ABSTRACT

In 1997 the Addiction Research Foundation of Ontario and Canadian Centre on Substance Abuse released updated guidelines for low-risk alcohol consumption. This paper presents the scientific rationale behind this statement. Important comprehensive overviews on the consequences of alcohol use were studied. Formal meta-analyses on morbidity and mortality were examined wherever possible. Individual elements from similar guidelines were investigated for their scientific foundation. Limited original analyses defined risk levels by average weekly consumption. The evidence reviewed demonstrated that placing limits on both daily intake and cumulative intake over the typical week is justifiable for the prevention of important causes of morbidity and mortality. Gender-specific limits on weekly consumption were also indicated. In these updated guidelines intended for primary prevention, days of abstinence are not necessarily recommended. Intoxication should be avoided and abstinence is sometimes advisable. Available evidence does not strongly favour one alcoholic beverage over another for cardiovascular health benefits.

ABRÉGÉ

Les fondements scientifiques des directives sur la consommation d'alcool à faible risque publiées en 1997 par la Fondation de la recherche sur la toxicomanie et le Centre canadien de lutte contre les toxicomanies ont fait l'objet d'une évaluation. L'évaluation portait sur une sélection d'examens épidémiologiques des conséquences de la consommation d'alcool les plus complets, dont des méta-analyses formelles sur la morbidité et la mortalité. Elle portait également sur des articles scientifiques principaux portant sur des questions précises. Les éléments des autres directives ont été examinés d'un oeil critique quant à leurs fondements scientifiques. Les données épidémiologiques ont servi à illustrer la courbe de risque relativement à certaines conséquences de la consommation d'alcool. La preuve scientifique appuie la définition des limites quotidiennes de consommation d'alcool, et des limites hebdomadaires, lesquelles diffèrent selon le sexe du buveur. Si ces limites sont respectées, il n'est pas nécessairement recommandé de réserver des jours d'abstinence. L'alcool doit être consommé lentement, et l'ivresse doit être évitée. Les effets sur la santé sont déterminés principalement par l'alcool en soit plutôt que par des boissons en particulier. Dans certaines circonstances, l'abstinence est recommandée.

Low-risk Drinking Guidelines: The Scientific Evidence

Susan J. Bondy, PhD,[1-3] Jürgen Rehm, PhD,[1,2,4,5] Mary Jane Ashley, MD,[2] Gordon Walsh, MSc,[1] Eric Single, PhD,[2,6] Robin Room, PhD[1,7]

In 1993 the Addiction Research Foundation of Ontario (ARF: now the Centre for Addiction and Mental Halth, Addiction Research Foundation Division) and the Canadian Centre on Substance Abuse (CCSA) released a joint statement on low-risk drinking.[1,2] Evidence continues to appear concerning levels and patterns of alcohol use in relation to health effects, social well-being, and economic costs. In 1996, the Ontario Ministry of Health established a committee to review the scientific evidence and produce standard low-risk drinking guidelines for the province.[3] This paper summarizes the scientific rationale for the 1997 guidelines, which are appended.

Guidelines on "low-risk" drinking should define a usual level and pattern of alcohol use that is not associated with an increased risk of alcohol-related problems for most healthy adults. Many aspects of alcohol use (total intake, drinking patterns, beverage choices) and diverse outcomes (acute and chronic health effects, accidents, injuries, adverse social effects) had to be considered.[4,5] For such a broad survey, systematic and objective approaches to research synthesis, such as meta-analysis, are not feasible. Therefore, the review of evidence began with the most complete overviews of the consequences of alcohol use, including meta-analyses and quantitative overviews, as available. Narrower lines of inquiry focused on whether specific elements in similar guidelines[6] were supported by evidence. The committee and eleven consultants, together, had broad expertise concerning alcohol effects and research methods in this field.

The committee agreed that many aspects of the associations between drinking patterns and consequences are not well described. However, there is strong evidence to support statements concerning the total consumption of alcohol and amounts on specific occasions. These two components of drinking patterns are associated with distinct sets of health-related consequences. Weekly limits in standard drinks (SD)* were defined primarily from evidence on long-term health effects. Daily limits were defined primarily by acute risks, but they also reflect how much can be consumed on most days without increasing risk in the long term.

Evidence for weekly limits

Relationships between levels of alcohol intake and risks of chronic health effects are well documented.[7-14] Health problems positively associated with total dose over time include diseases of the liver, pancreas, and nervous system, and certain cancers

1. Centre for Addiction and Mental Health, Addiction Research Foundation Division, Toronto, ON
2. Department of Public Health Sciences, University of Toronto
3. Institute for Clinical Evaluative Sciences, Toronto, ON
4. Polytechnical University (Fachhochschule) Hamburg, Germany
5. World Health Organization, Division on Mental Health and the Prevention of Substance Abuse, Geneva, Switzerland
6. Department of Community Health and Epidemiology, Dalhousie University, Halifax, NS
7. Canadian Centre on Substance Abuse, Toronto
8. Centre for Social Research in Alcohol and Drugs, Sveaplan, Stockholm University, Sweden

Correspondence: Susan Bondy, Institute for Clinical Evaluative Sciences, G-106, 2075 Bayview Avenue, Toronto, ON, M5N 3M5, Tel: 416-480-4055 x 2155, Fax: 416-480-6048, E-mail: susan.bondy@ices.on.ca

* A standard drink is defined as one 341 mL (12 oz.) bottle of beer (5% alcohol), one 142 mL (5 oz.) glass of table wine (12% alcohol), one 43 mL (1.5 oz.) serving of spirits (40% alcohol) or one 85 mL (3 oz.) serving of fortified wine, such as sherry or port (18% alcohol).

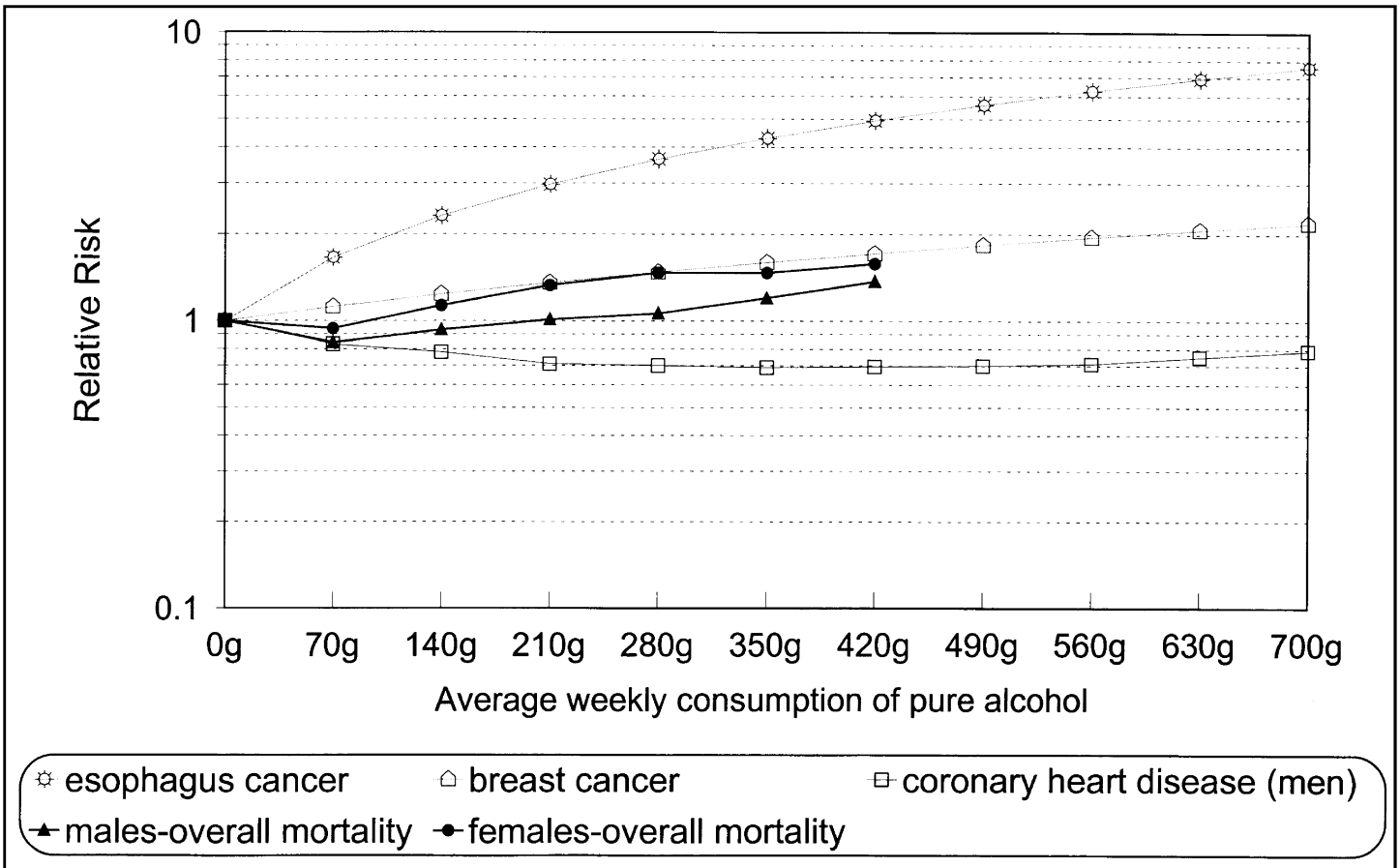

Figure 1. Risk of specific health outcomes in relation to average amount of alcohol consumed in a week, as found in selected epidemiologic studies.

A relative risk of 2.0 means that the average drinker's risk is twice that of the average abstainer; a relative risk of 0.5 means that the volume of alcohol indicated is associated with one half the risk, relative to abstainers.

The risk curves for cancer were estimated from an original meta-analysis conducted by Dr. J. Rehm for presentation at a symposium sponsored by the Department of Preventive Medicine and Biostatistics at the University of Toronto, June 1996. Esophageal cancer studies included were: Yu et al., 1988,[15] Graham et al., 1990,[16] Brown et al., 1988,[17] Valsecchi, 1992,[18] and La Vecchia and Negri, 1989.[19] Data used were for both sexes, and were adjusted for age, sex, smoking and other confounders. Female breast cancer studies included were: Friedenreich et al., 1993,[20] Gapstur et al., 1992,[21] Garfinkel et al., 1988,[22] Hiatt et al., 1988,[23] Hiatt and Bawol, 1984,[24] Nasca et al., 1990,[25] and Willett et al., 1987.[26] Data were adjusted for age and other confounders.

The risk curve for coronary heart disease in middle-aged men was adapted from Rehm.[27]

The male and female risk curves for all-cause mortality were taken from the meta-analysis of English et al.[10]

(e.g. upper respiratory and digestive systems, and breast). The rate at which risk increases with alcohol intake varies (Figure 1). For ischemic heart disease (IHD) and ischemic stroke, alcohol has a protective effect over a wide range of intakes, from less than 70 g (5 SD) per week to at least 700 g (50 SD) per week. However, beginning around 210 g (15 SD), risk does not decrease further with increased intake (27-29). Other risks steadily increase with all increases in total intake.[4,5]

Regarding overall mortality,[10,11,30] men averaging less than 210 g (up to 14 SD) a week are at lower risk of early death than men who abstain, while larger amounts are associated with increased risk. Women who drink 9 SD or less per week are at lower risk of early death than abstainers; risk begins to increase at an average intake of 140 g (10 SD) a week.[10] Therefore, weekly upper limits of 14 SD per week for men, and 9 for women were adopted. Besides low risks of long-term health problems, these weekly limits are associated with low rates of short-term drinking problems, including harm to personal relationships and jobs.[31-33]

Evidence for daily limits

Alcohol-related injuries are a major contributor to early death and disability and social welfare and health care costs in Canada.[34] For injuries and other acute consequences, the amount consumed on each drinking day is often shown to be at least as important as weekly intake.[35-41] Blood alcohol content (BAC) is closely associated with increased risk and severity of injuries, including motor vehicle crashes (Figure 2).[42] The risk of a crash is three times greater with a BAC of 0.08% (the legal limit for most drivers in Canada) than for a BAC of zero. Although there is considerable variation between and within individuals in the BAC reached with a given amount of alcohol, and tolerance to alcohol's effects,[43] every additional drink

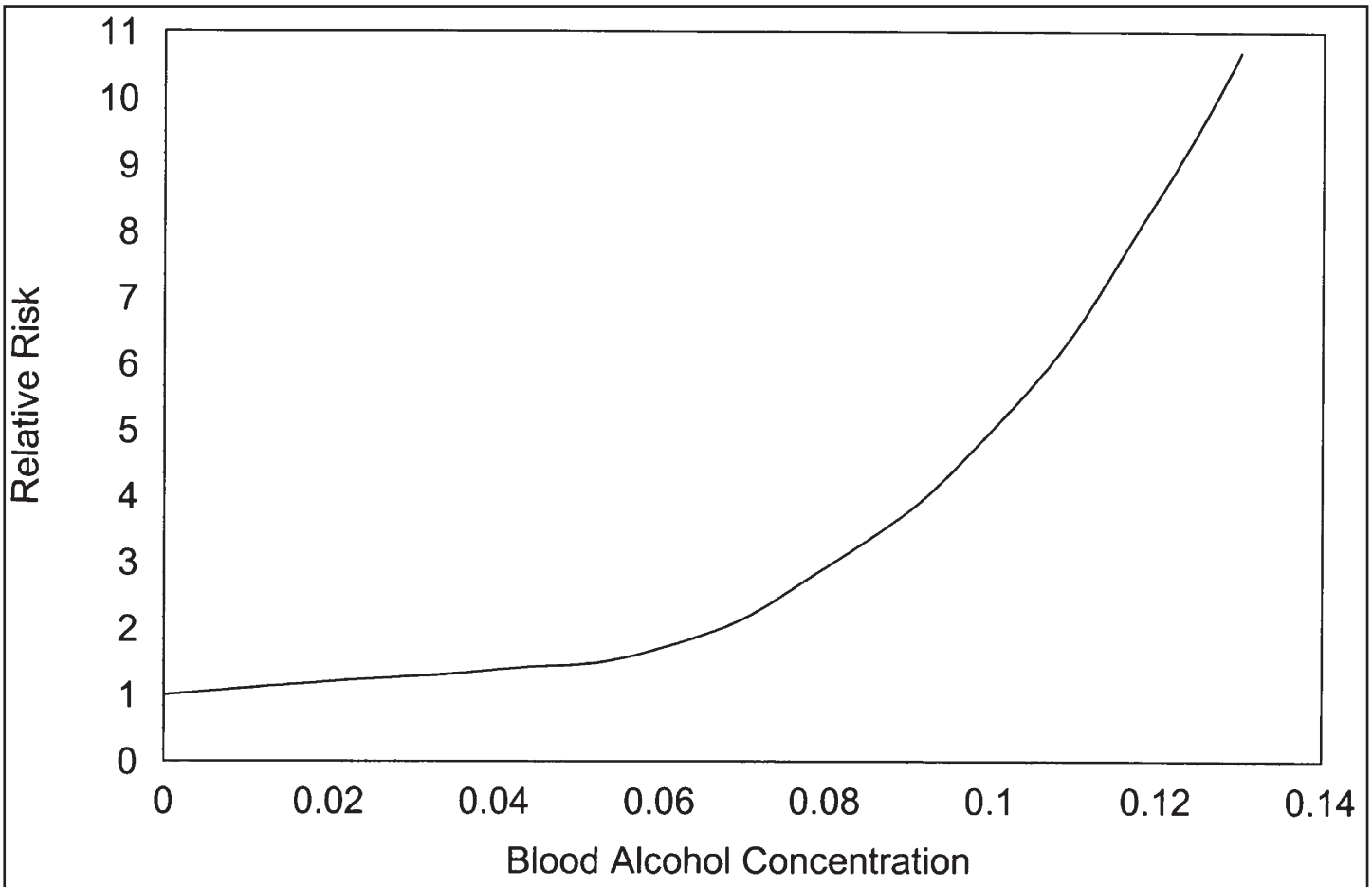

Figure 2. Risk of accidents in relation to blood alcohol concentration (BAC) at the time of the event.
A relative risk of 1.0 means the risk of an accident is the same as for a BAC of zero; a relative risk of 2.0 means the risk is doubled compared to that associated with a BAC of zero.
Data source: Hurst et al.[42]

increases the risk of crashes and other accidents.[44] Time elapsed between drinks, food consumption, and the presence of physical hazards are also important determinants of risk.

Acute episodes of heavier drinking cause physiologic changes relevant to chronic disease, such as increased blood pressure and effects on the heart's pumping action.[45-49] Such adverse effects have been demonstrated experimentally with doses of 4 to 6 ounces of spirits (2.5-4 SD) over intervals of up to 2 hours. These doses resulted in BAC levels around the legal limit (0.08%), and were described as "mildly intoxicating".[46] More frequent heavy drinking is also associated with raised blood pressure and increased risks of heart arrhythmias and stroke.[49-51]

Associations between acute alcohol intake and adverse effects on social well-being (home life, work, legal and financial problems) have been found in cross-sectional studies,[31-33,37-40,52] and prospectively, in studies of problem drinkers (e.g., ref. 33). Episodes of heavy drinking are highly correlated with problems, even after controlling for total consumption and other factors.[31,32,51,53-55]

Many studies define heavier drinking episodes as occasions on which five or more drinks were consumed (e.g., ref. 31). However, this number was chosen arbitrarily and its use is based on tradition rather than empirical study.[41,54] Another line of research shows that men and women who average no more than 4 and 3 drinks, respectively, on drinking days (and drink no more than 4 times per week) do not report problems.[33] Overall, there is no strong evidence favouring any specific amount as marking a discrete threshold of risk. Rather, risk appears to increase in a more or less linear manner with the amount consumed.[40] Each drink increases the risk of accidents, injuries and other consequences,[5,33,37] although it is difficult to quantify the increase across problem types and study populations.

Intoxication *per se* also increases risks of various problems. In surveys, the reported frequency of intoxication or having "too much to drink" is associated with alcohol dependence, accidents, work and legal problems.[32,37,41,55] The role of intoxication in assault, sexual assault and property crimes is also well documented.[9,56] The amount a person can drink without intoxication varies greatly with drinking experience and tolerance.[9,43] Related evidence shows that the greatest risk of injury is experienced by individuals with the greatest variability in the amount they consume relative to their average amount per occasion[57,58] which may be related to tolerance, setting, and personality. The committee

concluded that low-risk drinking includes the avoidance of subjective intoxication.

The committee considered whether daily drinking limits should be sex-specific. Women typically reach higher BAC levels than men drinking the same amount.[43] However, for most acute problems (e.g., injuries, driving while intoxicated), men are at much greater risk.[9,37] This excess risk remains even after controlling for sex differences in total amount consumed and other factors.[31,38] Therefore, daily limits were not made sex-specific.

As a preventive guideline, many authorities recommend taking no more than one drink per hour. This was examined critically. On average, a body weighing 70 kg (154 lbs) can reach a BAC of 0.08 with two drinks in one hour, and can eliminate roughly 8 to 10 g of absolute alcohol per hour,[31] less than the amount in one SD (13.6 g). A person's BAC can accumulate to 0.05%, a point at which legal driving sanctions may apply, even when the drink per hour rule is followed. Also, it takes 30 to 90 minutes for BAC to peak after drinking.[43] Therefore, waiting an hour before driving may not prevent legal consequences.

Overall, the evidence speaks to lower daily limits as representing less risk, but not to a specific value. A daily limit of no more than two SD was chosen because this should not result in a significant risk of problems (including legal consequences) for most people, including smaller individuals and those with lower tolerance. From the same evidence it was recommended that alcohol be drunk slowly. Also, since the risk of injury is highly dependent on environmental factors (e.g., 38,44), when daily limits are exceeded, extra caution to prevent injury is warranted.

Days without alcohol?

The 1993 ARF/CCSA guidelines recommended one or more abstinent days weekly, citing an association between daily drinking and alcohol dependence.[1,6,37] This evidence comes from North American settings, not cultures where daily wine drinking is more normative, and does not address daily drinking separately from increasing amounts.[9,37,59] Alcohol dependence is a remote possibility for healthy persons with no history of drinking problems, if they consistently drink within the limits specified. One analysis showed that when intake is limited to 7 to 14 drinks a week, spreading it over seven days instead of six reduces the risk of some problems.[35] Therefore, in these guidelines, intended for *primary prevention*, a statement about abstinent days was not included. However, the message about daily drinking in a treatment context is *unchanged*. A perceived need to drink daily, and reliance on alcohol to cope are signs of potential problems[60-62] and are associated with treatment failure and relapse.[63] Advice from a counsellor to take days off because of previous problems should take precedence over these guidelines.

Drinking for health?

The protective health effects of alcohol are largely limited to specific conditions involving processes of atherosclerosis and thrombosis, notably IHD and ischemic stroke.[6,47,65,66] Benefits are counterbalanced by increased risks of other chronic conditions and injuries.[5,11,30,37] The net benefit also depends on the drinker's age. In Canada, the risk of death from IHD begins to increase at 40 to 45 years in men and 45 to 49 in women.[67] Only above these ages may the protective effects of drinking outweigh the risks from other causes, including injuries.[30]

Studies of alcohol and IHD demonstrate a protective effect with an average intake as low as one drink every other day.[10,27,28,47] Importantly, larger amounts (e.g., > 14 SD/week) do not reduce risk further.[28,29] These guidelines allow sufficient alcohol to afford protection against IHD. Anyone considering using alcohol for prevention should also consider the risks, and discuss options with health care providers. Greater net benefit may result from smoking cessation, controlled blood pressure, regular exercise, dietary change, or medical interventions (e.g., anticoagulant or lipid-lowering therapies). Whether alcohol use has a protective effect greater than or not overlapping with other preventive measures has not been adequately studied.

Equivalence of beverage types

The guidelines refer to SDs of any alcoholic beverage. Beverage types differ in their content of congeners thought to have beneficial effects including phenolic compounds labelled as antioxidants.[64,68,69] However, the ethanol itself has been shown to produce the protective anticoagulant and lipid-altering effects.[70,71] The other chemicals are found in variable amounts in alcoholic beverages and in larger quantities in foods such as fruit. Also, these chemicals have not yet been proven to act as antioxidants *in vivo* or prevent heart disease.[68-70] Drinkers, however, should pay close attention to beverage differences in alcohol content and serving sizes.[72,73]

DISCUSSION

These guidelines express current best advice about the health benefits and negative effects of alcohol use. They define drinking patterns associated with low risk of a range of alcohol-related problems. The recommendations reflect upper limits, which if followed over most of the adult life-span, would avoid increased risks of the most common and/or devastating adverse consequences. The guidelines constitute a *low-risk package*. Adhering to one element without the others may not result in low risk. Further, there are circumstances under which alcohol should not be consumed (see Appendix).

The enormous breadth of subject matter relevant to primary prevention guidelines on 'low-risk drinking' must be noted. Possible combinations of exposure factors (patterns of drinking) and outcomes (acute and chronic effects, health and social welfare effects) are limitless. A fully objective, evidence-based approach is impossible. In determining the relative importance of findings, subjectively greater weight was given to systematic reviews and to broader indicators such as total mortality,[10,11] morbidity[10] and economic losses.[14,34]

The relevance and quality of data for different outcomes was uneven. For chronic diseases, most evidence comes from prospective studies. Methodologic problems have been identified and there are no experimental data.[74-78] However, the findings are quite consistent with respect to most chronic health outcomes, including cardiovascular disease. The benefit for

APPENDIX
GUIDELINES ON LOW-RISK DRINKING

Released by Addiction Research Foundation, and Canadian Centre on Substance Abuse, October 1997. These guidelines have been endorsed by the College of Family Physicians of Canada, the Alberta Alcohol and Drug Abuse Commission, the Addictions Foundation of Manitoba, and the Manitoba Medical Association. In Ontario, these guidelines have been endorsed by the Ontario Public Health Association, the Association of Local Public Health Agencies, and the Ontario Society of Nutrition Professionals in Public Health.

Healthy people who choose to drink and who are of legal drinking age can minimize the risk of alcohol-related problems (such as health and social problems, injuries and alcohol dependence) by observing the following guidelines. These guidelines should be taken as a whole to ensure a low risk of alcohol problems. If a person exceeds the daily or weekly limits on a regular basis, there is an increased risk of problems. If the daily limit is exceeded, take precautions to avoid injuries and other problems. As well, these guidelines do not apply to some people — please review the special populations information following the guidelines.

- Drink no more than two standard drinks on any day.
- Limit your weekly intake to 14 or fewer standard drinks for men and 9 or fewer standard drinks for women.
- Drink slowly to avoid intoxication, waiting at least one hour between drinks; take alcohol with food and non-alcoholic beverages.
- If you abstain, don't start drinking alcohol for its protective effect against heart disease; there are less risky alternatives such as exercise, better nutrition and quitting smoking.
- If you choose to drink, the protective effect of alcohol can be achieved with as little as one drink every other day.
- If you are seeking help for a drinking problem, follow the advice of your counsellor or health professional.

A standard drink is defined as one 341 mL (12 oz.) bottle of beer (5% alcohol); one 142 mL (5 oz.) glass of table wine (12% alcohol); one 43 mL (1.5 oz.) serving of spirits (40% alcohol) or one 85 mL (3 oz.) serving of fortified wine, such as sherry or port (18% alcohol).

Special populations

There are certain people who should not use alcohol, or who should limit their use to less than these maximum amounts. These groups include:

- people with certain health problems, such as liver disease or certain psychiatric illnesses
- people taking certain medications, such as sedatives, sleeping pills and pain killers
- people with a personal history of serious drinking problems
- women who are pregnant, trying to conceive, or breastfeeding
- people who are operating vehicles, such as automobiles, motorcycles, boats, snowmobiles, all-terrain vehicles, or bicycles
- people who need to be alert — for example, while working with machinery or dangerous equipment, when engaging in challenging physical activities, or when responsible for the safety of others or public order
- people who are under any legal or other restriction on drinking — personally or because of the environment they're in

These guidelines are based on current research and will be reviewed and revised as necessary by the Addiction Research Foundation and its partners.

IHD does not appear to be an artefact of the methods used, and is supported by biochemical data.

Data on accidents and injuries come largely from emergency room studies, which address acute drinking more often than usual drinking patterns. Injuries other than from traffic crashes are less well studied. Studies of the risk associated with modest levels of usual intake are uncommon.

Arguably, the evidence on psychological and social harm is weakest. Much of it comes from cross-sectional surveys, precluding assessment of causality, or from clinical settings rather than communities. Associations will be influenced by attitudes toward drinking, and outcome measures may be poor.[79-81] Statements about harm to people other than the drinker may encompass value-laden assumptions about acceptable risk.

The biggest challenge in establishing widely accepted guidelines for low-risk drinking lies in the lack of evaluation research on guidelines as an instrument of behaviour change, and in primary prevention.[6] Tough questions left unanswered include whether conservative limits are more or less effective than more liberal limits. There is little guidance about how to address audiences differing in drinking history, attitudes and cultural norms. Evaluative research is a priority.

While generally consistent with other guidelines intended for health promotion,[6] the 1997 statement sets lower limits for daily consumption than some clinical guidelines. The ARAI program of the Canadian College of Family Physicians[82] advises men and women to limit their alcohol drinking to no more than 4 or 3 drinks a day, respectively, and to 12 drinks a week, with abstinence being appropriate at certain times. The ARAI guidelines are aimed at harm reduction among patients whose drinking is high risk, and are effective in this context.[53,83] The new ARF/CCSA guidelines are intended to reinforce low-risk drinking in both community and clinical settings. They also address the concern that evidence of a health benefit may lead to an increase in alcohol consumption.

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