheduled to join the EU in 2004. Therefore, the Finnish Government decided to lower the alcohol taxes; on March 1, 2004, the alcohol excise duty rate was lowered by an average of 33% to prevent excessive imports and thereby losses in alcohol tax revenues.[91] The tax decrease was the greatest on distilled spirits (–44%), and was more moderate on wines (–10%) and beer (–32%). In 2004, both importation of alcohol from Estonia and retail sales of alcohol in Finland increased. Retail monopoly sales of alcohol in March, 2004, were 50% higher than in March, 2003. The total consumption of alcohol per head increased by 10%, from 9·4 L in 2003 to 10·3 L in 2004, with recorded consumption increasing by 6·5%, from 7·7 L to 8·2 L per head, and unrecorded—and thus untaxed—consumption by an estimated 25%, from 1·7 L to 2·1 L per head. The recorded consumption of spirits increased by 18%, but the increase in sales did not cancel out the effects of the tax cuts on tax revenues. The health effect associated with Estonia joining the EU was not statistically significant, but the effect of alcohol tax cuts in March, 2004, was significant, resulting in an estimated eight additional alcohol-positive deaths per week—a 17% increase compared with the weekly average of 2003,[92] with the largest number of deaths occurring in people who were underprivileged.[93] In response to the worsening situation, alcohol taxes were raised in Finland at the beginning of 2008 by an average of 11·5%. This case study shows, as was the experience with tobacco, that cross-border issues are not solved by decreasing taxes.

Target area 9: reducing the public health effect of illegally and informally produced alcohol

Unrecorded alcohol—defined as informally produced alcohols, illegally produced or smuggled alcohol products, and surrogate alcohol that is not officially intended for human consumption (mouthwash, perfumes, and eau-de-colognes)—could have health consequences because they have a high ethanol content and could be contaminated with methanol and lead, for which many poisoning outbreaks and fatalities have been recorded internationally, and possibly contaminated with some higher alcohols, which have been attributed to higher rates of alcoholic liver disease.[28,29] The complete removal of methanol from denatured spirits is probably the greatest measure to reduce morbidity and mortality attributable to methanol. Some countries, including Australia, have abolished the use of methanol to denature alcohol, with a subsequent substantial reduction in toxic effects.[29] Many European countries do not allow methanol (or methanol-containing wood alcohol) to be used as a denaturing agent.[29] For cosmetics, perfume oils that are part of the formula can be used as a denaturing agent. Other surrogate alcohols—eg, those for automobile products—could be treated with bittering agents to avoid consumption. Rigorous control of selling of medicinal alcohol and the selling of only small container sizes has reduced potential harm from medicinal alcohols in Nordic countries.[29] Illegally traded alcohol can be a health risk either from contamination during the trading process or because it is cheaper than legal alcohol, thus leading to higher consumption. The experience with tobacco smuggling[71] would suggest that the widespread introduction of tax stamps recording that duty has been paid, which have been previously used and which are now being re-introduced in several countries, together with electronic movement and surveillance systems to track the trade of alcohol, could reduce illegal trade.

Cost and cost-effectiveness of alcohol policies

The effect of harmful use of alcohol extends beyond the direct health-related consequences to drinkers (mortality and morbidity effects) to a broader set of social costs, including criminal damage, violence, and lost productivity in the workplace. Documentation of these social costs is important in itself, because the negative spill over effects (or so-called externalities) imposed on society as a result of the private consumption of alcohol represent instances of market failure, which is a central justification for government intervention and action. Studies of social costs have been done in many countries,[1] and the proportion of these costs that are avoidable via the implementation of cost-effective and effective policy measures has been estimated for a small subset.[97] Improved understanding of which measures or strategies represent best use of society's resources—and by how much they can reduce the harmful consequences of alcohol use—is directly relevant to an evidence-based approach to alcohol policy, planning, and assessment.

Building on the review of alcohol policy measures discussed previously, in this section we match international evidence for the cost-effectiveness of specific interventions against the various target areas for action. The primary data source is an earlier WHO analysis of the health costs and effects of population as well as individual-based measures for countering hazardous alcohol use in WHO regions,[98] which have been updated for this review. Specifically, population-level costs associated with the implementation of interventions, including legislation, enforcement, administration, and training costs, plus inpatient and outpatient services, have been updated from 2000 to 2005 international dollar prices, and now include estimates for school-based education and mass media awareness campaigns. (An international dollar [I$] has the same purchasing power as the US dollar has in the USA and is used as a means of translating and comparing costs from one country to the other with a common reference point, the US$.) Intervention health effects—expressed in disability-adjusted life-years (DALYs) saved, relative to an epidemiological situation of no alcohol control measures in the population—were also updated to reflect demographic change in regional populations since 2000, and have been extended to include the effect of a sustained campaign of tax enforcement on reducing amounts of unrecorded production and consumption. Despite these

updates, the analysis continues to rely on many sources of epidemiological and economic data, and assumes that estimates of effect size reported in international published work—eg, with respect to comprehensive advertising bans or roadside breath-testing of drivers—have applicability beyond their original context. Therefore results need to be interpreted with these caveats in mind. Furthermore, non-health effects of alcohol policy measures, such as reduced damage to property or enhanced work productivity, are not included in the analysis.

The results shown in table 2 are provided for three culturally and geographically distinct WHO reporting subregions in which alcohol use poses a substantial public health problem: countries of the Americas region with low child and adult mortality (eg, Brazil, Mexico); countries of the European region with low child mortality but high adult mortality (eg, Russia, Ukraine); and countries of the western Pacific region with low child and adult mortality (eg, China, Vietnam). Because evidence on which to undertake modelling is scarce, no quantitative estimates of cost or effectiveness were made for specific interventions relating to target areas 8 and 9 (harm reduction and reduction of illegal production).

For target areas 1 and 3 (information and education, and community action), we estimated the costs of school-based education and mass-media awareness campaigns, respectively. Although these interventions are not expensive (I$0·20–0·80 per year per person in the population across the three geographical settings considered here), they do not notably affect consumption levels or health outcomes. Such interventions are therefore not effective or cost-effective strategies to pursue to reduce health-related harm due to alcohol use (especially since other actionable strategies exist that are very cost effective).

For target area 2, the health-sector response, brief interventions for hazardous alcohol use have been greatly studied. Compared with the situation of no alcohol control policies, the cost-effectiveness of such interventions (in the range of I$2000–4000 per DALY saved in the three subregions) is not as favourable as is the population-level policy instruments because they involve direct contact with health-care professionals and services. For alcohol dependence—a disease entity in its own right—the relative cost-effectiveness of pharmacological agents (such as acamprosate and

	Coverage	WHO subregion					
		Americas (eg, Brazil, Mexico)		Europe (eg, Russia, Ukraine)		Western Pacific (eg, China, Vietnam)	
		Yearly cost per head (I$)*	Cost per DALY saved (I$)†	Yearly cost per head (I$)*	Cost per DALY saved (I$)†	Yearly cost per head (I$)*	Cost per DALY saved (I$)†
Target area 1: raising awareness and political commitment							
School-based education	80%	0·29	NA‡	0·34	NA‡	0·53	NA‡
Target area 2: health-sector response							
Brief interventions for heavy drinkers	30%	1·04	3870	1·78	2671	0·42	2016
Target area 3: community action							
Mass media campaign	80%	0·31	NA‡	0·79	NA‡	0·19	NA‡
Target area 4: drink-driving policies and countermeasures							
Drink-driving legislation and enforcement (via random breath-testing campaigns)	80%	0·44	924	0·72	781	0·24	1262
Target area 5: addressing the availability of alcohol							
Reduced access to retail outlets	80%	0·24	515	0·47	567	0·16	1307
Target area 6: addressing marketing of alcohol beverages							
Comprehensive advertising ban	95%	0·24	931	0·47	961	0·16	955
Target area 7: pricing policies							
Increased excise taxation (by 20%)	95%	0·34	277	0·67	380	0·20	1358
Increased excise taxation (by 50%)	95%	0·34	241	0·67	335	0·20	1150
Tax enforcement (20% less unrecorded)	95%	0·56	468	0·87	498	0·37	2603
Tax enforcement (50% less unrecorded)	95%	0·63	476	0·93	480	0·43	2733
Combination strategy							
Brief advice, random breath-testing, reduced access, advertising ban, plus increased tax (by 50%) and its enforcement (50% less unrecorded consumption)	..	2·35	691	4·10	754	1·31	1704

*Implementation cost in 2005 international dollars (I$). †Cost-effectiveness ratio, expressed in international dollars per disability-adjusted life-year (DALY) saved for the year 2005. ‡Not applicable (NA) because effect size not significantly different from zero (cost-effectiveness ratio would therefore approach infinity).

Table 2: **Cost and cost-effectiveness of interventions relating to different target areas for alcohol public health policy**

***Panel 3:* Six key policy approaches for countries in which alcohol is normally available**

1. Minimum tax rates for all alcoholic beverages, at least proportional to alcoholic content, should be introduced and increased regularly in line with inflation. In countries with high levels of unrecorded production and consumption, initial focus should be to increase the proportion of unrecorded alcohol that is taxed, rather than to increase overall alcohol taxes.
2. Government monopolies for the retail sale of alcohol should be introduced or maintained with a minimum age of purchase of 18–21 years. When government monopolies are not feasible, a licensing system should be introduced with restrictions on outlet density and days and hours of sale to manage the level of alcohol-related harm.
3. A ban on direct and indirect alcohol advertising.
4. Legal concentrations of alcohol in the blood for drivers should be introduced, with a phased reduction to 0·5 g/L and eventually to 0·2 g/L, with visible enforcement through random and systematic checks.
5. Widespread simple help for hazardous and harmful alcohol consumption should be made available through primary-care facilities, supported by more intensive help for alcohol dependence.
6. Educational programmes should not be implemented in isolation as an alcohol policy measure, or with the sole purpose of reducing the harm caused by alcohol, but rather as a measure to reinforce awareness of the problems created by alcohol and to prepare the ground for specific interventions and policy changes.

naltrexone) has yet to be assessed in these regions of the world.

For drink-driving policies and countermeasures (target area 4), there is good evidence from high-income countries for the effectiveness of drink-driving laws and their enforcement via roadside breath-testing and checkpoints. With the assumption that reported effect sizes from high-income study settings could be realised elsewhere, the estimated cost per DALY saved of such countermeasures across the three WHO subregions assessed here ranged from I$762 in eastern Europe to I$1264 in the western Pacific.

The effect of reducing access to retail outlets for specified periods of the week and implementation of a comprehensive advertising ban (which are specific interventions relating to target areas 5 and 6, addressing the availability and marketing of alcoholic beverages, respectively) have the potential to be very cost-effective countermeasures, but only if they are fully enforced (every healthy year of life restored costs between I$500 and I$1000).

Within the category of pricing policies (target area 7), consistent evidence shows that the consumption of alcohol is responsive to an increase in final price, which can be effectuated via higher excise taxes on alcoholic beverages. Tax increases (of 20% or even 50%) represent a highly cost-effective response in countries with a high prevalence of heavy drinking (eg, every DALY saved costs less than I$500 in both Latin American and eastern European settings). In lower-prevalence contexts—including the western Pacific subregion, where alcohol use in girls and women is relatively infrequent—population-level effects fall and cost-effectiveness ratios rise accordingly. The effect of increases in alcohol tax stands to be mitigated by illegal production, tax evasion, and illegal trading, which accounts for roughly a third of all consumption in the three subregions considered here (and up to 80% in some subregions of Africa and southeast Asia). Reduction of this unrecorded consumption (by 20–50%) via concerted tax-enforcement strategies is estimated to cost 50–100% more than a tax increase but produces similar levels of effect, at least in the three subregions examined in this paper. In settings with high levels of unrecorded production and consumption such as India, increasing the proportion of consumption that is taxed (and therefore more costly to the price-sensitive consumer) could be a more effective pricing policy than a simple increase in excise tax (which might only encourage further illegal production, smuggling, and cross-border purchases).

Specific intervention strategies are not implemented in isolation, but should be combined to maximise possible health gains up to the point at which it remains affordable to do so. The best possible mix of interventions at different spending limits will depend on the relative cost and cost-effectiveness of the individual components, and on the interactions that exist between them. Table 2 includes an example of a wide-ranging combination strategy, showing that although cost-effectiveness is maintained, implementation costs naturally rise.

Implications for policy development

A main goal of alcohol policy is to promote public health and social wellbeing. Additionally, policy can address market failures by deterring children from using alcohol, protecting people other than drinkers from the harm caused by alcohol, and providing all consumers with information about the effects of alcohol. Further, the notion of stewardship implies that liberal states have a duty to look after important needs of people individually and collectively.[99] It emphasises the obligation of states to provide conditions that allow people to be healthy and, in particular, to take measures to reduce health inequalities. The stewardship-guided state recognises that a primary asset of a nation is its health: higher levels of health are associated with greater overall wellbeing and productivity.[100] Panel 3 summarises six key policy approaches for countries in which alcohol is normally available.

Most of the evidence for effective alcohol policy comes from either Anglophone or Scandinavian countries, in which alcohol use is commonly characterised by low rates of abstinence and fairly high rates of heavy episodic drinking. Many of these societies have had a tradition of government regulation of the sale of alcohol,[101] and adoption of evidence-based alcohol policies is often a matter of recovering a lost policy tradition that has been abandoned in the face of the deregulatory phase of the past three or so decades.

The situation is very different in many low-income countries, where there is often little or no tradition of alcohol regulation by government, where the alcohol industry is attempting to expand its markets, and where few civil society organisations are attempting to reduce alcohol-related harm.[2,39] In such countries, there is a need to build public health infrastructures for alcohol policy, appoint governmental officials responsible for prevention of and management of alcohol-use disorders, provide capacity building in alcohol policy and research, and ensure that knowledge of evidence is introduced into policy and programme practice. Developed policies need to be comprehensive, keeping any negative consequences due to perverse incentives to a minimum.[102] Insufficient transparency and information, poor organisation and preparation for the introduction of new policies and laws, vertically as opposed to horizontally organised government, little financing, the presence of corruption, and public distrust of authority are all impediments to the acceptance, implementation, and enforcement of effective policy.[103,104]

Since there are substantial commercial interests involved in promotion of alcohol's manufacture, distribution, pricing, and sale,[2] the alcohol industry has become increasingly involved in the policy arena to protect its commercial interests, leading to a common claim among public health professionals that the industry is influential in setting the policy agenda, shaping the perspectives of legislators on policy issues, and determining the outcome of policy debates towards self-regulation.[2] Caution has been expressed against the role of industries in trying to do the work of governments, which are the proper guardians of the public interest, and are accountable to all citizens to set goals for regulators, deal with external factors, mediate among different interests, attend to the demands of social justice, and provide public goods and collect the taxes to pay for them.[105] Thus, the responsibilities of the alcohol industry in reduction of the harm caused by alcohol should be related to its product—eg, through commitments to a minimum pricing structure, and commitments to support reductions in illegally traded alcohol.

As will be discussed in more detail in the third paper in this Series,[2] to be effective, alcohol policy must also allow an expression of voice (the capacity of individuals to influence the decisions that shape their lives) from civil society to counteract the vested trade interests, which often dominate political decision making.[106] Non-governmental organisations are important partners for all elements of alcohol policy; they are an essential component of a modern civil society, raise people's awareness of issues and their concerns, advocate change, and create a dialogue on policy.[107]

Finally, effective alcohol policies can be eroded by international trade, trade agreements, and cross-border issues.[108,109] For example, substantive evidence suggests that the introduction of a single market for alcohol in the European Union in 2003 resulted in substantial tax competition between countries, and thus lower tax rates than would have occurred without a single market (panel 2).[110]

Conclusions

A substantial evidence base exists for the effectiveness of different policies in reducing the harm caused by alcohol. Essentially, policies that regulate the environment in which alcohol is marketed (economic and physical availability and commercial communications) are effective in reducing alcohol-related harm. Enforced legislative measures to reduce drink-driving are effective, as are individually-directed interventions to drinkers already at risk. However, the evidence shows that information and education type programmes do not reduce alcohol-related harm; nevertheless, they have an important role in providing information, and in increasing attention and acceptance to alcohol on the political and public agendas.

Addition of a cost component to health impact assessment allows the opportunity to identify alcohol prevention and control strategies that offer greatest (or worst) value for money. For example, devotion of scarce resources to interventions that do not discernibly reduce the harm caused by alcohol, as seen for information and education, is not economically rational and serves only to divert resources away from efficient prevention or control strategies. Conversely, taxation policies cost fairly little to implement but reap substantial health returns. In the three WHO subregions represented in this paper, all the population-based interventions represent a cost-effective use of resources (against the international benchmark of per head income), and compare favourably with treatment strategies for disease and injury that could in fact result from harmful alcohol use (eg, cirrhosis of the liver, depression, trauma care for people injured by alcohol-impaired drivers). Brief interventions for the treatment of individual high-risk drinkers also compare favourably with such treatment strategies, but are evidently harder to scale-up because of their associated training and manpower needs.

The presence of an evidenced-based alcohol policy, although important, is not enough. Policy needs to be implemented, assessed, and refined. Furthermore, alcohol is the only major dependence-producing psychoactive substance causing substantial harm to health, and globally it is the most often used psychoactive substance. However, at present alcohol is not covered by an international treaty. The extent to which this omission should be rectified will be discussed in the third paper in the Series.[2]

Contributors

All authors have participated in the preparation of this paper, and have seen and approved the final version.

Conflicts of interest
We declare that we have no conflicts of interest.

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