

## CHAPTER 14

# Strategies to prevent alcohol-related injury targeted to high-risk products, settings, and populations

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### SUMMARY

The allocation of resources to prevent alcohol-related injuries should address different risk groups within the population as well as hazardous alcohol products and drinking environments. Because of the high prevalence of hazardous drinking behavior, universal strategies that reduce the alcohol consumption of all drinkers should be a priority, particularly those targeting the price and physical availability of alcohol. Targeting the cheap, high-strength alcohol often preferred by hazardous drinkers through policy interventions (e.g., by setting a minimum price per standard drink) should also be a priority. The risk of alcohol-related injury is highly context-specific, and some drinking environments are especially high risk for injury. There are proven strategies for limiting the risk of injury both in public drinking venues such as bars and nightclubs and on the roads. For example, drinking environments may be modified and staff trained to reduce risk of injury independent of drinking behavior per se. Policing strategies, which can help to reduce risk of alcohol-related violence at drinking venues, and deter impaired driving, can also be implemented. Targeted strategies that screen, identify, and provide brief intervention to hazardous drinkers can also be effective. These types of interventions have been successfully implemented in emergency departments, resulting in reductions in alcohol consumption and related injuries. Evidence that school education and public alcohol awareness campaigns work is weak. However, it is recommended that alcohol education be re-conceptualized as a means to raising awareness of both alcohol-related harms and the availability of effective strategies to

increase public support for effective measures to reduce alcohol-related injury. A sea change in public opinion on alcohol and alcohol-related problems is required so that the yawning gap between what is known about the prevention of alcohol-related injuries and what is actually implemented can begin to be closed.

### INTRODUCTION

When strategies to address alcohol-related problems are considered, it is tempting to focus initiatives and resources only on those sectors of the population with the highest rate of problems. This approach is effective yet limited for two reasons. First, it does not address occasional alcohol-related incidents, which involve those who typically but not always drink modest amounts. Second, it has no preventive potential for those who 1) are currently not drinking and who may be hurt or injured by someone else's drinking, or 2) may drink themselves in a high-risk manner in the future. Thus, it is important that policies and prevention strategies target the whole population, as well as those who drink large amounts and are most likely to experience alcohol-related trauma. These two foci are related to the concept of the "prevention paradox," discussed in the section below.

It is also important to consider the wide range of risks and potential harm from alcohol. All members of society are at risk of encountering alcohol-related problems, either through their own drinking (e.g., (1)) or due to drinking by others (2, 3). As noted below, occasional heavy drinking is also a concern

from a population perspective because it can have dangerous, or even lethal, consequences for the drinker or other people in the immediate environment. In addition, there are many more occasional heavy drinkers than regular heavy drinkers, so at the population level the former contribute more to the overall burden from alcohol than the latter.

This chapter describes the importance of considering risk from several perspectives, including risk related to drinkers' behavior (e.g., high-volume alcohol intake), as well as risky products and drinking settings, and how it might change across different contexts. For example, having several drinks at a New Year's party may be low risk if the drinker is using public transit to get home, but is not advisable if he/she plans to operate machinery.

The concept of environmental prevention—the policy context—should also be considered. Environmental prevention refers to strategies that focus on alcohol, selling context, and serving practices, as well as controls on products and drinking settings. While these strategies may affect the drinker and his/her behavior, the focus is on not on the individual per se. As environmental prevention has substantial potential to reduce harm from alcohol (4, 5), the policy context is extremely important. However, sufficient resources and institutional capacity are required to determine which policies are most effective, and how to put them in place—including the necessary regulatory or legislative changes. There often also needs to be investment in informing the public about the value of these strategies, as without public support their effectiveness may be compromised. Finally, in many instances it is insufficient to have sound regulation unless there is sufficient capacity and political will to ensure adequate enforcement.

## **REDUCING HARM FROM ALCOHOL: THE “PREVENTION PARADOX”**

Alcohol-related harm includes various types of trauma, chronic disease, and social problems that can be experienced by the drinker; his/her family, friends, and work associates; or strangers. Even for persons who typically drink modest amounts of alcohol,

such as a few standard drinks per day, occasional events of heavy episodic drinking may contribute to alcohol-related negative incidents or increased probability of such events occurring. Furthermore, there are some situations and contexts when it is not advisable to drink in order to avoid health and safety risks. These include operating machinery; driving motor vehicles, aircraft, or motorized watercraft; being responsible for infants; and during work hours, to mention a few (6). These latter public health considerations apply to drinkers at all levels of consumption, ranging from the naïve first-time drinker to the regular, modest drinker, and the person who regularly drinks large quantities. Given that the number of moderate users in most societies is many times the number of high-risk users, even occasional events of hazardous drinking from this sector will contribute more overall damage in a society from alcohol than the minority who routinely drink to excess. Therefore, a comprehensive approach to reducing alcohol-related public health and safety problems needs to consider the total population, not only those who drink at levels that are hazardous to their health or are considered dependent on alcohol.

The “prevention paradox” was first outlined by Geoffrey Rose in 1981 (7), and later applied to alcohol consumption by Norman Kreitman (8). As noted by Hunt and Emslie (9), Rose contrasted “the consequences of a focus on sick individuals with that on sick populations.” For example, in the case of alcohol, focusing on hazardous users might result in an effective intervention, such as comprehensive screening, brief intervention, and referral to treatment, but would only reduce a portion of alcohol-related harm, and usually at relatively high cost in terms of resources. In contrast, population-level interventions, which have the potential of reducing alcohol-related hazardous incidents, including those associated with that sector of the population that typically drinks moderate amounts, might be very cost-effective. However, there may be little motivation for a moderate drinker with infrequent episodes of binge drinking to change his/her behavior in the absence of external incentives. Interventions that target hazardous users, which are typically more costly, also face the challenges of 1) determining the interven-

tion focus, and 2) once focused, convincing persons who are habituated or dependent on alcohol to dramatically change their behavior. On the other hand, at the societal level, there may be public or administrative resistance to implementing measures that do not target those who frequently drink large quantities, so population-level interventions or policies may face the challenge of persuading policy makers that bringing about modest change in many individuals has sufficient collective benefit to be worth pursuing. Of particular relevance to alcohol-related injury are analyses of the prevention paradox in relation to alcohol use showing that “acute” alcohol-related harms in general are mostly experienced by occasional heavy drinkers (10-12). This perspective may be helpful in overcoming theoretical political resistance to the implementation of effective prevention measures that target this common drinking pattern, especially in hazardous settings (e.g., when driving or operating machinery). Based on the theory of the prevention paradox, population-wide measures such as random breath testing, increased pricing and reduced physical availability of alcohol offer the promise of greater impact (5)—none of which depend on moderate drinkers being internally “motivated” to reduce their occasional excessive consumption.

This concept has been examined in several different contexts, including binge drinking among college students (13), general populations of Norway and Sweden (14), adolescents in 23 European countries (15), and a household survey in Brazil (16). A report by Spurling and Vinson (17) based on a population-based case-control and case-crossover study in three emergency departments in a U.S. county estimated the population-attributable fraction (PAF) associated with drinking in the six-hour period before injury. Based on their results, “the PAF that was due to what is usually considered less hazardous alcohol consumption (fewer than 5 standard drinks for men and fewer than 4 for women on one occasion) was 4.5% in the case-crossover analysis and 3.1% in the case-control analysis. The PAF that was due to alcohol dependence was 4.0%” (16, p. 47). The critical point here is that there are substantially larger numbers of individuals consuming at the lower levels of

consumption than there are with dependence, so after these attributable fractions are applied there are many more preventable cases among lower-risk versus high-risk drinkers.

Given their differences in scope and goal, these strategies are not mutually exclusive; neither is fully adequate alone in a comprehensive approach, and both population-level and the more focused interventions are needed (18). Action on the former is essential to make substantial progress in reducing hazardous drinking and alcohol-related harm, and supportive action in the latter area is required in a comprehensive approach.

In generic terms, eight strategies have been shown to be effective in reducing alcohol-related harm: four types of population-level policies, and four types of targeted policies. All have the potential for reducing the incidence of cases that come to emergency room services. They are presented below by category.

### **Population-level policies**

Population-level policies that have proven effective against alcohol-related harm include 1) alcohol pricing policies designed to control overall consumption and high-risk drinking; 2) controls on physical and legal availability; 3) curtailing alcohol marketing; and 4) regulating and monitoring alcohol control systems. These strategies have been shown to curtail overall drinking, reduce hazardous consumption, and lower harm from alcohol. There is extensive and growing literature in support of the population-level approach (4, 5), although the evidence is stronger with regard to pricing policies than it is for controls on alcohol marketing. Price and taxation of alcohol has been linked with overall consumption (19) as well as alcohol-related mortality and morbidity (20-22).

### **Targeted policies**

Targeted policies and interventions can be used to complement population-level policies. Effective targeted strategies include: 1) countering drinking and driving; 2) changing the drinking context; 3) educating and promoting behavior change; and 4) in-

creasing access to screening, brief intervention and referral to treatment. These types of interventions, while also of benefit to drinkers and non-drinkers, are especially relevant to consumers drinking at hazardous levels or in hazardous contexts—namely, those who drive motor vehicles after drinking, those who are over-served alcohol in license premises, and those who routinely drink above the low-risk drinking guidelines (6).

Furthermore, as discussed below, these types of interventions can target hazardous products, hazardous environments, and hazardous drinkers. Both population-level and focused interventions are needed to reduce harm from alcohol, and both types of initiatives will benefit the population presenting in emergency rooms with alcohol-related harm.

## TARGETING HAZARDOUS PRODUCTS

In countries with active alcohol markets, there are many thousand different alcoholic products available for sale, all varying in terms of beverage type (beer, wine, spirits, “coolers,” etc.); alcoholic strength; price; and volume (23). There are also non-beverage alcohol products, and homemade and illicitly supplied alcohol products. The likelihood that each of these products will be consumed in a way that increases risk of injury is not equal. In general terms, these products pose increased risk of injury if they are high in alcohol content and low in price. These two factors can be reduced to one fundamental concept: price per unit of ethanol, which is often usefully illustrated as a price per “standard drink” (a concept defined differently in different countries). Furthermore, associations with harmful outcomes of some beverage types (e.g., beer, fortified wine) can be attributed to having the lowest prices per standard drink.

### Risk from low-priced alcohol

There is good evidence that hazardous drinkers seek out the least expensive alcohol to maximize ethanol intake per dollar. Jones and Parry (24) found that young Australian drinkers often used labels on alcohol containers to calculate the cheapest way of get-

ting drunk. The consumption of very cheap alcohol from unofficial sources is reported in many countries and is sometimes associated with outbreaks of alcohol-related deaths from poisoning (25). Cheap wines have caused substantial problems in rural communities with a high Aboriginal population (26). Meier et al. (27) found that price increases among cheaper products have a particularly high impact on levels of consumption by hazardous drinkers. A study using relatively complete and accurate data from the Swedish government alcohol monopoly, Systembolaget, also found evidence of substantial brand substitution following price increases, especially among the cheapest brands (28). In the United States, Kerr and Greenfield (29) found significant substitution among heavier drinkers toward lower-priced alcohol products. An analysis of the 2000 National Alcohol Survey indicated the top 10% of drinkers spend about US\$ 0.79 per drink compared to US\$ 4.75 per drink for the bottom 50% of drinkers, with similar differences observed across beverage types.

Strong and significantly negative associations have been demonstrated between the price of alcohol and a range of acute adverse outcomes of relevance to injury. Chikritzhs et al. (30) found a significant relationship between a five-cent increase in the price of all alcoholic drinks and reductions in acute mortality and morbidity. Wagenaar et al. (20) conducted a systematic review and meta-analysis that confirmed significant negative associations between alcohol prices and rates of injury from all causes and specifically from assault, attempted suicide, and road crashes.

Canadian research has confirmed a relationship between the price of the cheapest alcohol available to the population and risk of acute harms from alcohol-related injury or poisoning. In a study of 89 areas in the province of British Columbia across 32 different periods, Stockwell et al. (22) reported that a 10% increase in the average price of the cheapest alcohol across all beverage types was associated with an immediate 9% reduction in alcohol-related admissions to the hospital from acute causes.

Collectively, these lines of evidence suggest that policy environments that permit the availability of

cheap alcohol increase the risk of acute alcohol-related harm such as injury.

### **Risk by beverage type**

Low-risk drinking guidelines are promoted in many countries and many of these provide separate advice recommending various upper limits of consumption to minimize risk of short-term or acute-risk harm (injuries and poisonings) as opposed to longer-term risk of serious illnesses (31). In Canada (32) and the United States (33), the suggested upper limits to reduce risk of short-term harm such as injury are 1) three “standard drinks” (12–14 g of ethanol in the US, 13.45g in Canada) in one day for a female and four standard drinks in one day for males. In Canada, the guidelines are qualified by age, with lower limits (by one drink in each case) recommended for young adults < 25 years old and people ≥ 64 years old (31). Additional advice is provided regarding low-risk drinking environments and drinking speeds, including suggestions about drinking alcohol with meals and avoiding combined use with other mood-altering drugs. Applying these criteria, Zhao et al. (34) analyzed national Canadian survey data to assess the extent to which different types of beverages were consumed in daily quantities inconsistent with these guidelines. Using a specific technique known as the Yesterday Method (35, 36), Zhao et al. (34) showed that on days when guidelines for avoiding acute harm were exceeded, 55% of the alcohol consumed was in the form of beer and 33% in the form of spirits. However, there were marked gender differences in these trends, with a much higher proportion of males drinking beer versus spirits on risky consumption occasions, and a reverse pattern for females.

Klatsky et al. (37) studied correlates of wine, spirits, or beer preference among 53 172 white men and women in a U.S. prepaid health plan. A preference for wine was more likely to be expressed by women, light drinkers, young or middle-aged people, nonsmokers, people with higher education, and those who were free of symptoms or risk of illness. Persons who preferred spirits were likely to be men, heavier drinkers, middle-aged or older, less educat-

ed, and afflicted with symptoms or risk factors for major illnesses. Persons who preferred beer were likely to be younger, male, and intermediate between wine and spirits drinkers on level of consumption and health.

The above findings do not imply that the ethanol in beer or spirits is intrinsically more risky than wine, for example, do suggest that due to a constellation of factors and beverage preferences, the consumption of some beverages is more associated with injury risk than others, a conclusion that has policy and prevention implications in relation to marketing and pricing of alcohol in particular. Earlier research also reported marked and similar variations in risk of hazardous drinking as a function of beverage type (36).

There is also growing evidence that combining alcohol with caffeinated or other energy drinks increases risk of a range of acute problems including death from alcohol poisoning (38, 39). It appears that adding stimulants to alcoholic beverages encourages people to drink for longer periods and thereby consume more and achieve higher blood alcohol levels. A further complication is that the stimulants appear to alter the drinker’s perception of the level of intoxication and give a false impression of being more in control of their reactions and behavior than they actually are (39). There is reason for concern here, particularly because caffeinated alcoholic drinks have increased in popularity in many countries (39).

### **Risk by beverage strength**

Stockwell et al. (40) conducted a controlled examination of the rates of serious alcohol-related harm in communities across Western Australia and related these to socio-demographic characteristics as well as per capita consumption of beer, wines, and spirits. They found that the beverage types most associated with serious harm (alcohol-related hospital episodes and night-time violence) were cheap bulk wines and “full-strength” beers (i.e., around 5% by volume), with low-strength beers (less than 3.8% by volume) associated with lower rates of serious harm. The idea that making higher-strength

drinks more available increases risk of harm is well illustrated in a U.S. college drinking study that compared drinking behavior and enjoyment at fraternity parties with free, unmarked beer, provided under two different conditions. In the first condition, the beer that was provided was only 3% alcohol by volume, and in the second condition, it was 7%. While there were only minor differences in the quantities of high- and low-strength beer consumed, partygoers indicated similar levels of enjoyment and, most importantly, consumers of the 3% beer had substantially lower blood alcohol concentration (BAC) readings than those who consumed the stronger beer (41). This implies that if the same scenario had occurred in a commercial setting, the same (or even greater) profit would have been made by the retailers on sales of the weaker beer, but the risk of adverse health and safety effects would have been much lower with the reduced-alcohol drinks. A more recent Canadian study found that young beer drinkers could not reliably tell the difference between high- and low-strength beer in terms of enjoyment or level of intoxication (42), suggesting that beverage strength (at least in relation to beer) may be a modifiable risk factor for adverse health and safety outcomes.

## TARGETING HAZARDOUS ENVIRONMENTS

Prevention strategies and policies can also target the environment. This can involve making drinking venues, roads, and workplaces safer. There is extensive research on policing of licensed premises, server training and intervention, and enforcement of laws against service to intoxicated patrons and those under-age, which is highly relevant to promoting a safer drinking environment (5, 43, 49). The design of licensed premises is also relevant. For example, in drinking establishments, poor lighting, steep staircases without proper railings, or physical arrangements that encourage crowding can contribute to accidents or inter-personal violence (43). Furthermore, if staff at these drinking establishments are prone to over-service (continuing to provide alcohol when a customer is obviously intoxicated), the

risk of injury is further enhanced (5). Precautionary serving practices in a well-lit, well-designed venue can reduce risk.

In many countries, there has been a decline in crashes, injuries, and deaths involving drivers under the influence of alcohol. While this change can be linked to campaigns, laws, and regulations focusing on preventing drink-driving it is also partly attributable to improvements in road and motor vehicle safety. These include but are not limited to better lighting and signage; more effective and better placement of roadside barriers; clearer and illuminated road markings; and electronic warnings of weather conditions and other hazards. Given these positive developments, someone driving under the influence of alcohol will have a better chance of avoiding a crash, or surviving, should it occur. Changes in automobile design are also relevant, including better braking systems; airbags; mandatory seatbelts; and center-high mount stop lamps (CHMSLs; central brake light mounted higher than the regular left/right brake lamps, sometimes referred to as the “eye-level” or “third” brake light), among others.

In the workplace, in recent decades, there may be a reduction of drinking on the job in some countries. In some settings, alcohol is not allowed and random screening of alcohol can curtail use. Nevertheless, this change will not fully eliminate coming to work while being under the influence of the previous night’s drinking. Safety features at the workplace will have potential in reducing all accidents, including those in which the drinker or another worker is harmed.

## TARGETING HAZARDOUS DRINKERS

Analyses of international emergency room data suggest that drinkers most likely to drink heavily and subsequently experience injuries have some predictable characteristics. One such study identified the group with the highest risk of alcohol-related injury as those who were male, single, and under 45 years old, who drank in the early hours of the morning on weekends (44). This study suggested that these types of presentations in the emergency

department could be used as a surrogate measure of alcohol-related injuries. In line with the prevention paradox theory, it is important to recognize that this pattern of occasional heavy drinking is highly prevalent among young men. A detailed analysis of a Brazilian national alcohol survey concluded that the majority of alcohol problems involved individuals whose average consumption was low or moderate but who occasionally engaged in heavy drinking episodes (15). Also, similar to analyses in the United States and Canada, the authors found that the top 10% of drinkers by volume consumed as much as 44% of all alcohol consumed in Brazil. In Canada, it was estimated that the top 10% of drinkers consume 53% of all alcohol consumed (45).

These two lines of evidence indicate that prevention strategies need to target both the relatively small proportion of the highest-risk drinkers while also using universal strategies that address drinking by the total population. While a small number of drinkers place themselves at extremely high levels of risk, risk of acute adverse outcomes such as injury are also distributed widely among the much larger group of drinkers who only occasionally drink to excess. There is evidence to support this latter pattern of drinking as characteristic of all regions of the Americas. There is also consistent evidence across multiple studies that risk of alcohol-related harm begins to taper off at higher levels of consumption on a given occasion. Graham et al. (46) examined risk of being involved in violent incidents among drinkers in Canadian bars and found that risk leveled off at higher blood alcohol levels, perhaps reflecting reduced activity and capacity at the highest levels of intoxication.

Beyond demographic factors, there is evidence that individual characteristics of drinkers may place them at risk over and above drinking context and amount of alcohol consumed. Sensation-seeking and risk-taking personality styles both independently predict risk of injury among drinkers (e.g., 38), even when contextual factors and amount of drinking are controlled, though typically the latter factors are the more important predictors (47).

## CONCLUSIONS

Those making decisions about prioritizing the allocation of resources to prevent alcohol-related injury should consider both 1) the evidence of the relative effectiveness of alternative strategies, and 2) the distribution of high-risk drinking and risks of harm among the whole population of people who drink. Three main types are recommended: 1) those that reduce the alcohol consumption of all drinkers; 2) those that limit the risk of injury affecting both drinkers and non-drinkers, in public drinking venues such as bars and nightclubs, and on the roads; and 3) use of targeted strategies that screen, identify, and provide brief intervention to individuals drinking above low-risk guidelines. The use of educational strategies as a means of raising awareness of alcohol-related harms and increasing public support for effective measures to reduce alcohol-related injury is also suggested.

Universal strategies that reduce the alcohol consumption of all drinkers are crucial, given the broad distribution of risk from alcohol-related harm, and the potential for hazardous drinking across the entire drinking population. This approach is further indicated by evidence that universal strategies that influence the price and physical availability of alcohol are the most effective (4, 5). In developing these types of strategies decision-makers should also be mindful of the evidence that cheap, high-strength alcohol is most likely to be used by the more hazardous drinkers, making pricing strategies that limit the availability of such products a priority (45).

There is a wide range of proven or promising strategies for limiting the risk of injury affecting drinkers and non-drinkers in public places and on the road. This includes policing strategies, which can help reduce risk of alcohol-related violence of drinking venues (e.g., (46) and deter drink-driving and hence alcohol-related road trauma (4). Risk of alcohol-related injury is highly context-specific, and certain drinking environments are predictably associated with higher risks of injury, such as late night drinking venues and driving while intoxicated. In some cases, environments can be modified and bar staff trained to reduce risk of injury independent of reductions in drinking behavior per se (43, 49).

Use of targeted strategies that screen, identify, and provide brief intervention to individuals drinking above low-risk guidelines is recommended based on encouraging evidence that these types of approaches can result in reduced consumption and related harms (4). Such interventions have also been mounted in emergency departments, with some showing success in reducing consumption and alcohol-related injuries (50).

Finally, although educational strategies were not covered specifically in this chapter (mostly because the evidence that school education and pub-

lic alcohol-awareness campaigns are effective is weak, at best (4, 5), they can also be used to help reduce alcohol-related injury, mainly as a complementary approach to those described above. There is some evidence that public information campaigns can help support the effectiveness of other, proven strategies to reduce alcohol-related injury, such as random breath testing or enforcement of liquor laws (48, 51). Alcohol education strategies should be re-conceptualized to focus on raising awareness of the efficacy of these other, more effective strategies, as well as the need for them (52). ■

## REFERENCES

1. Shield K, Rylett M, Gmel G, Gmel G, Kehoe-Chan T, Rehm J. Global alcohol exposure estimates by country, territory and region for 2005—a contribution to the Comparative Risk Assessment for the 2010 Global Burden of Disease Study. *Addiction*. 2013;108(5):912–22.
2. Giesbrecht N, Cukier S, Steeves D. Collateral damage from alcohol: implications of ‘second-hand effects of drinking’ for populations and health priorities. *Addiction*. 2010;105(8):1323–5.
3. Laslett AM, Catalano P, Chikritzhs T, Dale C, Doran C, Ferris J, et al. The range and magnitude of alcohol’s harm to others. Deakin West, ACT: Foundation for Alcohol Research and Education; 2010.
4. Anderson P, Chisholm D, Fuhr DC. Effectiveness and cost-effectiveness of policies and programs to reduce the harm caused by alcohol. *Lancet*. 2009;373(9682):2234–46.
5. Babor T, Caetano R, Casswell S, Edwards G, Giesbrecht N, Graham K, et al. Alcohol: no ordinary commodity—research and public policy. 2nd. ed. Oxford: Oxford University Press; 2010.
6. Butt P, Beirness D, Cesar F, Gliksman L, Paradis C, Stockwell T. Alcohol and health in Canada: a summary of evidence and guidelines for low-risk drinking. Ottawa: Canadian Centre on Substance Abuse; 2011.
7. Kreitman N. Alcohol consumption and the preventive paradox. *Br J Addict*. 1986;81(3):353–63.
8. Hunt K, Emslie C. Commentary: the prevention paradox in lay epidemiology—Rose revisited. *Int J Epidemiol*. 2001;30(3):442–6.
9. Stockwell T, Hawks D, Lang E, Rydon P. Unravelling the preventive paradox for acute alcohol problems. *Drug Alcohol Rev*. 1996;15(1):7–15.
10. Gmel G, Klingemann S, Müller R, Brenner D. Revisiting the preventive paradox: the Swiss case. *Addiction*. 2001;96(2):273–84.
11. Skög OJ. Alcohol and the so-called prevention paradox: how does it look today? *Addiction*. 2006;101(2):155–8.
12. Weitzman ER, Nelson TF. College student binge drinking and the “prevention paradox”: implications of prevention and harm reduction. *J Drug Educ*. 2004;34(3):247–65.
13. Rossow I, Romelsjö A. The extent of the ‘prevention paradox’ in alcohol problems as a function of population drinking patterns. *Addiction*. 2006;101(1):84–90.
14. Danielsson AK, Wennberg P, Hibell B, Romelsjö A. Alcohol use, heavy episodic drinking and subsequent problems among adolescents in 23 European countries: does the prevention paradox apply? *Addiction*. 2011;107(1):71–80.
15. Caetano R, Mills B, Pinsky I, Zaleski M, and Laranjeira R. The distribution of alcohol consumption and the prevention paradox in Brazil. *Addiction*. 2012;107(1):60–8. doi: 10.1111/j.1360-0443.2011.03567.x. Epub 2011 Oct 7.
16. Spurling MC, Vinson DC. Alcohol-related injuries: evidence for the prevention paradox. *Ann Fam Med*. 2005;3(1):47–52.
17. Giesbrecht N, Stockwell T, Kendall P, Strang J, Thomas G. Alcohol in Canada: reducing the toll through focused interventions and public health policies. *CMAJ*. 2011;183(4):450–5. doi: 10.1503/cmaj.100825.



18. Wagenaar AC, Salois MJ, Komro KA. Effects of beverage alcohol price and tax levels on drinking: a meta-analysis of 1003 estimates from 112 studies. *Addiction*. 2009;104(2):179–90.
19. Wagenaar AC, Tobler AL, Komro KA. Effects of alcohol tax and price policies on morbidity and mortality: a systematic review. *Am J Public Health*. 2010;100(11):2270–8.
20. Patra J, Giesbrecht N, Rehm J, Bekmuradov D, Popova S. Are alcohol prices and taxes an evidence-based approach to reducing alcohol-related harm and promoting public health and safety? A literature review. *Contemp Drug Probl*. 2012;39(1):7–48.
21. Stockwell T, Zhao J, Martin G, Macdonald S, Vallance K, Treno A, et al. Minimum alcohol prices and outlet densities in British Columbia, Canada: estimated impacts on alcohol-attributable hospital admissions. *Am J Public Health*. 2013 Apr 18. [Epub ahead of print].
22. Gruenewald PJ, Ponicki WR, Holder HD, Romelsjö A. Alcohol prices, beverage quality, and the demand for alcohol: quality substitutions and price elasticities. *Alcohol Clin Exp Res*. 2006;30(1):96–105.
23. Jones SC, Gregory P. The impact of more visible standard drink labelling on youth alcohol consumption: helping young people drink (ir)responsibly? *Drug Alcohol Rev*. 2009;28(3):230–4.
24. Nuzhynl V. Chemical composition, toxic and organic properties of non-commercial alcohol samples. In: Haworth A, and Simpson R, editors. *Moonshine markets: issues in unrecorded alcohol beverage production and consumption*. Washington: International Center for Alcohol Policies; 2004.
25. Gray D, Saggars S, Atkinson D, Sputore B, Bourbon D. Beating the grog: an evaluation of the Tennant Creek liquor licensing restrictions. *Aust N Z J Public Health*. 2000;24(1):39–44.
26. Meier PS, Purshouse R, Brennan A. Policy options for alcohol price regulation: the importance of modelling population heterogeneity. *Addiction*. 2010;105(3):383–93.
27. Treno AJ, Nephew TM, Ponicki WR, Gruenewald PJ. Alcohol beverage price spectra: opportunities for substitution. *Alcohol Clin Exp Res*. 1993;17(3):675–80.
28. Kerr WC, Greenfield TK. Distribution of alcohol consumption and expenditures and the impact of improved measurement on coverage of alcohol sales in the 2000 National Alcohol Survey. *Alcohol Clin Exp Res*. 2007;31(10):1714–22.
29. Chikritzhs T, Stockwell T, Pascal R. The impact of the Northern Territory's Living with Alcohol Program, 1992–2002: revisiting the evaluation. *Addiction*. 2005;100(11):1625–36.
30. Furtwängler NA, de Visser RO. Lack of international consensus in low-risk drinking guidelines. *Drug Alcohol Rev*. 2013;32(1):11–8. DOI: 10.1111/j.1465-3362.2012.00475.x
31. Stockwell T, Butt P, Beirness D, Gliksmann L, Paradis C. The basis for Canada's new low-risk drinking guidelines: a relative risk approach to estimating hazardous levels and patterns of alcohol use. *Drug Alcohol Rev*. 2012;31(2):126–34. DOI: 10.1111/j.1465-3362.2011.00342.x
32. Zhao J, Stockwell T, Thomas G. An adaptation of the Yesterday Method to correct for underreporting of alcohol consumption and estimate compliance with Canadian low risk drinking guidelines. Presented at the 39th Annual Alcohol Epidemiology Symposium of the Kettil Bruun Society for Social and Epidemiological Research on Alcohol, Kampala, Uganda, June 3–7, 2013.
33. Stockwell T, Donath S, Cooper-Stanbury M, Chikritzhs T, Catalano P, Mateo C. Under-reporting of alcohol consumption in household surveys: a comparison of quantity-frequency, graduated-frequency and recent recall. *Addiction*. 2004;99(8):1024–33.
34. Stockwell T, Zhao J, Chikritzhs T, Greenfield TK. What did you drink yesterday? Public health relevance of a recent recall method used in the 2004 Australian National Drug Strategy Household Survey. *Addiction*. 2008;103(6):919–28.
35. Klatsky AL, Armstrong MA, Kipp H. Correlates of alcoholic beverage preference: traits of persons who choose wine, liquor or beer. *Br J Addict*. 1990;85(10):1279–89.
36. Brache K, Stockwell T. Drinking patterns and risk behaviors associated with combined alcohol and energy drink consumption in college drinkers. *Addict Behav*. 2011;36(12):1133–40.
37. Brache K, Thomas G, Stockwell T. *Caffeinated alcoholic beverages in Canada: prevalence of use, risks and recommended policy responses*. Ottawa: Canadian Centre on Substance Abuse; 2012.
38. Geller ES, Kalsher MJ, Clarke SW. Beer versus mixed-drink consumption at fraternity parties: a time and a place for low-alcohol alternatives. *J Stud Alcohol*. 1991;52(3):197–204.
39. Segal D, Stockwell T. Low alcohol alternatives: a promising strategy for reducing alcohol related harm. *Int J Drug Policy*. 2009;20(2):183–7.

40. Graham K, Homel R. Raising the bar: preventing aggression in and around bars, clubs and pubs. Devon, UK: Willan Publishing; 2008.
41. Young DJ, Stockwell TR, Cherpitel CJ, Ye Y, Macdonald S, Borges G, et al. Emergency room injury presentation as an indicator of alcohol-related problems in the community: a multi-level analysis of an international study. *J Stud Alcohol*. 2004; 65(5):605-12.
42. Stockwell T, Zhao Z, Thomas G. Should alcohol policies aim to reduce total alcohol consumption? New analysis of Canadian drinking patterns. *Addict Res Theory*. 2009;17(2):135-.
43. Graham K, Osgood DW, Wells S, Stockwell T. To what extent is intoxication associated with aggression in bars? A multilevel analysis. *J Stud Alcohol*. 2006;67(3):382-90.
44. McLeod R, Stockwell T, Rooney R, Stevens M, Phillips M, Jelinek G. The influence of extrinsic and intrinsic risk factors on the probability of sustaining an injury. *Accid Anal Prev*. 2003;35(1):71-80.
45. Stockwell T, Zhao J, Giesbrecht N, Macdonald S, Thomas G, Wettlaufer A. The raising of minimum alcohol prices in Saskatchewan, Canada: impacts on consumption and implications for public health. *Am J Public Health*. 2012;102(12):e103-10.
46. Wiggers J, Jauncey M, Considine R, Daly J, Kingsland M, Purss K, et al. Strategies and outcomes in translating alcohol harm reduction research into practice: the Alcohol Linking Program. *Drug Alcohol Rev*. 2004;23(3):355-64.
47. Gentilello LM, Ebel BE, Wickizer TM, Salkever DS, Rivara FP. Alcohol interventions for trauma patients treated in emergency departments and hospitals: a cost benefit analysis. *Ann Surg*. 2005;241(4):541-50. doi: 10.1097/01.sla.0000157133.80396.1c.
48. Stockwell T. Alcohol supply, demand, and harm reduction: what is the strongest cocktail? *Int J Drug Pol*. 2006;17(4):269-77.
49. Giesbrecht N. Reducing alcohol-related damage in populations: rethinking the roles of education and persuasion interventions. *Addiction*. 2007;102(9):1345-9.