



**The Australian Wine Research Institute**

**submission**

**to**

**Australia: the healthiest country by 2020**

**A discussion paper prepared by the National Preventative  
Health Taskforce**

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Date; 19 December 2008

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## 1. Forward

This submission is presented by The Australian Wine Research Institute (AWRI), which is a private company limited by guarantee. The AWRI is funded by the Grape and Wine Research and Development Corporation, with matching funds from the Federal government. The AWRI formally affiliated with The University of Adelaide in 1991, and is governed by a Board, which comprises six directors elected by the Australian wineries and grape growers who pay *The Wine Grape Levy* and *The Grape Research Levy*; the Director of the Institute (*ex-officio*); and a up to four special qualification directors.

The AWRI is actively involved in education and research initiatives, independently and in conjunction with the Federal government. For example, the AWRI has supported independent research initiatives into gender differences in alcohol metabolism; health effects of alcohol and wine-derived phenolic compounds; and potential allergens in, and adverse reactions to, wine.

The AWRI also provides alcohol-related health and nutrition lectures to wine marketing and wine science students at The University of Adelaide and University of South Australia, and at the triennial Australian Wine Industry Technical Conferences, which hosts approximately 1700 delegates, provides a workshop on alcohol-related health and nutrition. It has also produced and published an educational booklet entitled *The A-Z of information on wine and health issues*, which was co-sponsored by the Federal Department of Health and Aged Care. The AWRI also provides technical advice and assistance to DrinkWise Australia on requested and is the co-author of a book chapter entitled *The biology of intoxication* for the book entitled *400 Rabbits: The Pain and Pleasure of Intoxication*, which is a collaboration between DrinkWise Australia and the International Centre for Alcohol Policies.

In addition, the AWRI supported the Wolf Blass Foundation International Wine and Health Conference, *Medically, is wine just another alcoholic beverage*, which was held in Sydney on 12–13 June 1996, the objective of which was to facilitate discussion and debate between academia, government, health practitioners and industry, in order to give direction to future research, and to future political and social policies.

The AWRI is also the recent recipient in conjunction with Melbourne Health of a research grant from Cancer Australia to undertake a study on the effectiveness of enhanced resveratrol containing wine on reducing biomarkers for colorectal cancer in humans.

**The following comments have been confined to areas and issues in which The Australian Wine Research Institute has access to information and mechanisms, and expertise or knowledge.**

## **2. Introductory comments**

In Australia there has been an approximate 19% decline in per capita consumption over the past two decades which has plateaued, although in 2004, approximately 50% of Australians were consuming at least one alcoholic beverage per week and 9% drank daily (AIHW 2005). The majority of consumers, however, drank on only one or two days per week

It has become increasingly apparent, however, that the pattern of alcohol consumption is as important as level of alcohol consumption to consequences of alcohol consumption and hence alcohol-related harms. Confounders, however, include other risk factors for health problems (Bondy and Rehm 1998) including obesity and smoking. Thus to isolate alcohol use could be considered simplistic. Accordingly, the drinking pattern is often a better predictor of alcohol-related harm than simply the amount consumed (Rehm et al. 2001) and a greater reduction of risk in the general community may be achieved through focusing on patterns rather than on a harmful consumption per se.

Hence, reference should have been made in the Discussion Paper introduction to the Strategy to the National Health & Medical Research Council (NHMRC) *Australian Alcohol Guidelines: health risks and benefits* (2001), the ethos of which is to reduce and minimise alcohol misuse. The Discussion Paper should also make reference to the *Dietary Guidelines for Australian Adults* (2003) and should also take into consideration that, internationally, alcohol has been included in the *Dietary Guidelines for Americans* (2000) in moderation and with meals. Similarly, *The Sensible Drinking* of the UK (1995) also recommends the regular and moderate consumption of alcohol, which was endorsed by the Royal College of Physicians, Psychiatrists and General practitioners (1995).

Accordingly, this Discussion Paper should have included mention of maximising the benefits of moderate and responsible alcohol consumption, while seeking to reduce the harmful consequences of alcohol consumption. Harm minimisation or reduction for alcohol is not aimed at zero consumption, but is to “avoid problems when you drink” (Single 1997), that is, it focuses on decreasing the risk and severity of adverse consequences arising from alcohol consumption without necessarily decreasing the level of consumption. This definition reflects the evidence regarding the potential health benefits of moderate alcohol consumption, as well as the evidence that moderate and responsible consumption is socially acceptable in Australia. Consequently, the introduction to the Discussion Paper should state that its objective is to identify effective and evidence-based strategies for minimising harm while ensuring that the benefits of the moderate and responsible consumption of alcohol are retained. This is also an omission in the monograph by Collins and Lapsley (2008) *The costs of tobacco, alcohol and illicit drug abuse to Australian Society in 2004/05*, yet is acknowledged in the Australian Institute Health and Welfare’s *A guide to Australian alcohol data* (2004) and in the introduction to the *National Alcohol Strategy 2006–2009*. Despite the paper by Fillmore et al. (2006), low risk alcohol consumption, that is moderate consumption,

remains recognised internationally as being associated with both physiological and psychological benefits, for which there are plausible biological mechanisms. The draft revised Guidelines also accept the reality of the J-shaped curve as is stated in the text and Klatsky and Udaltsova's (2007) recent re-analysis seems to take benefit out to at least three US standard drinks/day or 42 g/day. Mukamal's (2006) meta-analysis of 34 studies shows a similar effect, as does Doll's (2005) meta-analysis. In addition, data from the Statistics Canada 2005 Canadian Community Health Survey was used to test the hypothesis that classification errors of the type noted by Fillmore *et al.* (2006) could invalidate the statistical results on the effects of alcohol consumption on self-rated health and the incidence of heart disease and diabetes. The results obtained in this study showed that the beneficial effects of moderate alcohol use shown in so many studies, still appear even when the correct classification of alcohol use is employed (McIntosh 2008). Given that cardiovascular disease is the leading cause of death in Australia (33%), this relationship remains relevant.

Indeed, importantly the Discussion Paper should have included a clear and concise definition of 'harmful alcohol consumption', a reduction of which should be the basis of any actual strategies outlined, which should be clearly delineated from low risk alcohol consumption. Definitions should also be included for intoxication, short-term and long-term harm, and safer drinking, which are used throughout the document. The broad objective 'reducing the prevalence of harmful drinking for all Australian by 30%' should be clearly defined and additionally, specific measurable and meaningful objectives and performance indicators should be included.

The Discussion Paper should have also referred to the National Alcohol Strategy 2005–2009 which should build on the previous *National Alcohol Strategy—a plan for action 2001 to 2003–2004*, the premise of which was to 'minimise and reduce the uptake of harmful alcohol use and minimise the effects of this use in Australian society' and specifically should 'reduce the proportion of the population who drink regularly at levels above those identified by the NH&MRC as low risk'. It is thus for these particular population groups within Australian society that engage in harmful alcohol that specific and targeted strategies are most applicable and appropriate.

The top three key issues that should be specifically included and actioned in any subsequent strategies are:

1. Informing the community
6. Harm reduction—drinking environments
2. Protecting those higher at risk, particularly young people and indigenous Australians

For example, the risk of mortality and morbidity from accidents including motor vehicle accidents, drowning and suicide increases with any amount of consumption. The available data suggests that this risk is greatest for young adults aged 18 to 24 years who regularly consume alcohol at above moderate amounts (Klatsky and Armstrong 1993, Wells and MacDonald 1999, Britton *et al.* 2003). Binge drinking (greater than five to six drinks on an occasion) is a common and hazardous pattern of drinking in this age group irrespective of ethnicity. In 1995, while approximately two thirds of Australian consumers drank alcohol at

a harmful level on one occasion, generally their consumption could be classified as 'safe' (McAllister 1993, Single and Rohl 1997), but the converse was observed for young adults. Furthermore, while moderate consumption is generally cardioprotective for older adults aged 40 to 45 years or more and may confer a modicum of cardioprotection for younger adults (Power et al. 1998, Thadhani et al. 2002), cardioprotection is not considered relevant for young adults as the risk of mortality and morbidity from accidents predominates (Single et al. 1999).

Furthermore, although indigenous Australians are more likely to abstain completely from alcohol than non-indigenous Australians, those who do consume alcohol are more likely to drink at risky levels. 56% of indigenous Australians drink at a level of low risk compared to 74% of other Australians. 23% of indigenous Australians consume at high risk levels compared to 10% of other Australians. The issue of alcohol consumption and consumption of other substances in the rural indigenous communities and in urban areas is a complex one requiring identification of cultural, socio-economic and other factors in order to tailor targeted programs as well as ensuring that the wider population-based educational and social marketing measures are relevant to the indigenous population.

The Discussion Paper should thus have advocated that any specific or targeted strategies are nationally accepted and hence adopted by all the stakeholders, as well as that there is sufficient and sustainable funding available for the media and other campaigns.

Due-dates and numbers should be set for outputs and these due-dates could also be staggered over a two to three-year time frame. Regular screenings and surveys could also be undertaken to determine whether target groups are actually being targeted in the first instance and latterly to determine whether the targeting has positively influenced behaviour and hence harms.

Concerning the proposed establishment of a National Prevention Agency, surely this is duplication or at least overlap with the role of the Federal Department of Health and Ageing, which consults with allied Federal and State departments and academic institutions, and which has the experience and expertise in this area already? Resources could be better utilised in funding the longer-term, well-coordinated and well-directed national and state programs recommended in the Discussion Paper.

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### 3. Specific comments on the major actions outlined

#### 3.1 Reshape consumer demand towards safer drinking through:

- *Managing both physical availability (access) and economic availability (price)*

This is supported for indigenous Australians in remote communities. Specifically, actions such as the Living with alcohol program (LWAP) and sobering up centres, that were targeted at indigenous Australians and which have been shown to be successful in reducing alcohol abuse and misuse within this high-risk group, are supported.

For example, while indigenous Australians constitute only a small proportion (2.4%) of the overall population, numbering 400 000 people who identify as Aborigines or Torres Strait Islanders (Brady 2007), their communities have higher rates of abstinence and intoxication than in non-indigenous communities (Hunter 1992, Perkins et al. 1994), with approximately 50% abstinent and 50% heavy drinkers. For example, indigenous Australian men and women consumed alcohol on an average of 2.75 and 1.40 days per week, respectively, and consumed an average of 44 and 15 standard drinks per day, respectively, on the days that consumption occurred (Kelly et al. 2006). Consistent with or consequent of this heavy drinking, indigenous Australians have higher rates of economic, health and social problems than non-indigenous Australians.

The Northern Territory government (for whom 28% of the population comprises indigenous Australians), initiated and implemented the LWAP in 1992 which continued until 2000. It was culturally relevant for Indigenous Australian communities and comprised both general and community-based initiatives. The aim of the LWAP was to reduce the level of alcohol consumption and related harm in the Northern Territory and its remote communities down to national levels by 2002 by using strategies such as increased controls on alcohol availability and expanded education, drink driver programs, night-patrol programs, rehabilitation and treatment facilities, programs and services (Stockwell et al. 2001, d'Abbs 2004). It was funded from 1992–1997 by a Northern Territory specific alcoholic beverage levy on the sale of products containing more than 3% alcohol by volume.

Examples of community-based initiatives are in Tennant Creek, Curtin Springs and Elliott in the Northern Territory, and Derby and Halls Creek in Western Australia. The initiatives used measures to reduce the supply of, as well as demand for, alcohol, and Indigenous Australian individuals were involved in the design and delivery. The emphasis in local restrictions was on alcohol availability and, specifically, take-away sales of alcohol and in particular, sales of cask wine.

For example, in Elliott beginning in 1991 there was a ban on admission of children to public bars, a maximum purchase limit for take-away alcohol sales and cessation of Sunday sales. In Hall's Creek beginning in 1992, no take-away alcohol sales were permitted before 12 pm, cask wine sales were only permitted between 4–6 pm and there was a limit of one cask per person per day.

In Tennant Creek beginning in 1995, for the front bar sales were only permitted between 9 am and 10 pm, where there were no sales permitted on Thursdays. Thursday is the traditional pay and pension day. Wine was also only sold with meals in the front bar where only light beer was sold prior to 12 pm. Furthermore, there were no take-away sales of alcohol on Thursday and only between 12–9 pm on other days. Take-away alcohol sales were limited to 2 L wine casks such that wine could not be purchased in greater than 1 L glass containers. In addition, take-away alcohol sales were not permitted to taxi-drivers for third party sales.

In Derby beginning in 1997, no take-away alcohol sales were permitted on Thursdays and only between 12–10 pm on other days, where take-away sales of 4 L wine casks was prohibited. In Curtin Springs beginning in 1997, no alcohol was permitted to be sold in front bars or as take-away to any Indigenous Australian resident in, or travelling to Ngaanyatjarra Pitjantjatjara Yankunytjajara (NPY) lands.

Subsequent assessments of these restrictions on alcohol availability, which had wide-spread community support, showed that they had a modest but real impact on alcohol consumption and a significant impact on indicators of alcohol-related harm, especially criminal charges and violence (d'Abbs and Togni 2000). Alcohol-related road accidents were also significant decreased in Curtin Springs (d'Abbs and Togni 2000). The most significant impacts were for the Tennant Creek community which called their initiative 'Beat the grog'. For example, hospital-based indicators showed that admissions to the Accident and Emergency department decreased by 34% compared with the same months in the preceding year, which included decreases in fractures, head-injuries, general injuries, gastrointestinal conditions, lacerations and stab injuries (Gray et al. 2000). These decreases were sustained over the life of the initiative (d'Abbs and Togni 2000), such that the combined impact of the LWAP Levy and programs and services funded by the Levy reduced alcohol-related harm both in the short- and long-term in the NT (Stockwell et al. 2001, Chikkrizhs et al. 2005).

Another community-based initiative was the sobering up centre, which was been established across Australia. They are non-custodial safe overnight accommodation for the publicly intoxicated individuals (who have committed no offense) as an alternative to the arresting and holding of individuals in police cells and watch houses. They have been instrumental in the decriminalization of public intoxication which, for example, was decriminalized in the Northern Territory in 1975 and in state of New South Wales in 1979 where it also legislated for alternative care for intoxicated individuals. In the Northern Territory alternative care was not legislated for another seven years such that significant numbers of Indigenous Australians were subsequently apprehended and held in police custody cells without being charged. For example, in Tennant Creek in 1983, 94% of protective custody apprehensions were for indigenous Australians (Brady 1988). The first sobering up centre was opened in Darwin in the Northern Territory in 1983. The Tennant Creek sobering up centre was opened in 1984 by the Barkly Region Alcohol and Drug Abuse Advisory Group Inc (BRADAAG). The importance of the concept of a sobering up centre for indigenous Australians was highlighted by the Northern Territory coroner in 2003 while investigating the death of an indigenous Australian while in protective custody (Cavanagh 2003). The Royal Commission into Aboriginal Deaths in Custody facilitated the establishment of more centres across Australia. In the state of South Australia from 1991 to 2000, there were 6,486 admissions to centres,

97.1% of which were intoxicated indigenous Australians (Brady et al. 2006). In a sample of 6486 admissions to centres in South Australia, the mean blood alcohol concentration (BAC) was 0.217% but ranged from 0.00–0.55%, significantly higher than non-indigenous intoxicated Australians, who had an average BAC of 0.159%. They were primarily residents of Ceduna and visitors from the broader region. High usage by indigenous Australians is related to the extent of their public drinking, a lack of appropriate accommodation, the role of the town as a service hub for indigenous Australians in the broader region and the activities of the mobile assistance patrol (MAP) (Byrne et al. 2001, Brady et al. 2003). Large numbers of indigenous Australians travel through the region in association with periodic ceremonial activity and as part of the normative high mobility of desert people (Peterson 2004, Taylor and Bell 2004).

These centres care not only for intoxicated indigenous and non-indigenous Australians in public places, but reduce social disruption and harm and violence by and against intoxicated individuals, and reduce the costs of health and law enforcement agencies. They are not alcohol treatment facilities but can identify and refer individuals to appropriate treatment facilities. No accident or complaint has occurred at a centre to date.

Indeed, for the specific groups of consumers who drink to intoxication, that is the 'at risk' group, the data suggest that direct and targeted interventions are the most effective measures to reduce alcohol consumption and the concomitant problems arising in those groups. Interestingly, the reintroduction of these direct targeted interventions is currently being considered by the Northern Territory Government and in particular the communities of Tennant Creek and Halls Creek in Western Australia. In the latter community, a local liquor accord, agreed to by hotel licensees, has been instigated which places specific and special resale restrictions on alcohol each Wednesday; Wednesday is the day that many individuals within the local community receive their government welfare payments. A ban on all take-away alcohol is under discussion. A similar ban on take-away full-strength alcoholic beverages has also been reintroduced in the neighbouring community of Fitzroy Crossing where there has been a small but significant reduction in alcohol-related violence, suicide and injury as well as increased school attendance with the ban.

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- ***Addressing the cultural place of alcohol***

Specific and targeted social marketing and public education are supported. It is acknowledged that there is considerable misinformation within the community that contributes to a lack of understanding of alcohol-related harms or problems, as well as an inaccurate assessment and understanding of any health benefits derived from moderate alcohol consumption. There are, however, different harms or problems associated with different patterns of alcohol consumption, for example, short-term versus long-term heavy or excessive alcohol consumption. These differences may or may not be readily recognised by each population group, or may be specific to a particular population group, within the community. Thus these different patterns and harms need to be differentiated in order to focus on or target the appropriate strategies for each pattern and hence harm and perhaps, each population group.

Information provided should be accurate, appropriate and balanced to enable the members of the community to make informed decisions. This information should also be regularly

updated as further research results are reported. It is also agreed that the level of information, including language, should be appropriate for each target group, but again the information provided should be balanced, where each subsequent level should build on the previously provided information.

For example, research suggests that telling an individual that a behaviour is harmful or providing information about the risk associated with a behaviour is insufficient to affect an individual's actions. In addition, increasing an individual's knowledge about a health risk does not necessarily cause that individual to change or modify negative or risky behaviour (Engs 1989).

### ***Health warning labels***

It is considered that health warnings on product labels cannot readily and reliably be targeted to 'high risk' groups and individuals, such as excessive consumers of alcohol, whether regular consumer or 'binge drinkers'. The personal experiences affecting judgements of personal risk, motivations for high risk behaviour and the individual pharmacological and physiological properties of, and responses to, alcohol, all make the design of warnings that are effective with these individuals difficult. Young people, for example, who are considered to be an 'at risk' group, may have difficulty in judging or perceiving risks associated with alcohol consumption. This is because if an event has not occurred to an individual, and he/she cannot associate an event with a certain risk, then the individual may perceive that the risk may not occur in the future—that is, the risk is not related or relevant to them personally (Patterson *et al.* 1992). Also, 'at risk' individuals apparently give greater weight to uneventful experiences with alcohol interpreted to indicate that it carries low risk (Cvetkovich and Earle 1994, 1995). Indeed, the possibility that there are different reasons and motivations for high-risk behaviour makes it difficult to target messages to these individuals. Heavy alcohol consumers also perceive the risk of alcohol-related harm as low and less believable (Andrews *et al.* 1991, Andrews 1995) than do light alcohol consumers.

Personal susceptibility or relevance is also affected by a range of social and psychological factors, which act to establish the context of the judgement regarding credibility and hence the eventual effectiveness of the warning label (Cvetkovich and Earle 1995). Indeed, for a health warning label to be effective, it should involve the individual consumer, such that the individual will read the warning and process the information contained in the warning. It should also be relevant to the individual, as well as believable and credible.

Interestingly, a study of alcohol consumption in 34,001 students in Cyprus, France, Hungary, Iceland, Ireland, Lithuania, Malta, the Slovak Republic, Slovenia, Sweden and the United Kingdom participating in the 1999 European School Survey Project on Alcohol and Other Drugs Study (Bjarnason *et al.* 2003) suggests that adolescent or underage drinking is more common in all types of non-intact families; this was observed in all 11 countries. The adverse effect of living in non-intact families is greater in societies where alcohol availability is greater and where adolescents drink more heavily. A combination of school-based approaches, involving curricula targeted at preventing alcohol, tobacco, or marijuana use and extracurricular approaches, offering activities outside of school in the form of social or life skills training or alternative activities, may be effective in reducing underage drinking (Komro and Toomey 2002).

Overall, however, the usefulness of international data in Australia is limited as the observations are not consistent. For example, a study by Engels and Knibbe (2000) suggests that the drinking patterns of young people in Mediterranean countries can be characterized as ‘innovative’ while those of young people in Northern countries as ‘rebellious’. The main health risk associated with the innovative pattern is the volume of consumption and associated chronic consequences, where the main health risk associated with the rebellious drinking is intoxication and the associated risks concerning violence, traffic accidents and acute health consequences.

***School Health and Alcohol Harm Reduction Project (SHAHRP)***

The School Health and Alcohol Harm Reduction Project (SHAHRP) aimed to reduce alcohol-related harm by enhancing students' abilities to identify and deal with high-risk drinking situations and issues. The SHAHRP study involved a quasi-experimental research design, incorporating intervention and control groups and measuring change over a 32-month period. The study occurred in metropolitan, government secondary schools (13 to 17-year-olds) in Perth, Western Australia. The 14 intervention and control schools involved in the SHAHRP study represent approximately 23% of government secondary schools in the Perth metropolitan area. The sample was selected using cluster sampling, with stratification by socio-economic area, and involved over 2,300 intervention and control students from junior secondary schools. The retention rate of the study was 75.9% over 32 months. The intervention incorporated evidence-based approaches to enhance potential for behaviour change in the target population. The intervention was a classroom-based program, with an explicit harm minimization goal, and was conducted in two phases over a 2-year period. The results were analysed by baseline context of alcohol use to assess the impact of the program on students with varying experience with alcohol. Knowledge and attitudes were modified simultaneously after the first phase of the intervention in all baseline context of use groups. The program had little behavioural impact on baseline supervised drinkers; however, baseline non-drinkers and unsupervised drinkers were less likely to consume alcohol in a risky manner, compared to their corresponding control groups. In line with program goals, early unsupervised drinkers from the intervention group were also significantly less likely to experience harm associated with their own use of alcohol compared to the corresponding control group. Unsupervised drinkers experienced 18.4% less alcohol-related harm after participating in both phases of the program and this difference was maintained (19.4% difference) 17 months after the completion of the program. This study indicates that a school drug education program needs to be offered in several phases, that program components may need to be included to cater for the differing baseline context of use groups, and that early unsupervised drinkers experience less alcohol-related harm after participating in a harm reduction program (McBride et al. 2003).

In summary, to change the behaviour of an individual is complex, and price and labelling are simplistic interventions. Interventions to reduce risky alcohol drinking must make an individual:

- feel personally susceptible to a health (or other) risk;
- believe that the risk can cause a significant harm; and

- know what actions can be taken to avoid the harm, and also know the cost or benefit of the actions; if the costs outweigh the benefits, the action to avoid the harm is unlikely to be taken.

### ***Standard drinks labelling***

Standard drinks labelling has been an undervalued educational tool and a lost or wasted opportunity for the Federal government. The premise of standard drinks strategy is to enable consumers to and self-monitor their consumption simply by counting the number of standards that they consumed on any one occasion. The units of a standard drink, 10 g alcohol, correspond with the initial 1987 and 1992 ascriptions of the NHMRC for light to moderate, hazardous and harmful amounts of alcohol.

While labels on alcoholic beverages are an opportunity to provide consumers with information regarding safe levels of consumption, recent surveys of approximately 80 consumers undertaken by the School of Marketing of The University of South Australia (personal communication, School of Marketing, The University of South Australia, Gual et al. 1999), suggested that, depending on the age group of the consumer, between 40 and 86% of consumers are aware of the labelling, although only a smaller percentage was correctly able to interpret the labelling. The introduction of this labelling in December 1995 was, however, to be accompanied by an extensive education campaign for consumers, which did not eventuate, which limited the success of the labelling; this was acknowledged in the *Evaluation of the National Drug Strategy 1993–1997*. Indeed, there has been minimal formal education of the community although State and Territory drug and alcohol services have promoted, and continue to promote, standard drinks to their clients in the community. Thus, while the concept of including the number of standard drinks in the container on the label of each alcohol container is supported, an education campaign is also supported to increase the ability of consumers to interpret the labelling. The Australian Medical Association has continuously commented that a standard drinks media campaign should be re-launched in the community and supporting strategies should be sanctioned in clubs, hotels and restaurants, to support the standard drinks media campaign.

Interestingly, this strategy is currently being adopted by the United Kingdom, and is being evaluated in the European Union.

### ***Drink driving***

A systematic review of the effectiveness of mass media campaigns for reducing alcohol-impaired driving (AID) and alcohol-related crashes was conducted for the Guide to Community Preventive Services (Community Guide). In eight studies that met quality criteria for inclusion in the review, the median decrease in alcohol-related crashes resulting from the campaigns was 13% (interquartile range: 6% to 14%). Economic analyses of campaign effects indicated that the societal benefits were greater than the costs. The mass media campaigns reviewed were generally carefully planned, well executed, attained adequate audience exposure, and were implemented in conjunction with other ongoing prevention activities, such as high visibility enforcement. According to Community Guide rules of evidence, there is strong evidence that, under these conditions, mass media campaigns are effective in reducing AID and alcohol-related crashes (Elder et al. 2004).

It has been suggested that as the conditions that give rise to drinking and driving are complex, with multiple and interrelated causes, prevention efforts benefit from an approach that relies on the combination of multiple interventions, including a combination of educational, behavioral, environmental, and policy approaches (Howat et al. 2004). Health education interventions alone that have insufficient evidence for effectiveness include passive server training programs, school drug and alcohol education programs, community mobilization efforts, and health warnings. Because each intervention builds on the strengths of every other one, ecological approaches to reducing alcohol-impaired driving using all four components of the health promotion model are likely to be the most effective. Settings such as schools, workplaces, cities, and communities offer practical opportunities to implement alcohol-impaired driving prevention programs within this framework.

While a degree of deterioration in the performance of driving skills has been demonstrated at a low BAC, drivers with a low BAC comprise a relatively small percentage of those drinking drivers who crash and are injured—there is an exponential increase in the risk of crash involvement with increasing BAC above a level of 0.05 (McLean 1997).

Improved laws, enhanced enforcement, and public awareness brought about by citizens' concern, during the 1980s has led to dramatic declines in drinking and driving in the industrialized or western world. The declines included about 50% in Great Britain, 28% in The Netherlands, 28% in Canada, 32% in Australia, 39% in France, 37% in Germany, and 26% in the USA. Some of these declines may be due in part to lifestyle changes, demographic shifts, and economic conditions. In most countries the declines reversed in the early 1990s and drinking and driving began to increase. By the middle of that decade the increases stabilized and the rates of drinking and driving again began to decline. These decreases were much less dramatic than those in the 1980s. Approaching the end of the 1990s and early in the new century, the record has been mixed. Some countries (France and Germany until 2002) continued to reduce drinking and driving while in other countries (Canada, the Netherlands, Great Britain, and the United States), there was stagnation and in some cases small increases or even large increase as was the case in Sweden. Complacency and attention to other issues in recent years have been difficult to overcome in some countries. Harmonization of traffic safety laws in the European Union has strengthened laws in some countries but threatens existing strong policies in others. It may be that the major gains have already been made and that additional progress will require a much greater level of scientific knowledge, use of new and emerging technologies, and political and social commitment to put in place proven countermeasures.

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### ***3.2 Reshape supply towards lower-risk products through:***

- ***Changes to the current taxation regime***

This is simplistic and hence not supported. Over the past two decades, numerous studies have been published which have analysed whether price is a determinant of alcohol consumption (Cook 1982; Maynard 1988; Progue *et al.* 1989; Collins *et al.* 1991; Richardson *et al.* 1994). Some of these studies have built on the Kreitman Theory, whereby increased taxation based on alcohol content and hence increased selling price of an alcohol beverage, decreases the total alcohol consumption of a population and, therefore, decreases alcohol abuse in a population (Kreitman 1986). This also equates to a reduction in alcohol-related costs (Richardson 1989; Crowley *et al.* 1991). Implementation of the theory is problematic (Richardson *et al.* 1994) and studies to date have been methodologically imperfect.

For example, many of the studies consider the individual alcoholic beverages, that is, beer, wine and spirits, separately and do not examine the possibilities for beverage substitution in response to selective tax increases (Maynard 1988). Alcohol is a complex good composed of

different types and qualities. While certain consumers respond to price increases by altering their total consumption, others vary their choice of type or quality. Indeed significant reductions in sales have been observed in response to price increases but these reductions were mitigated by significant substitutions between beverages types of qualities (Gruenewald et al. 2006).

While it can be demonstrated that the mean consumption of alcohol correlates with the prevalence of excessive alcohol consumption in a population (Rose *et al.* 1990), a reduction in total alcohol consumption results from some and not necessarily all individuals in a population consuming less. Unless the effect of the policy on the consumption by alcohol abusers is known specifically, such a policy can be regarded as a social experiment rather than a scientific prescription (Duffy 1977). Indeed when studies have evaluated whether prices have a differential effect on light, moderate and heavy alcohol consumption, the results suggest that both light and heavy alcohol consumption are much less price elastic than moderate consumption (Manning et al. 1995).

Indeed, as Skog remarked in 1980 and which was reiterated by Duffy in 1980, the necessity is to obtain direct evidence of the effect of specific control policies on the consumption habits of heavy drinkers. Hypothetical examples illustrating the 'effects' of hypothetical policies capable of halving or doubling the *per capita* consumption are of little value, particularly when they are also based on untenable statistical assumptions (Duffy 1980; Skog 1980).

Furthermore, econometric analysis of aggregate alcohol consumption shows that income, rather than price, is a main source of variation over time in consumption. The decline in alcohol consumption in Ireland in the mid 1970s and in the early 1980s was due to recession and high unemployment rather than to tax-induced price increases (Walsh 1987).

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- ***Improved enforcement of current legislative and regulatory measures***

This is supported. For example, one of the groups that remain ‘at risk’ of alcohol-related harm are drink drivers. An ongoing objective of the National Alcohol Strategy has been to ‘reduce the rate of road crashes involving drivers who have consumed alcohol beyond prescribed blood alcohol concentration levels’.

In Western Australia from 1987 to 1995, drink driving accidents were more severe than those not involving alcohol. Serious drink driving accidents involving fatalities or hospitalisations accounted for 20% of alcohol-related accidents, but only 6% of all accidents reported over the study period (Rosman et al. 2001).

In 1995, 15% of South Australian drink drivers involved in motor vehicle accidents had a BAC below 0.05 while 85% had a BAC above 0.05 (Safety Strategy Section, Transport SA 1998). Indeed, while a degree of deterioration in the performance of driving skills has been demonstrated at a low BAC, drivers with a low BAC comprise a relatively small percentage of those drinking drivers who crash and are injured—there is an exponential increase in the risk of accident involvement with increasing BAC above a level of 0.05 (McLean 1997). Indeed, there is little evidence to recommend reducing the legal BAC limit from 0.05 to 0.02 as a measure to reduce the risk of harm from drink driving, and indeed in Sweden where the legal BAC limit was reduced to 0.02 in 1990, there has been no change in the perception of risk of drink driving amongst Swedes (Aberg 1995).

Data from the Federal Office of Road Safety (FORS) shows that there was a significant initial decline of all alcohol-related fatal road accidents in the proportion from 1990 to 1994 but this proportion has begun to increase. Additional data which describes the proportion of road accidents per se that resulted in hospitalisation where drivers had a BAC of greater than or equal to 0.05 g/100 mL, shows that there has been decline in the proportion from 1990 to

1994 overall in Australia (to 28%). Again this decline has continued or plateaued depending on the Australian State or Territory. The difference between the effectiveness in the Australian States and Territories is attributed, in part, to differing random breath testing (RBT) strategies (personal communication, The University of Adelaide Road Accident Research Unit). Interestingly, the proportion of the age 15–24 year-old group that are considered most ‘at risk’ for alcohol-related road accidents has not correspondingly significantly declined in any Australian State or Territory, irrespective of RBT and related strategies. The maintenance and further development of existing educational and law enforcement programs, such as RBT, may be an effective measure to further reduce the risk of harm from drink driving.

The relationship between drink driving behaviour in the 15–24 year-old group and rates of traffic accidents was analysed in a birth cohort of 907 New Zealanders studied to the age of 21 (Horwood and Fergusson 2000). Drink driving was significantly ( $P < 0.0001$ ) related to active traffic accidents in which the driver's behaviour contributed to the accident but was not related to passive accidents in which driver behaviour did not contribute to the accident ( $P > 0.15$ ). After adjustment for confounding factors such as driver behaviour, those engaging in high rates of drink driving had rates of active accidents that were 1.5-times higher ( $P < 0.01$ ) than those who did not drink and drive. It is concluded that although the study findings support the view that the regulation of drink driving behaviour amongst young people is likely to contribute to a reduction in traffic accidents, to be fully effective attempts at regulation of drink driving also need to be accompanied by a similar level of investment in regulating other aspects of risky or illegal driving behaviour amongst young people.

In 1995, a study by Holubowycz and McLean of 302 male drivers and motorcycle riders admitted to the Royal Adelaide Hospital in Adelaide, South Australia, showed that the likelihood of having a BAC of 0.08 or above did not differ with demographic profile. For example, as BAC increased, there was a significant increase in: various indices of quantity and frequency of drinking; beer being the preferred beverage; percentages drinking alone, in a hotel, in a vehicle and for various less socially acceptable reasons; frequency of drink-driving; likelihood of previous drink-driving suspension; and, more liberal attitudes towards drink-driving. Approximately 25% of those with a BAC of at least 1.50 were probably experiencing alcohol-related problems prior to the crash, compared with only a very small proportion of those with a lower BAC. Pre-accident drinking most commonly involved drinking in a hotel, drinking with friends and drinking beer, with no significant differences between BAC groups. These results suggest that usual drinking and drink-driving patterns, as well as attitudes to drink-driving, become more extreme as the BAC of male accident-involved drivers and riders increases. This study serves to highlight the complexity of issues surrounding the ‘decision’ to drink and drive, and hence the complexity of measures required to minimise the risks, although the primary issue is a high BAC. For repeat offenders there is limited evidence that ignition interlocks are effective in reducing repeat offences, particularly while the device is installed in the vehicle of the offender, although the long-term effectiveness is yet to be established (Willis et al. 2004).

Furthermore, a study of the relationship between incident-free traveling speed and a driver's BAC showed that a higher BAC is associated with a higher traveling speed, although the

average difference in speed is less than 3 km/h (Kloeden and McLean 1998); traveling speed is independently associated with an increased risk of motor vehicle accident. Indeed, the study indicated that if the BAC is multiplied by 100 and the resulting number is added to 60 km/h, the risk of involvement in a motor vehicle accident associated with that incident-free speed is almost the same as the risk associated with the BAC. Hence the risk of is similar for a BAC of 0.05 and a traveling speed of 65 km/h, for 0.08 and 68 and for 0.12 and 72 etc. Hence, an adjunct to measures to reduce drink driving could be measures to reduce exceeding the maximum permitted traveling speed.

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- ***Removal of tax deductability***

No comment.

- ***Strengthen, skill and support primary health care to help people make healthy choices***

This is supported. The healthiest level of alcohol consumption depends on an individual's age, sex, overall health and lifestyle—a calculation which is best determined by a medical practitioner (Pearson et al. 2004). The literature, however, suggests that medical students and practitioners are not necessarily adequately trained in alcohol-related issues identify early abuse and dependence, intervene, and to give appropriate advice/recommendations about alcohol. Medical school curriculum and continuing medical education on alcohol abuse and addiction should be required of all students and practitioners so they can be best prepared to prevent problems and identify and treat those for whom prevention has failed.

Indeed, a strategy that has shown to be effective in the USA, both in terms of cost and in decreasing risky alcohol consumption, including in 'at risk' groups, are brief interventions, that is, the screening and interviewing of patients by primary health care providers.

For example, brief interventions involve one to three short (5-10 minute) sessions comprised of personal feedback on alcohol-related health problems and risk, as well as advice, options of treatment and self-help (Ockene et al. 1999, Chang et al. 1999, 2000, 2005, 2006, Reiff-Hekking et al. 2005). Several controlled studies have examined the effectiveness and impact of brief interventions with pregnant women, for example, and all concur that pregnant women following the brief intervention were up to five-times more likely to abstain from alcohol completely or at least reduce their alcohol consumption from heavy to light, with improved birth outcomes (Hankin et al. 2000, Handmaker and Wilbourne 2001, Hankin 2002, Sokol et al. 2003, O'Connor and Whaley 2007, Chang 2004). Inclusion of the pregnant woman's partner in the brief intervention improved the outcome for heavy alcohol consumers (Chang et al. 2005). Thus brief interventions appear to be an appropriate effort to modify problematic and potentially problematic alcohol consumption and to avert its adverse consequences in at risk pregnant women or those planning pregnancy. Even for women who are not 'at risk', a routine screening provides an opportunity to discuss the health effects of alcohol consumption in a non-judgemental, health-orientated setting to convey the message that these issues are important to the pregnancy and birth outcomes.

Motivational interviewing involves more comprehensive counseling and guides the recipients to explore their ambivalence about changing behaviour while focusing on the perceived discrepancy between current behaviours and overall goals (Miller and Rollnick 2002). It is particularly effective in reducing the consumption of heavy consumers. For example, in a pilot study of motivational interviewing, which was an empathic, participant-centred but directed session focusing on the health of the participant's unborn baby, all participants reduced their alcohol consumption and maximum blood alcohol concentrations throughout their pregnancy (Handmaker et al. 1999). Another pilot study entitled the Project CHOICES targeted non-pregnant women at high risk of an heavy alcohol-exposed pregnancy and hence giving birth to an alcohol-affected child (The Project CHOICES Intervention Research Group 2003). It consisted of four brief motivational interviews. At the six-month followup, 68.5% had reduced their risk.

The impediments to implementing the screenings, brief intervention and motivational interviewing include commitment, inadequate knowledge and skills among health care providers reinforced by limited education and training in medical school and in general practice, lack of time, and system barriers such as lack of intervention tools, protocol, referral or treatment resources (Nevin et al. 2002, Mengel et al. 2006). These impediments have been identified by both US and Australian primary health care providers. A Healthy Habits training program has been effectively initiated in the USA to address clinician certainty and confidence in diagnosing problematic alcohol consumption (Seale et al. 2005).

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### ***3.3 Close the gap for disadvantaged communities***

This is supported.

### ***3.4 Improve the evaluation of interventions through:***

- ***Monitoring and evaluation of regulatory measures and other programs***

This is supported.

- ***Developing effective models of safer patterns of alcohol consumption in different communities***

No comment.

## 4. Additional comments

### 4.1 J-shaped curve

The conclusions of Fillmore's (2006) publication can be questioned in that there have been, especially in recent years, a number of prospective epidemiologic studies that have avoided the errors used by Fillmore et al. (2006) to exclude studies from their analyses. For example, these prospective epidemiologic studies have used 'lifetime abstainers' as the referent group, and have included occasional drinkers within specific 'low-intake' categories, and not mixed them into categories of abstainers or regular consumers of small amounts. One could use such studies to test the hypotheses the authors present and avoid the two types of errors that the authors have sought to evaluate. The first type of error is the former drinker misclassification error ("failure to separate former drinkers...from complete abstainers"), and the second is the occasional drinker misclassification error ("failure to separate occasional drinkers...from complete abstainers").

A review of all recent studies that have avoided the two errors described above, and accounted for the pattern of drinking as well, is needed to fully test the hypotheses proposed by Fillmore et al. (2006) Only two studies for cardiovascular mortality and seven studies for total mortality were used as a basis for the final conclusions of Fillmore et al. in this paper, and these can not be considered as 'representative' of the general population. The analysis also inappropriately used significance testing for inference, and has ignored quantification for possible biases, for example, from misclassification or residual confounding.

Klatsky and Udaltsova (2007) reworked previously published data (Klatsky et al. 1992, Klatsky et al. 2003) to address the purported confounding and potential over-estimation of a health benefit from moderate alcohol consumption claimed by Fillmore et al (2006, 2007), and showed a shallower but still significant J-shaped relationship between alcohol consumption and all-cause mortality risk that is not discussed in the draft revised Guideline. The data was of 21,535 deaths through to 2002, where the follow-up included 2,618,523 person-years of observation with a mean follow-up of 20.6 years. Their re-analysis reconfirmed the relationship previously published with an increased risk for individuals consuming more than three (14 g) drinks per day and a reduced risk at three or less drinks per day, almost always due to a reduced risk of death from cardiovascular disease. Former consumers were observed to be at increased risk of death from non-cardiovascular disease and occasional consumers were observed to have a risk similar to lifelong abstainers.

There are also other relatively recent studies where neither type of 'error' studied by Fillmore et al. (2006) was present. For example, a study by Mukamal et al. (2006) on a large group of older adults which separated lifetime abstainers from former drinkers, and occasional drinkers from regular light drinkers, demonstrated reductions in the risk of a variety of cardiovascular outcomes from moderate consumption. In another study on older people by Tolvanen et al. (2005) where ex-drinkers were separated from lifetime abstainers, total mortality was highest in the ex-drinkers and lifetime abstainers, and 30–40% lower in current consumers. In addition, another study by Klatsky et al. (2005) which identified lifetime abstainers and separated occasional drinkers from regular light drinkers showed that

consumption of one to two drinks/day was associated with 40% less heart failure associated with coronary artery disease.

One of the salient points to come out of eight commentaries, which were published in the February 2007 edition of the journal *Addiction Research and Theory*, on the Fillmore et al. 2006 paper, as well as from commentaries in the May 2007 edition of *The Annals of Epidemiology*, is that there is evidence for plausible biological mechanisms for protection against coronary heart disease by moderate alcohol consumption which adds credence to a causal hypothesis. As previously mentioned, these mechanisms include effects via high density lipoprotein, improved haemostatic factors, improved endothelial function, and a lower risk of diabetes mellitus.

An earlier meta-analysis of 42 experimental studies, which examined the effects of alcohol consumption on cardiovascular biomarkers, attributed the cardioprotective effect of light-to-moderate alcohol consumption 60% to effects on high density lipoprotein, 20-30% to fibrinogen, 5-10% to insulin and 0-5% to other haemostatic factors (Rimm et al. 1999). The meta-analysis also estimated that 30 g of alcohol per day would increase the plasma concentration of high density lipoprotein by approximately 4 mg/dL which would be associated with a 17% reduction in risk of coronary heart disease. It would also decrease the plasma concentration of fibrinogen by approximately 0.075 g/L, which would be associated with a 12.5% reduction in risk of coronary heart disease (Hines and Rimm 2001). This translated into an overall 24.7% reduction in the risk of coronary heart disease from the consumption of 30 g of alcohol per day. Klatsky et al. (2007) further translated this into a 10% reduction in risk of all-cause mortality.

Interestingly, in their reply to the eight commentaries on this point, Fillmore et al. (2007) do not dispute the evidence for plausible biological mechanisms and merely suggest that “the lot falls to epidemiology to establish whether human populations will benefit greatly from the use of alcohol and if they should be advised to use the substance for medicinal purposes”.

From the commentary by Rehm (2007), “All scientific knowledge is subject to revision, and there may be new evidence leading to changes in decision-making, but given the current level of knowledge, the convergence of experimental and observational knowledge supports the cardioprotective effects [of light to moderate alcohol consumption].”

Biomedical and epidemiological evidence generally suggest that a reduced risk of death from cardiovascular disease is associated with one to two standard drinks of alcohol per day for both men and women (Maclure 1993, Corrao et al. 2000, Rehm et al. 2001, Klatsky et al. 1992, Gmel et al. 2003, Klatsky 2003, Corrao et al. 2004, Di Castelnuovo et al. 2006, Klatsky and Udeltsova 2007, Rehm et al. 2007) and some of these studies have even been cited in the draft Guideline but dismissed without discussion. For example, in a meta-analysis by Rehm et al. (2007) it was observed that when heavy consumption (greater than 39 g alcohol/day for men and 19 g for women) was excluded from estimations of benefits and risks from alcohol consumption, the net effect was beneficial, where consistent with other observations, the net burden was higher for younger ages and the net benefit for older ages.

In addition, concerning the pattern or regularity of consumption necessary to confer cardiovascular benefits, the literature is consistent in that the pattern of alcohol consumption required for cardioprotection is regular consumption, which can be determined as daily consumption (McElduff and Dobson 1997). This regularity is related to short-term or acute effects on the dissolution of blood clots and on platelet aggregation, which are readily reversible (Renaud *et al.* 1984, Renaud *et al.* 1992, Hendriks *et al.* 1994), and to longer-term effects on plasma antioxidant capacity, on low density lipoprotein oxidation and on systolic blood pressure (Klatsky *et al.* 1977, Gillman *et al.* 1995, Klatsky 1995). Furthermore, any lowering effect of alcohol on systolic blood pressure is readily reversible, within seven to 14 days (Puddey *et al.* 1985), such that regular consumption is necessary to maintain this particular cardioprotective effect (Klatsky *et al.* 1990, Gillman *et al.* 1995, Klatsky 1995).

Conversely, binge drinking is seen to significantly increase systolic blood pressure, which significantly increases the risk of a heart attack or stroke (Hillbom and Kaste 1981, Hillbom *et al.* 1984, Donahue *et al.* 1986, Suhonen *et al.* 1987, Kozarevic *et al.* 1988, Renaud and Ruf 1996).

Indeed, essentially all epidemiological studies that have considered patterns of consumption have shown that regular moderate consumption is allied to lower risk of diseases rather than occasional consumption, while episodic heavy consumption, considered as binge drinking, negates any beneficial health effect.

For example, from a 2003 study by Mukamal *et al.*, men who consumed alcohol three to four or five to seven days per week had decreased risks of myocardial infarction compared with men who consumed alcohol less than once per week, where the risk was similar among men who consumed less than 10 g of alcohol per drinking day and those who consumed 30 g or more. This is a similar observation to that of Tolstrup *et al.* 2004, where for the same average consumption of alcohol, an infrequent intake implied a higher risk of mortality than a frequent one, and also to that of Baglietto *et al.* 2006, who investigated associations between average volume of alcohol consumption, beverage type and consumption pattern, and all-cause mortality. After adjustment for total amount of alcohol consumed, the number of drinking days was inversely associated with the risk of dying in men, confirming previous observations about the effect of average volume of alcohol and beverage type and suggest that consumption pattern is an independent risk factor for all-cause mortality. The beneficial health effects of alcohol may thus be limited or linked to certain patterns of consumption (Puddey *et al.* 1999, Rehm *et al.* 2003) as are the harmful effects.

## **4.2 Health warning labels**

Health warning labels for products such as alcohol and cigarettes are ineffective at changing consumer behaviour, where awareness and knowledge of labels is not associated with behavioural change. For example, the USA has had health warning labels on drink driving since 1988 such as “Consumption of alcoholic beverages impairs your ability to drive a car or operate machinery, and may cause health problems”, but there has been no significant reduction in the occurrence of drink driving in the USA, which is the primary goal of a health warning label. In addition, perceived risks associated with drink driving did not increase but

rather decreased (Greenfield and Kaskutas 1993, Parker et al. 1994). Furthermore, in the USA and Australia, which both have health warning labels on tobacco products, there has been no significant reduction in the occurrence of cigarette smoking and specific disease states related to cigarette smoking in either the USA (Robinson and Killen 1997) or Australia, since its introduction in 1966 and 1987, respectively. However, in Canada, since the introduction of new graphic cigarette warning labels in December 2000 31% of cigarette smokers cited the graphic cigarette warning labels as motivation to cease smoking; 36% cited smoke-free policies as motivation to cease smoking (Hammond et al. 2003, Hammond 2004).

Indeed, In Australia, health warnings on cigarette packages were subsequently reviewed and revised in 1995. The review indicated that although there were increases in the awareness and knowledge of the labels in the first few months after their introduction, this increase was not sustained (Hill 1988, Borland and Hill 1997b). This results of this review also included adolescents (Centre for Behavioural Research in Cancer 1992). In addition, the hypothesised linkage between awareness, knowledge and effectiveness, that is, a change in consumer behaviour, was not observed (Borland and Hill 1997). While the revised labels have moderately increased awareness and knowledge in the population per se, no effect on consumer behaviour, such as cessation of smoking has been observed (Borland 1997).

Concerning, health warning labels, such as "women should not drink alcoholic beverages during pregnancy because of the risk of birth defects", which were also legislated and enacted in the USA in November 1988 as the Alcoholic Beverage Labelling Act 1988 under the Omnibus Drug Act 1988, one year following its inclusion there were increases in the awareness, exposure and recognition memory of the general public, but this change was slow to grow (Mayer et al. 1991, Scammon et al. 1992). In 1993, five years after its inclusion, however, studies showed that there had been no significant or substantial positive changes in actual or intended behaviour regarding the consumption of alcohol, or in the attitudes, beliefs and perceptions about the risks described on the warning labels (Mayer et al. 1991, Marzis et al. 1991, Kaskutas and Greenfield 1992, Greenfield et al. 1993, Hilton 1993, McKinnon et al. 1993, US Department of Health and Human Services 1993); significant funding for the studies has been provided by the National Institute on Alcohol Abuse and Alcoholism. Furthermore, the general public who consumed a chronic heavy amount of alcohol, that is, the group 'at risk', believed that there was less risk associated with the consumption of alcohol than those who abstained, or consumed a light or moderate amount of alcohol (Andrew et al. 1991, Patterson et al. 1992, Hankin 1994). In addition, data from a study of African Americans, that is, an 'at risk' group, showed also that while awareness changed, behaviour did not (Hankin et al. 1993a, 1993b, Hankin et al. 1995). Indeed, the decrease in maternal consumption was relatively minor (approximately a half to one drink per week, an amount which would not be expected to influence their pregnancy) and did not impact on the heavy consumers. The studies are consistent with earlier studies, which suggested that women 'at risk' were less responsive to media/promotion campaigns (Little et al. 1981; Streissguth et al. 1982, Weiner et al. 1989, Kaskutas and Graves 1994). This implies that targeted education efforts are required for the 'at risk' group.

While it may be argued that 18 to 24 months post implementation may be insufficient time to observe changes in the overall consumption of alcohol (Scammon et al. 1991), data from a

six-year study of African Americans, that is, an 'at risk' group, showed also that while awareness changed initially and then plateaued after approximately three years of warning labels, there was no change in the behaviour of a specific 'at risk' group of chronic and heavy consumers of alcohol (Hankin et al. 1993a, 1993b, Hankin et al. 1995). In addition, a recent study observed that in an 'at risk' group, multiparae ignore the labelling and actually increase their consumption of alcohol whilst pregnant (Hankin et al. 1996).

Furthermore, in 2004, there is no evidence to suggest that there has been a decrease in the incidence of FAS since warning labels were introduced, and indeed the data available suggest that the incidence of FAS has remained stable over the past decade in the USA.

The approach adopted by the majority of health/medical associations, institutions and professionals in Australia, is that alcohol is a beverage, which is responsibly consumed by the majority of consumers in an environment of concise and current information, where the effects can be beneficial rather than harmful to the consumer. For the minority of consumers who abuse and misuse alcohol, the actual 'at risk' group, the data suggest that direct and targeted educational intervention is an effective measure to reduce the concomitant problems, such as the incidence drink driving and foetal alcohol syndrome (FAS), as well as under-age and 'young people' consumption. Indeed, a specific National Youth Alcohol Campaign 1999, which included advertising/marketing strategies, was developed by the Commonwealth Department of Health and Aged Care. Specific strategies, such as random breath testing with concomitant education and legislative elements have also been effective in influencing consumer behaviour. Another specific strategy was the program, Living with alcohol, targeted at Indigenous Australians, which reduced alcohol abuse and misuse within this high-risk group; it was pioneered by Northern Territory government.

Applications for health warning labels for alcoholic beverages have also been assessed by Canada and the United Kingdom (UK). While both the Addiction Research Foundation (ARF) and Canadian Centre for Substance Abuse (CCSA) support the theory of labels, they consider that, in practice, their effect on consumer beliefs and behaviour would be minimal (Canada House of Commons Standing Committee on Health 1996). Indeed, the CCSA states that they have "seen no direct, incontrovertible evidence that applying warning labels to alcoholic beverage containers has any impact on reducing the problems associated with abusive drinking". It was also stated by the ARF that "judging from the fairly subtle effects that these types of warnings have on beliefs and behavioural intentions, it is unlikely that warning labels, effectively worded and prominently placed, will have a large effect on behaviour in and of themselves" (Canada House of Commons Standing Committee on Health 1996). Also during the Canadian assessment, the former Deputy Minister of Community Occupational Health, Alberta, asserted that the established educational programs have "created a sufficiently aware public that the kind of simple message that can practically be applied to bottles and packages is no longer of any real value" (Canada House of Commons Standing Committee on Health 1996).

The UK House of Lords rejected legislation for health warning labels on alcoholic beverages in 1991, following similar comments and conclusions. Indeed, the then Parliamentary Secretary of Health argued that "...the problem of alcohol misuse is complex. It would be

rather difficult to devise a clear, non-misleading and concise message which would effectively inform consumers about all aspects of the alcohol-related harm” [Hansard Parliamentary Debates (Lords) 1991].

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### 4.3 Issues with low ethanol wine production

There are three potential impediments to reducing the alcohol content in a traditional wine beverages:

1. Production methodology;
2. Sensory characteristics of the product; and
3. Regulations re specific and standardised definitions.

#### 4.3.1 Production of alcohol in winemaking

The production of alcohol is a natural fermentation process in the production of traditional wine involving naturally fermented products, which is in contrast to the production process of RTDs. Alcohol is referred to here as ethanol to distinguish it from the other alcohol compounds which have different effects.

In wine, the alcohol content is directly related to the constituents of the raw material, grapes, and the conditions of the fermentation process. Wine is an alcoholic beverage produced from fermented grapes. The yeast *Saccharomyces cerevisiae* metabolises or breaks down the glucose and fructose in the grape berry via the glycolytic pathway in a series of steps to ethanol and carbon dioxide. This is referred to as the primary alcoholic fermentation. The fermentable sugars must first be extracted from the grape skins and pulp into the must in the initial days of the fermentation. An average fermentation takes 5–7 and 10–14 days to complete, for red and white wine, respectively, where an adequate supply of yeast nutrients such as minerals and vitamins is necessary for the fermentation to complete. The choice of yeast will have also influence the amount of ethanol produced in the ferment although only by approximately 1-2% and which will depend on the conditions of the ferment. One molecule of glucose (or fructose) yields two molecules each of ethanol and carbon dioxide. Approximately 95% of the grape sugars are converted into ethanol and carbon dioxide (Boulton et al. 1996).

Several studies have tried to determine empirical conversion factors that go directly from the Brix value to the final ethanol content on a volume basis:

$$[\text{Ethanol}] \% \text{v/v} = a + b \times \text{brix},$$

where the values of factor b range from 0.55 to 0.63 depending on the growing region (nutrients, soil, temperature and water), cultivars or varieties and the growing season, and in particular the amount of sunlight hours. A value of 0 is usually ascribed to the variable a. Brix is simply a measurement of the sugar content of grapes and must, indicating the degree of the grapes' ripeness or sugar level at harvest. Most wine grapes are harvested at between 20 and 25 degrees Brix, where each degree of Brix is equivalent to 1 gram of sugar per 100 grams of soluble solids. If fermentation does not complete, the resultant wine has a high concentration of residual sugar which renders it microbiologically unstable as sugar is a substrate for microbes, and the resultant wine may also be unbalanced to the phenolic/tannin and acid concentrations on the palate.

Grapes contain approximately 20% sugar when ripe in about equal amounts of glucose and fructose. They also contain small quantities of sucrose and several other sugars. The amount of glucose and fructose in the grape berry increases throughout the growing and ripening period. At the véraison stage of growth, water, sugars aromas and flavours increase but the acid level decrease. Véraison or a 'change of color of the grape berries' signifies the change from berry growth to berry ripening in grapevines. In white varieties, carotenoids are formed, while in red varieties anthocyanins and xanthophylls are formed.

Grapevines produce sugar from water and carbon dioxide in the air using a process called photosynthesis, which requires healthy green leaves and sunshine. The former must be maintained throughout the growing season so that the grapevine is able to make maximum use of the available sunlight to produce sugars such that deficiencies of zinc, magnesium, iron and manganese are common and must be treated to avoid decreased production. The subsequent deposition of sugar into the berry depends on the level of leaf photosynthesis, the number of competing sinks on the grape vine and sugar importation. At the dehydration stage of growth, sugar production stops, but Brix may continue to increase slowly because the grape berries lose water. Most winemakers prefer to pick white grapes late in the veraison stage (20–23.5 Brix) but prefer red grapes picked early in the dehydration stage (23.5–25 Brix).

Tartaric and malic are the two major acids in grapes, and they account for 90% or more of the total acids present. After véraison, tartaric acid (in grams per berry) remains approximately the same, but the tartaric acid, measured in grams of acid per liter of juice, decreases because of the increasing water content. Conversely, grapevines respire malic acid during hot weather, such that malic acid decreases after veraison both in grams per berry (by respiration loss) and grams per liter (by dilution). Grapes also contain about 5% citric acid and smaller quantities of other organic acids. For the same degrees Brix, grapes grown in cool climates have a higher acid level than the same variety grown in warm climates.

In Australia, although the minimum alcohol concentration specified for wine in Standard 4.5.1 of the Australian New Zealand Food Standards Code is 8% by volume (v/v), the actual alcohol concentration in Australian wines is generally clustered between 12% and 14% (Godden and Gishen 2005), due to the climatic conditions of warm to hot temperatures and long sunlight hours, where high natural sugar levels are observed at harvesting, as well as high levels of phenolic/tannin compounds which impart colour, flavour and texture to the wine. The attributes of a sound and merchantable wine include a balance between the sugar/alcohol, astringent and bitter phenolic/tannin, and acid concentrations of the wine.

#### **4.3.2 Contribution of role of alcohol in sensory characteristics of wine**

Sensory science is relatively new discipline. In the alcohol referred to in this section is ethanol. Relatively recent studies undertaken on the taste receptors of rhesus monkeys suggest that ethanol elicits a strong taster response. Ethanol stimulates all sweet-best fibres and in high concentration some salt-best fibres, but not acid-best or bitter-best fibres. Indeed, lower ethanol concentrations are associated with a sweet 'taste' while at an ethanol concentration of 0.7 M (approximate to that of full-strength beer), ethanol suppress bitter tastes (Hellekant et al. 1997, Danilova and Hellekant 2000). Ethanol also contributes to the mouthfeel or texture of a beverage, that is, it provides 'thickness' and 'weight'. Alcohol is

again referred to here as ethanol to distinguish it from the other alcohol compounds which have different effects.

As discussed above, the increased ripeness of grapes to achieve increased concentrations of desirable flavour compounds will result in wines with an increased concentration of ethanol.

Ethanol contributes to the 'mouth-feel' or textural flavour or taste attributes such as the viscosity of wine (Fischer et al. 1996, Pickering et al. 1998, Jones et al. 2008), interacting with the concentration of glycerol, polysaccharides and volatile components in the wine. For example, a higher concentration of alcohol in white wine enhances the 'unpleasant' textural characteristics of hotness, roughness and bitterness that are suppressed by glycerol, while in the absence of polysaccharides, a higher alcohol concentration is associated with a unpleasant metallic character. Ethanol also contributes to the aroma of wine by affecting the volatility of the aroma compounds, such that the activity coefficients of volatile components in a 100 g/L ethanol solution are twice as low as those obtained in water. Thus ethanol does not suppress volatile components in wine. Indeed, ethanol leads to modifications in protein conformation which acts to reduce the number of binding sites of the aroma compounds (Lubbers et al. 2001).

With respect to balance in wine, ethanol imparts sweetness to the taste sensory characters of wine in that it heightens the sweetness of sugars present in the product (Peynaud 1987, 1996). In white wines, which have minimal tannin/phenolic compounds, sweetness from either residual sugar and ethanol or ethanol alone counterbalances acidity. For example, for a 'dry-style' white wine with no added (grape concentrate) or residual sugar, the ethanol alone balances but does not neutralise the acidity of the wine, referred to as providing 'softness' and 'firmness' or 'strength' as well as 'warmth' to the sensory taste characters. Out of balance, that is, excessive acidity to ethanol, and the wine is described as 'light', 'weak', 'thin', 'acidic' or 'green', whereas excessive ethanol to acidity, and the wine is described as 'alcoholic', 'mellow', 'rich' or 'heavy'. Too little acid and ethanol and the wine can be described as 'little', 'flat', 'thin' or 'insipid', whereas too much ethanol and acid, and the wine can be described as 'hot', 'alcoholic', 'firm' or 'hard'.

In red wines, which also contain potentially bitter tannin or phenolic compounds, the ethanol has to be in balance with the tannins as well as with the acidity. Dealcoholised wines are generally described as 'acidic' and 'bitter'. Where the ethanol content is too low, then bitterness and acidity predominate and the wine is described as 'hard', 'harsh' or 'astringent' whereas if there is excess ethanol to acid and tannin, the wines can be described as 'soft' and 'flabby'.

Simply put: "A wine tolerates acidity better when its alcohol degree is higher; acid, bitter and astringent tastes reinforce each other; the hardest wines are those which are at the same time acidic and also rich in tannins; a considerable amount of tannin is more acceptable if acidity is low and alcohol is high".

### 4.3.3 Definitions

There are no definitions or prescribed names for low or reduced alcohol wine in the Australia New Zealand Food Standards Code, or in the Australian Excise Tariff Schedule. For example, certain alcohol content limits had previously been provided in the Australia Food Standards Code and in the New Zealand Food Standards Code prior to 20 December 2000 as follows.

Type	Australia	New Zealand
Reduced alcohol	0 mL/L, <65 mL/L	>11.5 mL/L, <65 mL/L
Low Alcohol	>0 mL/L, <11.5 mL/L	>0 mL/L, <11.5 mL/L
Dealcoholised	>0 mL/L, <5 mL/L	No provisions

A prescribed name could also be provided such that these beverages would have to include on the label, for example, “ready-to-drink alcoholic beverage” or an alternative descriptive name such as, for example, “coloured and flavoured beverage containing x% v/v alcohol”. Prescribed names had previously been included in the Australia Food Standard Code prior to 20 December 2000. One such prescribed name was “wine product”.

Definitions and prescribed names for reduced and low alcohol wines were removed from the Code, with the arguments cited by Food Standards Australia New Zealand that at all these types of wine products are merely ‘mixed foods’, and that the arbitrary delineations of reduced and low alcohol, which overlap, were not meaningful to the consumer and could adequately be covered by the mandatory alcohol content statement. It was also cited that products such as de-alcoholised wine, wine coolers and wine mixers are “essentially miscellaneous foods being a mixture of two or more foods. Their composition may vary...It may, therefore, be inappropriate to have these products regarded as wine products.”

The Code only specifies a product definition and list of potential ingredients (additives and processing aids) and their limits (compositional requirements) regarding health and safety. It also specifies labelling re fraud and deception, health and safety (see Tables 1 and 2). It does not, however, specify the production process. Legislation such as a statement as to the alcohol content is mandatory if the alcohol content is greater than 0.5%, as is standard drinks labelling.

**Table 1. (Australian) Legal definitions for alcoholic beverages and related regulations**

Australia New Zealand Food Standards Code	Wine Equalization Tax Ruling WETR 2006/1	ATO Excise Tariff Schedule (27 April 2008)
<p><b>Standard 4.5.1 Wine Production Requirements (Australia only)</b>  <b>wine</b> means the product of the complete or partial fermentation of fresh grapes, or a mixture of that product and products derived solely from grapes.</p> <p><b>grape spirit</b> means the spirit obtained from the distillation of wine or the byproducts of winemaking or the fermented liquor of a mash of dried grapes and contains methanol in a proportion not exceeding 3 g/L at 20°C of the ethanol content</p>	<p><b>Grape wine</b> is a beverage that: is the product of the complete or partial fermentation of fresh grapes or products derived solely from fresh grapes; and does not contain more than 22% of ethyl alcohol by volume</p>	<p>“<b>Wine</b>” has the same meaning as in Subdivision 31-A of the <i>A New Tax System (Wine Equalisation Tax) Act 1999</i></p> <p>“<b>Grape wine</b>” has the same meaning as in Subdivision 31-A of the <i>A New Tax System (Wine Equalisation Tax) Act 1999</i></p>
<p><b>Standard 2.7.4</b>  A <b>wine product</b> means a food containing no less than 700 mL/L of wine as defined in this Standard, which has been formulated, processed, modified or mixed with other foods such that is not wine</p>	<p>A <b>grape wine product</b> is a beverage that contains at least 70% grape wine; has not had added to it any ethyl alcohol from any other source except grape spirit or alcohol used in preparing vegetable extracts (including spices, herbs and grasses) e.g. in producing vermouth and contains between 8% and 22% (inclusive) of ethyl alcohol by volume. They include...imitation spirits.</p> <p>Grape wine products do not include wine coolers (unless they satisfy the requirements above); ready to drink (RTD) or designer drinks that contain a wine base (unless they satisfy the requirements above); RTDs or designer drinks that contain spirits (other than grape spirit). RTDs or designer drinks containing grape spirit must also satisfy the requirements above in order to be included; and spirit base (other than grape spirit) cocktails, creams and liqueurs.</p>	

**Table 2. Standard 2.7.1 Labelling of Alcoholic Beverages and Food Containing Alcohol**

**2 Declaration of alcohol by volume**

- (1) The label on a package of food listed in column 1 of the Table to this subclause must include a statement of the alcohol content in the corresponding form specified in column 2.

**Table to subclause 2(1)**

<b>Column 1</b>	<b>Column 2</b>
Food, including alcoholic beverages, containing more than 1.15 % alcohol by volume	Expressed in mL/100 g or mL/100 mL or X% ALCOHOL BY VOLUME or words and expressions of the same or similar effect
Alcoholic beverages containing not more than 1.15 % alcohol by volume  Beverages containing no less than 0.5% alcohol by volume	'CONTAINS NOT MORE THAN X% ALCOHOL BY VOLUME' or words and expressions of the same or similar effect

- (2) The statement required by subclause (1) must, for the foods specified in column 1 of the Table to this subclause, be accurate to within the limits specified in column 2.

**Table to subclause 2(2)**

<b>Column 1</b>	<b>Column 2</b>
Beer, cider and perry	0.3% alc/vol
Spirits, liqueurs, fortified wine, fortified fruit or vegetable wine, and all other alcoholic beverages containing more than 1.15 % alcohol by volume	0.5% alc/vol
Wine and fruit wine (including sparkling forms), and wine products and fruit or vegetable wine products containing more than 6.5 % alcohol by volume	1.5% alc/vol

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