

Alcohol and public health

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Alcoholic beverages, and the problems they engender, have been familiar fixtures in human societies since the beginning of recorded history. We review advances in alcohol science in terms of three topics: the epidemiology of alcohol's role in health and illness; the treatment of alcohol use disorders in a public health perspective; and policy research and options. Research has contributed substantially to our understanding of the relation of drinking to specific disorders, and has shown that the relation between alcohol consumption and health outcomes is complex and multidimensional. Alcohol is causally related to more than 60 different medical conditions. Overall, 4% of the global burden of disease is attributable to alcohol, which accounts for about as much death and disability globally as tobacco and hypertension. Treatment research shows that early intervention in primary care is feasible and effective, and a variety of behavioural and pharmacological interventions are available to treat alcohol dependence. This evidence suggests that treatment of alcohol-related problems should be incorporated into a public health response to alcohol problems. Additionally, evidence-based preventive measures are available at both the individual and population levels, with alcohol taxes, restrictions on alcohol availability, and drinking-driving countermeasures among the most effective policy options. Despite the scientific advances, alcohol problems continue to present a major challenge to medicine and public health, in part because population-based public health approaches have been neglected in favour of approaches oriented to the individual that tend to be more palliative than preventative.

Introduction

Alcoholic beverages have been used in human societies at least since the beginning of recorded history. Fermented drinks were prepared and consumed in most parts of the world before the European colonial expansion, which changed the cultural position of alcohol nearly everywhere.¹ New forms of alcoholic beverages were introduced, and a product prepared within the household and community was gradually transformed into an industrial commodity available at any time and virtually any place. As part of the contemporary dynamic of globalisation, this process continues today in much of the developing world.

Accompanying the near ubiquity of alcoholic beverages in human history has been a lively appreciation of the social and health problems caused by drinking. Whether in Greece, Palestine, or China, ancient texts speak eloquently about such problems. Every major world religion has at least some strands that counsel abstinence from alcoholic beverages. In most countries where Protestant Christianity was strong, substantial temperance movements in the 19th century at first sought individual pledges to abstain and eventually pressed for national prohibition. When these movements lost momentum, a new compromise was reached: alcohol was no longer viewed as a threat to all, but rather to a small subclass of "alcoholics", or in today's technical terms, people who were alcohol dependent. It became the task of health professionals, among others, to cure alcoholism, and the task of science to discover its basis as a key to treatment and prevention.

Scientific attention to alcohol problems has accelerated during the past 30 years, when substantial advances have occurred in our understanding of drinking problems as well as their prevention and treatment. In this review our discussion of these advances is organised into three

subtopics: the epidemiology of alcohol's role in health and illness; the treatment of alcohol use disorders as part of the public health response; and prevention and policy research. We do not cover here the substantial advances in neuroscience and genetic studies in recent years, since these are reviewed elsewhere² and as yet have little relevance for public health approaches to alcohol problems.

In our review of the evidence, we have emphasised both the medical and public health implications of alcohol use. Whereas medical approaches are appropriate responses to alcohol problems in health care settings, they need to be complemented by population-based public health interventions to address the broad dimensions of alcohol problems at the level of communities and nation states.

Epidemiology

Alcohol and health outcomes

It has long been known that alcohol consumption is responsible for increased illness and death.³ Recent research has contributed substantially to our understanding of the relation of drinking to specific disorders, and has shown that the relation between alcohol consumption and health outcomes is complex and multidimensional. Alcohol has been shown to be causally related to more than 60 different medical conditions,⁴ in most but not all cases detrimentally. Not only volume of consumption, but also patterns of drinking, especially irregular heavy drinking, have been shown to determine burden of disease.⁴⁻⁶ Table 1^{7,8} summarises the major disease and injury categories, and provides estimates (discussed below) of the proportion of the worldwide disability and death attributable to alcohol within each category.

For most diseases, there is a dose-response relation to volume of alcohol consumption, with risk of the disease

Lancet 2005; 365: 519-30

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	Men	Women	Both
Malignant neoplasms			
Mouth and oropharynx cancers	22%	9%	19%
Oesophageal cancer	37%	15%	29%
Liver cancer	30%	13%	25%
Breast cancer	n/a	7%	7%
Neuropsychiatric disorders			
Unipolar depressive disorders	3%	1%	2%
Epilepsy	23%	12%	18%
Alcohol use disorders: alcohol dependence and harmful use	100%	100%	100%
Diabetes mellitus			
	-1%	-1%	-1%
Cardiovascular disorders			
Ischaemic heart disease	4%	-1%	2%
Haemorrhagic stroke	18%	1%	10%
Ischaemic stroke	3%	-6%	-1%
Gastrointestinal diseases			
Cirrhosis of the liver	39%	18%	32%
Unintentional injury			
Motor vehicle accidents	25%	8%	20%
Drownings	12%	6%	10%
Falls	9%	3%	7%
Poisonings	23%	9%	18%
Intentional injury			
Self-inflicted injuries	15%	5%	11%
Homicide	26%	16%	24%

Sources: references 7 and 8.

Table 1: Major disease and injury conditions related to alcohol and proportions attributable to alcohol worldwide

increasing with higher volume. The exceptions are in the cardiovascular area, especially coronary heart disease (CHD) and stroke, diabetes mellitus, and injuries, where other dimensions of consumption than average volume play a crucial role in determining outcome. We discuss the relations between alcohol and disease outcome for three important disease categories (breast cancer, CHD, and intentional injury) chosen because there have been recent advances in our knowledge of the association. These categories are substantial, but not the largest, contributors to the health harms from drinking. Many of the results described are based on medical epidemiological work, which has some shortcomings with respect to alcohol: exposure is often poorly measured, and studies typically have a shortage of people with patterns of irregular heavy drinking.⁹ Another recent advance has been in the methods used to estimate the total effect of alcohol consumption on the burden of disease.¹⁰

Breast cancer

While a role for alcohol in breast cancer has been suspected for some time, the evidence has only recently become clear. Meta-analyses have shown a linear increase of risk of breast cancer with increasing average volume of consumption.^{11–14} Thus, a pooled analysis of six cohort studies found a significant dose-response effect, with consumption of 10 g per day of pure alcohol increasing risk of breast cancer by 9%, and consumption

of 30–60 g per day increasing the risk by 41%.¹¹ Epidemiological evidence further indicates that oestrogen replacement therapy after menopause increases risk of breast cancer, and that oestrogen replacement therapy combined with alcohol use magnifies the risk.¹⁵ Largely driven by the findings in postmenopausal women using oestrogen replacement therapy, discussion has focused on the role of oestrogen and its metabolism as one candidate for a causal pathway. A role for genetic polymorphisms in the association between alcohol and breast cancer has also been proposed.^{16,17}

Coronary heart disease

A comprehensive meta-analysis on average volume of alcohol consumption and CHD found a J-shaped curve.¹⁸ Compared with non-drinking, low-to-moderate consumption of alcohol is associated with lower CHD incidence and mortality, the lowest risk being found at 20 g per day (fewer than 2 drinks). For higher average volume of alcohol consumption, the risk relation reverses^{18,19} with consumption of more than 70 g per day associated with greater risk than in abstainers. Several physiological mechanisms have been suggested to explain the cardioprotective effect of moderate drinking, including effects on lipids and haemostatic factors.^{20,21} However, most of these mechanisms seem to apply only to people who have a pattern of regular drinking without heavy drinking occasions.

Several studies confirming the cardioprotective effect of regular light-to-moderate drinking found an increased risk for major coronary events in drinkers with an episodic heavy drinking pattern compared to abstainers, even when overall volume of drinking was low.^{22,23} In addition to its effect on CHD, an irregular pattern of heavy drinking occasions appears to be related to other types of cardiovascular problems such as stroke or sudden cardiac death.^{24,25} This association is consistent with the increased clotting, lowered threshold for ventricular fibrillation, and elevation of low density lipoproteins that occur after heavy drinking.^{5,26}

In summary, a pattern of irregular heavy drinking is associated with physiological mechanisms that increase the risk of CHD, sudden cardiac death, and other cardiovascular outcomes, whereas regular low to moderate alcohol consumption is associated with physiological mechanisms linked to favourable cardiac outcomes.^{26,27} Another drinking pattern that seems to have a role in the cardioprotective effect is drinking with meals;^{28,29} such an effect also has plausible physiological pathways.

For a specific country, the net effect of alcohol on CHD will depend on the distribution of drinking patterns in a society. For most countries, the net effect of alcohol on CHD is negative, especially in the former Soviet countries and developing nations with episodic heavy drinking patterns.³⁰ Related to the question of the net

effect on CHD in a population at a particular moment is the question of what happens to rates of CHD when consumption of alcohol goes up or down. Since alcohol is typically used in social situations, an individual's drinking tends to be influenced by the drinking of those around them. As the level of drinking in the population as a whole rises or falls, it is probable that some will gain from a change in their consumption while others will lose. The optimum average level of drinking for the population as a whole is likely to be lower than that for an individual,³¹ and lower than the prevailing levels of consumption in western European countries. In recent time-series studies of the relation between national alcohol consumption levels and changes in CHD death rates, Hemström³² found no significant relation for 13 western European countries, and a positive relation (more drinking related to more CHD) for Spain.

Intentional injury (violence)

Alcohol is consistently associated with violent crime,³³ although the relation might not always be causal.³⁴ Experimental research suggests that alcohol causes aggression under certain circumstances, and meta-analyses suggest a small to moderate effect size of about 0.22³⁵ in the overall relation between alcohol consumption and aggression; the effect size measure can be interpreted as a correlation here.³⁶ Alcohol alters brain receptors and neurotransmitters, and several pharmacological effects of alcohol are likely to increase the probability of aggressive behaviour. First, alcohol seems to have an effect on the serotonin and γ -aminobutyric acid (GABA) brain receptors similar to that produced by some benzodiazepines.³⁷ The subjective experience of this effect might be reduced fear and anxiety about the social, physical, or legal consequences of one's actions,³⁸ resulting in increased risk-taking and aggressive behaviour in some drinkers. Findings linking alcohol, GABA receptors, and aggression in animals add to the evidence for this causal

pathway.³⁹ Alcohol also affects cognitive functioning,⁴⁰ leading to impaired problem solving in conflict situations,⁴¹ and overly emotional responses or emotional lability.⁴²

Cultural differences have also become apparent in the strength of the relation between alcohol consumption and violence,^{43,44} mediated by patterns of drinking and by cultural expectations about behaviour while drinking. Thus, time-series analyses of the relation of changes in level of drinking to changes in homicide rates have found a gradient from the south to the north among western European nations, with an extra litre per capita of ethanol raising the homicide rate by more than twice as much in northern Europe as in southern Europe.⁴⁵ The experience of Russia during the anti-alcohol campaign of 1985–88, in the late period of the Soviet Union, suggests that changes in alcohol consumption are even more dramatic in their effects there than in northern Europe: in a period when alcohol consumption (including unrecorded alcohol) is estimated to have dropped by 25%, the rate of male victims of homicide dropped by 40%.⁴⁶ These findings imply that there is not a single relative risk relating average level of alcohol consumption to homicide everywhere; rather, the relative risk will depend on the patterns of drinking and of behaviour associated with drinking in a particular society. In the new estimates in connection with the WHO's Global Burden of Disease project, the relative risk for alcohol's role in violence and in injuries in general varies among countries and subregions according to differences in their patterns of drinking.⁸

Alcohol and global burden of disease

Table 2^{7,47} summarises indicators of alcohol use in major regions of the world.⁸ Two kinds of information are needed to estimate variations in the global burden of disease attributable to alcohol: the average volume of alcohol consumption, and the predominant patterns of drinking. Average volume of alcohol consumption can

WHO regions*	Recorded consumption†	Unrecorded consumption†	Total consumption†	Proportion drinkers	Consumption per drinker†	Pattern‡	
Developing countries							
Very high or high mortality; lowest consumption	EMR-D, SEAR-D (Islamic middle east and Indian subcontinent)	0.41	1.47	1.88	15.0%	12.27	2.9
Very high or high mortality; low consumption	AFR-D, AFR-E, AMR-D (poorest countries in Africa and America)	3.11	2.82	5.93	42.8%	14.21	2.8
Low mortality emerging economies	AMR-B, EMR-B, SEAR-B, WPR-B (better-off developing countries in America, Asia, Pacific)	3.79	1.44	5.23	51.0%	10.53	2.4
Developed countries							
Very low mortality	AMR A, EUR A, WPR A (North America, western Europe, Japan, Australasia)	9.62	1.28	10.90	77.8%	14.00	1.5
Former socialist: low mortality	EUR B, EUR C (eastern Europe and central Asia)	6.97	4.44	11.42	74.5%	15.09	3.3
World		4.22	1.81	6.03	48.6%	12.26	2.5

Calculations based on reference 8. *Regional subgroupings defined by WHO⁴⁷ on basis of mortality levels (A=very low child and very low adult mortality; B=low child and low adult mortality; C=low child and high adult mortality; D=high child and high adult mortality; E=very high child and very high adult mortality). †Litres of pure alcohol per resident aged 15 and older per year. ‡Indicator of hazard per litre of alcohol consumed, composed of several indicators of heavy drinking occasions plus frequency of drinking with meals (reverse scored) and in public places (1=least detrimental; 4=most detrimental).

Table 2: Economic development status and alcohol consumption variables

be derived from country-specific estimates of *per capita* consumption and survey information. Both recorded and unrecorded consumption should be taken into account to arrive at a realistic estimate of total consumption, because in many regions of the world the larger part of the production, sales, and consumption is not recorded (table 2).⁸ Patterns of drinking are shown in terms of a country-specific hazardous drinking score.⁸ The score is an indicator of the hazard per litre of alcohol consumed, and is composed of several indicators of heavy drinking occasions plus the frequency of drinking in public places and not drinking with meals.⁸ It was used in conjunction with the volume of drinking in assessing the alcohol burden from CHD and injuries in the following burden estimates.

Table 3 shows alcohol-related burden based on both average volume of consumption and patterns of drinking. Globally, the effect of alcohol varies greatly by region, from 1.3% of the burden of disease in the poorest developing countries with low consumption to 12.1% in formerly socialist countries. Overall, 4.0% of the global burden of disease is attributable to alcohol (table 3). Thus, alcohol accounts for about as much of the burden of disease globally as tobacco (4.1%), and is surpassed only by the burdens caused by underweight (9.5%), unsafe sex (6.3%), and high blood pressure (4.4%).^{7,10}

In interpreting these global figures, it should be taken into account that they are based on several assumptions⁸—most importantly, that patterns of drinking are homogeneous within a country and that the risk relations between exposure and chronic disease (excepting CHD) do not differ by region.

The role of alcohol use disorders (ICD categories of alcohol dependence and harmful use) within the burden of disease also varies by region. Globally, about a third of the alcohol-attributable burden of disease is accounted

for by alcohol-use disorders, ranging from less than 20% in Africa and the formerly socialist countries to more than half of the alcohol-related burden of disease in high-income countries with very low mortality (western Europe, North America, Japan, Australia). As attention turns increasingly to prevention and management of alcohol problems across the globe, it is therefore important to look beyond the frame of alcohol dependence, which has tended to dominate the concerns of alcohol-related research over the past decades.

Implications for policy and practice

Recent years have brought substantial advances in our understanding of the risk relations of alcohol consumption and specific disorders. The contraindications of heavy drinking occasions now include not only the well-recognised risk of accidental injuries but also such consequences as heart failure. The popularly believed connection between drinking and violence has now received substantial scientific support. This connection, and more broadly the connection with traffic accidents and other injuries, means that alcohol consumption can cause substantial harm to the health of others besides the drinker. There are a number of medical grounds for health workers to strongly discourage heavy drinking even on holidays or weekends. The findings for breast cancer imply that advice about moderate drinking should emphasise that almost no pattern of drinking is entirely risk-free, and that consumers should be aware that a range of health risks should be balanced against benefits they might derive from drinking.

Studies such as the Global Burden of Disease project have greatly enhanced the opportunity for quantitative comparisons between nations of drinking practices and problems. The comparisons themselves become arguments for new policies. That British, Danish, and

	Developing countries			Developed countries		World
	Very high or high mortality; lowest consumption (Islamic middle east and Indian subcontinent)	Very high or high mortality; low consumption (poorest countries in Africa and America)	Low mortality (better-off developing countries in America, Asia, Pacific)	Very low mortality (North America, western Europe, Japan, Australasia)	Former socialist: low mortality (eastern Europe and central Asia)	
Perinatal conditions	29 (0.5%)	48 (0.7%)	29 (0.1%)	6 (0.1%)	11 (0.1%)	123 (0.2%)
Malignant neoplasms	154 (2.6%)	502 (7.0%)	2321 (9.1%)	828 (10.5%)	395 (3.4%)	4200 (7.2%)
Neuropsychiatric conditions in total	1780 (29.8%)	1692 (23.5%)	10142 (39.7%)	5697 (72.1%)	2591 (22.1%)	21902 (37.6%)
Only alcohol use disorders (also part of neuro-psychiatric disorders)	1578 (26.4%)	1328 (18.5%)	2906 (36.7%)	5100 (64.6%)	2299 (19.6%)	19671 (33.7%)
Cardiovascular diseases	899 (15.1%)	442 (6.1%)	2260 (8.9%)	-1548 (-19.6%)	1931 (16.4%)	3984 (6.8%)
Other non-communicable diseases	303 (5.1%)	594 (8.3%)	1864 (7.3%)	787 (10.0%)	1010 (8.6%)	4558 (7.8%)
Unintentional injuries	2293 (38.4%)	2740 (38.1%)	5961 (23.4%)	1571 (19.9%)	3929 (33.5%)	16494 (28.3%)
Intentional injuries	506 (8.5%)	1183 (16.4%)	2940 (11.5%)	558 (7.1%)	1874 (16.0%)	7061 (12.1%)
Total alcohol related burden in DALYs	5966	7199	25519	7897	11742	58323
Total burden of disease in DALYs	458 601	364 117	409 688	115 853	96 911	1 445 169
Proportion of total disease burden that is alcohol related (%)	1.3%	2.0%	6.2%	6.8%	12.1%	4.0%

Data in thousands of disability adjusted life years (DALYs) unless otherwise stated.

Table 3: Economic development status and alcohol-associated burden of disease

Irish 15-year-olds, for instance, considerably exceed those of the same age elsewhere in Europe in the proportion who have been drunk three or more times in the past 30 days⁴⁸ can serve as a wake-up call for action. The Global Burden of Disease analyses have underlined that, although the health problems from drinking can be familiar and often even taken for granted in many societies, they are very substantial in magnitude, accounting on a net basis (subtracting protective effects) for 6.8% of the total burden of disease in developed societies such as in western Europe. In making policy, social problems from drinking—for instance, the effect on family life—must be taken into account on top of the health problems measured in the burden of disease analyses. There is thus a strong justification for the health professions stepping up their health advocacy with respect to policies to reduce rates of alcohol problems.

Treatment of alcohol-use disorders

When a diagnosis indicates that an individual has a mental or behavioural disorder related to alcohol use, several important clinical decisions must be made about the type, setting, and intensity of the intervention. Among heavy drinkers without evidence of severe alcohol dependence, an intervention in primary care aimed at the reduction of drinking to moderate levels of consumption may suffice. By contrast, chronically alcohol-dependent people and other drinkers with high levels of alcohol consumption are likely to have a range of associated disabilities that also need attention. The goals of treatment for such cases typically include complete abstinence from alcohol, management of acute medical and psychiatric conditions, assistance with occupational, interpersonal, and housing needs, and promotion of long-term recovery. The presence of complicating medical (eg, acute pancreatitis, bleeding oesophageal varices) or psychiatric conditions (eg, psychosis, suicidal intent) is an important determinant of whether rehabilitation is initiated in an inpatient or an outpatient setting. Other considerations are the current living circumstances and social support network of the person with alcohol problems. The focus of this section is the clinical management of mental and behavioural disorders due to the use of alcohol, with special emphasis on the ICD-10 categories of harmful use (F10.1) and alcohol dependence syndrome (F10.2).⁴⁹

Approaches to management

A range of interventions have been developed to deal with alcohol-related problems.^{50,51} These treatments can be divided into three general categories: brief intervention; specialised treatment programmes; and mutual help groups. The figure⁵² provides a schematic diagram of current approaches to clinical management, starting with the results of a common screening test designed to differentiate among different levels of risk

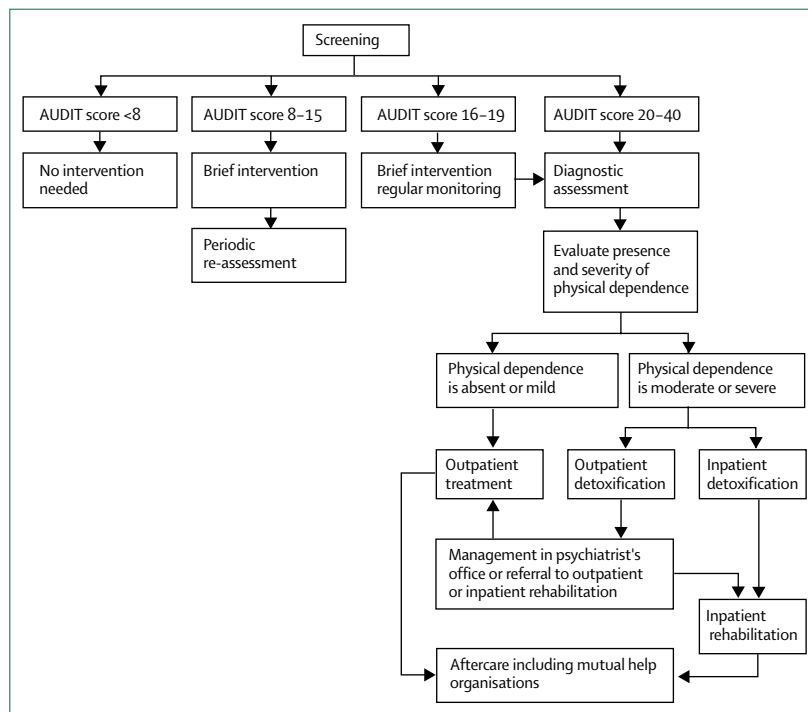


Figure: Algorithm for identification and management of harmful drinking and alcohol dependence. Adapted from reference 52.

and severity. In such an approach, persons who score in the low positive range (8–15) on the Alcohol Use Disorders Identification Test (AUDIT)^{53,54} should receive a brief intervention based on their risk for the consequences of acute alcohol intoxication and the possibility of developing alcohol dependence. Those scoring in the intermediate range (16–19) need a brief intervention and regular monitoring, including referral for a more formal diagnostic assessment if heavy drinking and related problems continue. Those scoring in the high range (20–40) should receive a diagnostic assessment and, depending on the severity of physical dependence, detoxification and other treatments.

Brief intervention

Brief interventions are intended to provide prophylactic treatment before or soon after the onset of alcohol-related problems. They are typically designed to motivate high-risk drinkers to moderate their alcohol consumption, rather than promote total abstinence. They are often simple enough to be delivered by primary care practitioners and are especially appropriate for patients whose hazardous drinking meets ICD-10 criteria for harmful use rather than dependence. During the past two decades, several randomised controlled trials have been done to assess the efficacy of brief interventions. The cumulative evidence^{55–58} shows that clinically significant effects on drinking behaviour and related problems can follow from brief interventions. Nevertheless, the results have not always been

consistent across studies,⁵⁸ and the feasibility of routine screening in primary-care settings has been questioned.⁵⁹ Moreover, there is little evidence that these interventions are beneficial for alcohol-dependent individuals.⁶⁰

Specialised treatment

Specialised treatment refers to interventions directed at the management of alcohol withdrawal, the prevention of relapse to alcohol dependence and the social and psychological rehabilitation of the problem drinker. Specialised treatment services consist of both programmatic or setting components (eg, detoxification facilities, inpatient residential programmes, outpatient clinics) and therapeutic approaches (eg, the twelve steps of Alcoholics Anonymous, relapse prevention).

Management of alcohol withdrawal

An important initial intervention for many alcohol-dependent patients is the management of alcohol withdrawal to relieve discomfort, prevent medical complications, and prepare the patient for rehabilitation. Non-pharmacological or social detoxification consists of frequent reassurance, personal attention, monitoring of vital signs, and general nursing care;^{61–63} this is most appropriate for patients in mild-to-moderate withdrawal. Pharmacological detoxification, typically done in an inpatient setting, is indicated for serious medical or surgical illness, and for individuals with a past history of adverse withdrawal reactions or with current evidence of delirium tremens. The benzodiazepines are preferred for the treatment of alcohol withdrawal because of their favourable side-effect profile.⁶¹

Rehabilitation treatment

Alcohol rehabilitation has typically been provided in a residential setting lasting for periods of a month or more. Residential settings include hospital-based rehabilitation programmes, freestanding units, and psychiatric units. Because of increasing cost concerns, outpatient management has recently become the dominant setting in many countries. Treatment outcomes^{64–66} tend to be similar regardless of setting, but residential treatment may be indicated for patients who are highly resistant to treatment, have few financial resources, come from environments that present a high risk of relapse, and have more serious, coexisting medical or psychiatric conditions.⁶⁷

Therapeutic modalities

Therapeutic approaches most often employed in both residential and outpatient programmes include behaviour therapy, motivational enhancement, Twelve Step Facilitation, family therapy, and pharmacotherapy.

Behavioural treatments, which focus on the teaching of relapse prevention skills and the development of more appropriate cognitive strategies, have been found

to be more effective than insight-oriented, confrontational and family therapies.⁶⁴ Several large studies have indicated that Twelve Step Facilitation, which is designed to introduce patients to the principles of Alcoholics Anonymous, and Motivational Enhancement Therapy, which is designed to increase the drinker's motivation for abstinence, are as effective as cognitive and behavioural therapies.^{68–70} Although patients with certain characteristics (eg, severe dependence, high levels of anger, social networks that support drinking) respond marginally better to certain types of therapy (eg, Twelve Step Facilitation, motivational enhancement, cognitive behavioural, respectively),^{70,71} the research findings do not suggest that matching to therapeutic modality substantially improves treatment outcomes beyond the effect of receiving any intervention.

Pharmacotherapy

Although the benzodiazepines have played a key role in the treatment of alcohol withdrawal, and disulfiram, an alcohol-sensitising drug, has been in clinical use since the 1940s, pharmacotherapy has not yet had a demonstrable impact on treatment of alcohol dependence. During the past decade, however, medications have begun to play a more important part both in the treatment of co-morbid psychiatric disorders in alcoholics and in the rehabilitation of alcohol dependence.^{72–75}

Alcohol-sensitising drugs such as disulfiram and calcium carbimide cause an unpleasant reaction when combined with alcohol, due to raised concentrations of acetaldehyde. Despite its durability in the alcohol problems pharmacopoeia, the few placebo-controlled studies that have been done have shown that the drug is ineffective because of poor medication compliance.⁷⁶ However, a variety of approaches to enhancing voluntary compliance with disulfiram therapy have been employed.^{77,78} These include the use of incentives, contracting with the patient and a partner to promote the patient's taking disulfiram, providing additional information to the patient, behavioural training, social support, and depot formulations.

Another class of drugs is designed to directly reduce alcohol consumption. Consistent with neurobiological research implicating neurotransmitter systems in the control of alcohol consumption,² medications to treat excessive drinking have increasingly focused on agents that have selective effects on endogenous opioids, serotonin, and catecholamines, especially dopamine. Opioid antagonists, such as naltrexone, have been shown to reduce the rate of relapse to heavy drinking^{79,80} but the effects tend to be fairly small.^{75,81–85} Factors such as poor medication compliance, severe alcohol dependence, and the choice of concomitant psychotherapy might therefore determine whether the medication is effective.

Another focus of interest on medications to treat alcohol dependence has been the indoleamine neurotransmitter, serotonin. Placebo-controlled trials have generally shown no overall advantage in drinking outcomes,^{86,87} perhaps because these drugs are differentially effective with different types of individuals, such as those with a family history of alcohol problems.⁸⁸

Acamprosate, an aminoacid derivative, affects neurotransmission of both GABA and excitatory aminoacid (glutamate). Multicentre studies in Belgium, the Netherlands, and Luxembourg,⁸⁹ Austria,⁹⁰ Germany,⁹¹ and Italy,^{92,93} have shown substantial advantages of acamprosate compared with placebo. Despite at least one negative study in the UK⁹⁴ (which showed no significant effect on consumption, but some psychological effects), studies with more than 4000 patients have provided consistent evidence of the efficacy of acamprosate in alcohol dependence rehabilitation.^{75,95} In view of the benign side-effect profile, and a 13% overall improvement in 12-month continuous abstinence rates,⁹⁵ the drug seems to hold substantial value for the treatment of alcohol dependence.

Mutual help organisations, aftercare, and maintenance

Although mutual help societies composed of recovering alcoholics are not regarded as a formal treatment, they are often used as a substitute, an alternative and an adjunct to treatment.⁹⁶ Mutual help groups, such as those based on the Twelve Steps of Alcoholics Anonymous, have proliferated throughout the world.^{97,98} Published research lending support to the effectiveness of Alcoholics Anonymous is limited.⁹⁹ Attendance at the programme is associated with long-term abstinence,¹⁰⁰⁻¹⁰² but the type of motivated person that persists with Alcoholics Anonymous might do just as well with other forms of supportive therapy. Results of several large-scale, well-designed studies^{68,70,103} suggest that Alcoholics Anonymous can have an incremental effect when combined with formal treatment, and attendance at the group alone might be better than no intervention. Evidence also suggests that Alcoholics Anonymous is especially effective in people whose social network includes large numbers of heavy drinkers.^{68,71}

Implications for policy and practice

During the past 25 years, substantial progress has been made in the scientific study of the treatment of alcohol problems. The following conclusions appear warranted at this time: (1) individuals who obtain help for a drinking problem, especially in a timely manner, have better outcomes than those who do not receive help, but the type of help they receive (eg, self-help or formal treatment) makes little difference in long-term outcomes;¹⁰⁴ (2) the intensity and duration of treatment are not associated with pronounced improvements in outcome, (3) medically-based inpatient treatment, although more costly, is not demonstrably more effective

than non-medical residential or outpatient treatment; and (4) little evidence exists that any one psychotherapy or pharmacological approach is best. Although several studies have shown that patients experience substantial improvement during the year after treatment for alcohol problems, results of follow-up studies over a longer period^{100,105} showed that treatment had little effect on long-term outcome. More long-term investigations are needed to assess the effects of different kinds of treatment on the course of alcohol dependence. Additional research is also needed to clarify both the prognostic relevance of patient-related variables, including co-morbid psychiatric disorders, and their interaction with different kinds of treatment. The verdict is, at best, a “guarded affirmative”¹⁰⁶ to the question of whether increased provision of treatment has an effect in lowering the rate of alcohol problems in the population. Provision of such treatment is an imperative for a humane society, but it is not in itself a sufficient policy for reducing rates of alcohol problems.

Policy research and options

Published evidence on prevention programmes and policies for reducing alcohol-related problems has been substantially strengthened in recent years. Studies in the field now include well-designed experimental trials not only of programmes aimed at individuals, but also of community-oriented approaches¹⁰⁷ and even of national policies.¹⁰⁸ Unfortunately, the cultural coverage of the research is somewhat restricted: policy and prevention research tends to be particularly strong for English-speaking and northern European societies,¹⁰⁹ whereas often only case-study information is available for developing societies and southern Europe.¹ Policymakers in societies where published work is strong, however, now have a substantial knowledge base on what works, under what circumstances, for whom, and how well. The general principles based on these findings are also applicable in other countries, but the implementation needs to be adapted to the specific culture.

Education and public information: popular but ineffective

The first recourse in case of public concern about rates of alcohol problems in a society is usually to enhance school-based education and public information campaigns. However, research findings suggest that these measures are not likely to be effective. Much work has been published on assessments of school-based alcohol education, which is increasingly technically sophisticated.¹¹⁰ In general, this evidence suggests that, although knowledge can be increased, and expressed attitudes may be changed, affecting drinking behaviour through school programmes is a very difficult task.¹¹¹ School-based efforts to influence individuals not to drink or to drink less have generally

failed to show lasting effects.¹¹² Efforts to affect the collective social climate of students in terms of drinking have shown more promise, but programmes tend not to show a measurable effect after 3 years,¹¹² and claims of success with university students are now disputed.¹¹³

Experience with public information campaigns is also largely negative.¹¹¹ Unless governments are willing to proceed with intensive counter-advertising campaigns, which the alcohol industry will interpret as a frontal attack, the most promising path forward for public information campaigns in the alcohol field is rather in terms of building support for implementing proven prevention strategies.¹¹⁴

Controlling price and availability: effective but out of favour

There is no doubt that consumption of alcoholic beverages, like consumption of other commodities, is responsive to price. For instance, price elasticities in the UK have been estimated as -0.48 for beer consumed on-premises, -1.03 for packaged beer, -0.75 for wine, and -1.31 for spirits.¹¹⁵ This means that a change in taxes that raised the prices of alcoholic beverages across the board by 10%, for instance, would be expected to diminish on-premise beer consumption by 4.8% and spirits consumption by 13.1%. Substantial evidence exists that heavy drinkers are, like other drinkers, affected by taxes and prices of alcoholic beverages.^{116,117} In accord with this finding, tax increases have been shown to affect rates of cirrhosis mortality, drink-driving deaths, and violent crime, to name a few outcomes.^{118–120} Putting together the price-elasticity estimates and analyses of UK alcohol-related mortality data,¹²¹ we can estimate that a 10% rise in British alcohol prices would produce a drop in cirrhosis mortality of 7.0% in men and 8.3% in women, and a fall of 28.8% in men and 37.4% in women in deaths from explicitly alcohol-involved causes (alcohol dependence, poisoning, etc). Although price elasticities vary between societies, as do the sizes of effects of changes in consumption on mortality, raising the price of alcoholic beverages is an effective way to reduce rates of alcohol-related problems everywhere.

Besides price, other controls on the availability of alcoholic beverages have been shown to affect levels of drinking and rates of alcohol-related problems. Ironically, much of this evidence has become available through studies of what happens when controls are removed or weakened.¹⁰⁹ As the strict controls imposed in many places as an alternative to prohibition in the early 20th century were progressively weakened after 1950, levels of consumption and rates of alcohol-related problems rose substantially.¹²² Drinking and alcohol-related problems can be affected by restriction of the hours and days of alcohol purchasing^{108,123–125} and of the numbers and types of alcohol outlets.^{111,126}

As a partial exception to the general trend toward loosening controls on alcohol sales, in the past 25 years the minimum legal age for purchasing or drinking alcohol has been raised in the USA and some other countries. Strong evidence exists that raising the drinking age diminishes both alcohol consumption and traffic casualties for the affected ages.¹⁰⁷

Reducing alcohol-related vehicle casualties

Rates of alcohol-related casualties have been reduced in many countries by a combination of counter-measures, such as the adoption in much of the world of “per-se laws” forbidding driving above a stated blood-alcohol concentration, and the subsequent lowering of the accepted level.^{111,127} Britain and Ireland, in which the accepted blood-alcohol concentration is 0.08%, have lagged behind most of the rest of Europe in this. Even a further reduction from the general European standard of 0.05% to the current level in Sweden of 0.02% has had a further substantial effect on drink-driving fatalities.¹²⁸

The effectiveness of such laws is, to a substantial extent, dependent on the perceived probability of being caught driving at greater than the allowed level. There is clear evidence that sustained police attention to drink-driving has an effect in lowering the number of alcohol-related casualties.¹²⁷ Routine use of sobriety checkpoints, where people whom police judge to have been drinking are asked to take a breath-test, has some effect; an Australian study showed a 15% reduction in fatal accidents.¹²⁹ Several analyses of Australian experience, however, have shown that a sustained programme of publicised and random breath-testing, in which motorists passing a check-point are chosen randomly to take a breath-test, to be significantly more effective than sobriety checkpoints. In some Australian states, motorists are stopped for random breath-testing about 0.6 times a year, on average.¹¹¹ Sobriety checkpoints and random-breath testing have also shown similar reductions in alcohol-related casualties in other jurisdictions, most notably in the USA.¹²⁷

Graduated licensing measures, with a blood-alcohol limit of zero for young or new drivers, have also been shown to reduce drink-driving, crashes, and injuries for those affected.^{111,127} Taken together, drink-driving counter-measures have clearly demonstrated effectiveness in reducing alcohol-related traffic injury, but have not been as fully or widely applied as they could have been.

Although evaluative studies are scarce, increasing attention is also being paid to strategies for reducing alcohol-related casualties in other vehicular environments—eg, recreational boating.^{130,131}

Reducing violence and casualties around public drinking

Injuries, whether intentional or unintentional, account for a very substantial fraction of the burden of harm from drinking. For instance, 29% of the alcohol-attributable deaths in the UK are related to injuries.¹³² In

recent years, prevention strategies have focused on drinking in public places, primarily pubs or taverns and restaurants. These strategies have a particular relevance for cultures with strong traditions of pub drinking, such as Britain and Ireland (70% of the beer consumed in Britain in 1998 was consumed in pubs).¹³³ The strategies are predicated on a licensing system and enforcement mechanisms for on-premise serving of alcohol, so that the pub or restaurant manager or owner can be held responsible for house policies and their implementation.

One such strategy has been the enforcement of responsible service training and policies denying alcohol service to those who are already intoxicated or underage. Assessments have generally shown that training in itself has little effect on behaviour of servers. However, clear positive effects have been noted on indicators such as rates of customer intoxication when server training and policies are backed up by active enforcement,^{134,135} including evidence of reduced drink-driving casualties¹³⁶ and violence.¹³⁷ A related strategy with promising results is to combine server training with training of pub staff as a means of reducing violence in and around the premises.¹³⁸

In the USA, and to a lesser extent in Canada and Australia, civil liability law has increasingly been used to enforce responsible serving, by holding the serving establishment partly liable for damage caused by a customer who is underage or drunk when served. Goodliffe¹³⁹ has argued that this strategy is also potentially available in the UK. Assessments lend support to the effectiveness of the server's civil liability for damages in reducing rates of traffic fatalities and homicide.^{111,140,141}

What unites these strategies is their focus on holding the alcohol seller responsible for staying within legal parameters in the on-premise drinking situation. On the other hand, current approaches in the UK tend to focus attention on the drinker, through such mechanisms as Pubwatch schemes for sharing information on troublesome drinkers and exclusion orders to ban such people from pubs.¹⁴² Only perceptions, rather than formal assessments, of the UK approach are available.¹⁴³ But the general rule in such situations is that it is easier and more effective for the state to influence licensed occupational behaviour than it is to influence the behaviour of private customers.¹⁴⁴

Building effective alcohol policies

A stark discrepancy exists between research findings about the effectiveness of alcohol control measures and the policy options considered by most governments. In many places, the interests of the alcohol industry have effectively exercised a veto over policies, making sure that the main emphasis is on ineffective strategies such as education. A case in point is the recent Alcohol Harm Reduction Strategy for England, which emphasises co-operation with the alcohol industry and eschews

effective strategies.¹⁴⁵ The tendency has often been to treat alcoholic beverages more and more as an ordinary commodity, overlooking the very serious health and social problems related to alcohol consumption. In the context of the European Union, national controls such as relatively high taxes are increasingly undercut by large traveller's allowances for imports for personal use.¹¹¹

There has been a growing contrast between the treatment of alcohol in trade agreements and disputes as an ordinary commodity and the more restrictive treatment of such other commodities as tobacco and pharmaceuticals, which also entail public health risks. In a globalising world of common markets and trade agreements, alcohol policy is thus no longer only a national or subnational matter. To reverse the trend, a new international agreement on alcohol control, along the lines of the Framework Convention on Tobacco Control, is needed.¹¹¹

At the national and subnational levels, responsibility for the alcohol market and for the various social and health problems from drinking is typically split among several government departments, and often between different levels of government. The crucial need, from a public health perspective, is for a regular means of co-ordination whereby prevention of alcohol-related problems is taken fully into account in policy decisions about alcohol controls and other regulation of the market for alcoholic beverages.

Conflict of interest statement

We declare that we have no conflict of interest.

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