WHO/MSD/MSB/00.4
Original: English
Distribution: General

INTERNATIONAL GUIDE FOR MONITORING ALCOHOL CONSUMPTION AND RELATED HARM

Department of Mental Health and Substance Dependence
Noncommunicable Diseases and Mental Health Cluster
World Health Organization

Acknowledgments

Many people have committed their time, energy and ideas to the project of developing this guide. The project was first conceived by Dr Alan Lopez when Acting Director of the Programme on Substance Abuse at WHO. Tim Stockwell and Tanya Chikritzhs of the National Drug Research Institute, Curtin University of Technology, Perth, Western Australia were commissioned by WHO to coordinate and edit the guide. They were greatly assisted in this by the following people who wrote first drafts of various of the chapters: Harold Holder (USA), Eric Single (Canada), Marina Elena Medina-Mora (Mexico), David Jernigan (USA) and Deborah Dawson (USA). In addition a number of other experts in alcohol research attended a preliminary workshop held in Perth in February 1998 to present and discuss preliminary drafts of the chapters. In addition to the authors listed above they were: Sir Richard Doll (England), Jonathan Chick (Scotland), E. Deshapriya (Sri Lanka), David Hawks (Australia), Tom Greenfield (USA), Robin Room (Canada) and Wayne Hall (Australia). Proceedings of that meeting were drafted by Tanya Chikritzhs (Australia) and circulated to participants for correction and use in redrafting of the chapters. Subsequently, each of the authors and also Robin Room, Johnathan Chick, Tom Greenfield and David Hawks provided detailed editorial feedback on the first complete draft of this Guide. A second set of revisions were then completed following input from Kim Bloomfield (Germany), Sawitri Assanangkornchai (Thailand), Isidore Obot (Nigeria), Lee Rocha-Silva (South Africa), Maria Elena Medina Mora (Mexico), Airi Värnik (Estonia), Tom Greenfield (USA), Jonathan Chick (Scotland), Shekhar Saxena (WHO) and Juergen Rehm (WHO). Finally, the document was reviewed by participants at a Thematic Meeting of the Kettil Bruun Society for Social and Epidemiological Research on Alcohol "Measuring Drinking Patterns, Alcohol Problems, and their Connection", held in Stockholm 3-7 April 2000. Feedback from that meeting has also been incorporated into the final document. Special thanks are due to Dr Pia Mäkelä for her detailed and helpful comments on that draft.

The final draft was written largely by Tim Stockwell and Tanya Chikritzhs. There are still substantial sections, however, contributed with only minor amendment from the original authors listed above. We are indebted also to Sue Wilson of the National Drug Research Institute for many hours of work in formatting this report. Lastly, we wish to thank Dr Mary Jansen for her guidance in finalizing this project while she was Director of the Substance Abuse Department at WHO.

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Section 1:

Introduction to the Guide

Chapter 1.1

Why monitor alcohol use and related problems?

Summary

The purpose of this document is (1) to provide guidance to WHO Member States on epidemiological monitoring in order to inform and facilitate effective policy formation and (2) to improve the global and regional comparability of data on alcohol use and health consequences in order to improve monitoring and to facilitate research and risk assessment. It is intended to provide general principles and also practical guidance on the development of realistic and effective sets of indicators of alcohol consumption and harm for different countries with different levels of resources.

The overall exercise is placed into the context of other WHO initiatives on alcohol and drug prevention and monitoring such as the "Global Burden of Disease" report (Murray and Lopez, 1996), "Global Alcohol Report" (WHO, 2000) and the Alcohol Policy and Public Good Project for Developing Countries.

The number and severity of adverse consequences related to alcohol use constitute a major rationale for international monitoring of alcohol's use and effects. Murray and Lopez (1996) estimated that globally in 1990 alcohol contributed to 773,600 deaths, 19.3 million years of life lost and 47.7 million disability adjusted life years. Some 82% of this burden of death, illness and injury falls on regions of the world classified as 'developing'. Estimates of the annual economic costs of alcohol each year in developed economies range from 0.5% to 2.7% of GDP and invariably greatly exceed the economic costs of illicit drug use.

The major uses to which national alcohol monitoring systems can be put is summarised with particular emphasis on raising awareness among the public and policy makers of the contribution of alcohol to serious problems in the domains of public health, safety and order. The different types of data that can be used and their strengths and limitations for different purposes are discussed in general terms.

The organisation of the guide is introduced and some fundamental issues discussed such as: the importance of measuring volume as well as pattern of drinking; the usefulness of distinguishing between the long and short-term consequences of alcohol use. The chapter concludes with a discussion of how alcohol consumption and problems should be monitored and the results disseminated.

Introduction

The misuse of alcohol represents one of the leading causes of preventable death, illness and injury in many societies throughout the world. Alcohol consumption is associated with a variety of adverse health and social consequences. Adverse effects of alcohol have been demonstrated for many disorders, including liver cirrhosis, mental illness, several types of cancer, pancreatitis, and damage to the fetus among pregnant women. Alcohol use is also strongly related to social consequences such as drink driving injuries and fatalities, aggressive behaviour, family disruptions and reduced industrial productivity.

A number of strategies are available to governments and communities for both treating and preventing alcohol-related harm. These include regulation of the sale, supply and consumption of alcohol; health promotion strategies targeting whole populations or important at-risk groups, harm minimisation strategies to reduce the risk of adverse consequences following drinking in particular contexts (e.g. licensed drinking settings and road safety) and/or for particular high risk groups; screening and early intervention programs; treatment programs to assist problem drinkers to reduce or abstain altogether from drinking. In each of these major domains evidence has accumulated for the effectiveness of particular strategies and policies. In relation to the prevention and control of alcohol-related problems, this evidence is authoritatively reviewed in the WHO sponsored international review “Alcohol Policy and the Public Good” (Edwards *et al*, 1994). A forthcoming WHO publication will update that review with special reference to developing countries under the direction of the Alcohol Policy and Public Good for Developing Countries project. The evidence for harm minimisation approaches to prevention and treatment has also been overviewed by Plant *et al* (1997). Furthermore, a comprehensive international handbook on the nature, treatment and prevention of alcohol problems will be published in late 2000 (Heather *et al* in press).

There is clearly no shortage of effective strategies for tackling alcohol-related harm, nor information as to how to implement these. For a number of reasons, in many countries few if any of these strategies are being applied and there is a major task to be undertaken to persuade governments and other authorities of their potential value. Among the important reasons are that, unlike tobacco, alcohol use is frequently a positive experience without discernible negative health or social benefits; in recent years there has been substantial publicity about the apparently beneficial effects of moderate alcohol consumption on long-term health; alcohol use is also deeply integrated into social and even religious customs in many societies; the alcohol manufacturing and retail industries contribute significantly to employment and government revenues; alcohol control policies in particular are sometimes unpopular with voters who either do not believe they will be effective or do not accept that alcohol problems are sufficiently serious to warrant such interventions. In essence, the major contribution of particular patterns of alcohol consumption to social, health and economic harms is often not well understood, documented or conveyed to either policy makers or the public at large. As a cause of death, injury and illness alcohol use is often unseen but, as will be shown below, nevertheless very real.

In recent years the major alcohol groups have expanded their markets in the developing world and also in former Eastern Bloc countries. Jernigan (1997) has documented this phenomenon carefully in countries such as Malaysia, Estonia and Zimbabwe. Jernigan has also shown that while governments in developing countries are frequently eager to welcome the development of new alcohol markets for economic reasons, the initiation of regulatory mechanisms and treatment systems are usually given less priority. There is an urgent need, therefore, for guidance to such countries in terms of available prevention strategies and their implementation which will be provided in other WHO publications. There is also a need for more economically developed countries to respond more effectively to alcohol problems. However, if governments are to implement such strategies they must also be advised that alcohol-related harm is sufficiently harmful and costly to be afforded any priority over the many other competing social and economic issues with which they must grapple. The present guide has been developed specifically to provide direction and advice on the establishment of national monitoring systems in order to provide accurate information upon which to base and develop national policies.

This guide needs to be seen as complementary to other WHO publications concerned with national and international monitoring. For example, the “Global Burden of Disease” (Murray and Lopez, 1996; to be updated in 2000) includes estimates of the prevalence and social impacts of alcohol-related death and disability across eight regions of the world, defined in socio-economic as well as geographic terms. In addition, the recent publication “The Global Alcohol Report” (WHO, 2000) provides available data on alcohol consumption and harm for over 200 countries. They are also designed to be complementary to the “Guide to Drug Abuse Epidemiology” (WHO, 1998) particularly in relation to the practical advice contained there on developing survey instruments accessing police and health data. In some respects the present guide also provides more updated and detailed advice on alcohol epidemiology than in the latter document. For advice on monitoring alcohol-related problems at the local level, the reader is referred to Gruenewald *et al* (1997).

The global burden of alcohol-related problems

Reviews of the international literature on disease and death related to alcohol have identified at least 61 different types of injury, illness or death which are *potentially* caused by the consumption of alcohol. The major review and meta-analyses conducted by English *et al* (1995) concluded, against stringent criteria, that there was sufficient evidence for a direct causal association with ‘hazardous or harmful’ alcohol use for 38 of these conditions (see Table 3.1.1 in Chapter 3.1) – in one of these cases (cholelithesis) a protective effect of alcohol consumption was identified. (In addition, English *et al* (1995) then estimated the proportion of each of these conditions that could be attributed solely to alcohol with values ranging from 3% (in Australia) for breast cancer and 100% for wholly alcohol caused conditions such as alcoholic liver cirrhosis and alcoholic cardiomyopathy.

The English *et al* (1995) review is still regarded as a benchmark in international alcohol epidemiology as indicated by the application of their results with only minimal amendment in the “Global Burden of Disease” project (Murray and Lopez, 1997) and also to the estimation of alcohol-related morbidity and mortality in Canada (Single *et al*, 1999). A methodology will be outlined in Section 3 of this guide for applying the English *et al* approach to other countries.

The “Global Burden of Disease” (Murray and Lopez, 1997) report includes estimates of both numbers of alcohol-related deaths and the extent of social and other disability caused by alcohol-related illness and injury. As shown in more detail in Table 1.1.1 for each of the 8 global regions used in the study, it was estimated that for 1990 in the developing world alcohol was responsible for 636,800 deaths, 14.6 million years of life lost and 32.3 million ‘disability adjusted’ years of life lost. The latter measure includes estimates of the impact of non-fatal alcohol caused injury and illness on general quality of life. There is considerable variation evident in the extent of alcohol-related harm in different regions of the world. In the developed Western countries, India, China and former Eastern Bloc countries alcohol is estimated to contribute between 1.2% and 1.4% of all deaths, higher levels are evident in other Asian countries (1.8%), Sub-Saharan Africa (2.1%) and Latin American countries (4.5%). It should be noted that these are almost certainly underestimates as several alcohol-related causes of death were excluded from the analysis since it was not possible to make reliable estimates of their prevalence. Despite this fact, it was estimated that for men, alcohol was the leading cause of disability in developed countries and the fourth leading cause of disability for men in developing countries out of a list of 11 major risk factors. For women, alcohol was considered to be a much less significant contributor to disability.

Table 1.1.1: Numbers of deaths and Years of Life Lost (YLL) due to disease and injury attributable to alcohol use in 1990, source: Murray and Lopez (1997)

Region[a]	Deaths ('000)	As % of total deaths	YLLs ('000)	As % of total YLLs	DALYs ('000)	As % of total DALYs
EME	83.8	1.2	2537	5.1	10 204	10.3
FSE	53.0	1.4	2063	5.7	5 193	8.3
IND	112.9	1.2	2723	1.4	4 697	1.6
CHN	114.1	1.3	2118	1.8	4 856	2.3
OAI	97.4	1.8	1862	1.6	5 053	2.8
SSA	170.7	2.1	4435	2.0	7 603	2.6
LAC	136.1	4.5	3319	5.9	9 520	9.7
MEC	5.6	0.1	229	0.2	666	0.4
World	773.6	1.5	19287	2.1	47 687	2.6

It is important to note that the above estimates are conservative and only apply to health and their social consequences. Alcohol also contributes directly to a wide range of other social and legal problems. Notably there is now compelling evidence for alcohol intoxication contributing causally to violent injury in situations where there is some degree of social conflict (Graham, in press). Only a relatively small proportion of the victims of violence are admitted to hospitals and thus are not recorded in health statistics. Alcohol also is known to contribute to absenteeism, family disruption and divorce in many countries (Epstein, in press). Murray and Lopez (1996) also provide estimates of deaths, Years of Life Lost, Years Lived with Disability (YLD) and disability adjusted life years (DALYs) from alcohol for health problems of a psychiatric nature and also caused by violence in the "Global Burden of Disease" report. These are reproduced in Tables 1.1.2 and 1.1.3 below.

Table 1.1.2: Estimated percentage of all deaths due to selected alcohol-related conditions and ischaemic heart disease

Region[a]	alcohol related psychiatric conditions	liver cirrhosis	road injuries	violence	ischaemic heart disease
EME	0.22%	1.64%	1.84%	0.42%	23.42%
FSE	0.21%	1.37%	2.40%	0.79%	27.09%
IND	0.05%	1.61%	1.86%	0.60%	12.54%
CHN	0.06%	2.10%	1.52%	0.57%	8.58%
OAI	0.09%	2.37%	2.40%	0.92%	8.33%
SSA	0.06%	0.41%	1.89%	2.50%	2.55%
LAC	0.37%	2.06%	3.62%	3.39%	11.57%
MEC	0.02%	0.99%	1.54%	0.86%	13.40%
World	0.11%	1.54%	1.98%	1.12%	12.40%

Table 1.1.3: Estimated percentage of all Years of Life Lost (YLL) due to selected alcohol-related conditions and ischaemic heart disease

Region [a]	alcohol related psychiatric conditions	liver cirrhosis	road injuries	violence	ischaemic heart disease
EME	0.45%	2.49%	5.96%	1.57%	16.33%
FSE	0.31%	1.68%	5.81%	1.94%	17.72%
IND	0.04%	1.16%	2.31%	0.66%	4.42%
CHN	0.08%	2.08%	2.71%	1.19%	4.47%
OAI	0.08%	1.61%	3.26%	1.18%	3.05%
SSA	0.03%	0.23%	2.06%	2.65%	0.92%
LAC	0.35%	1.61%	5.21%	5.02%	4.69%
MEC	0.01%	0.63%	1.87%	1.09%	4.54%
World	0.10%	1.16%	2.89%	1.71%	4.59%

[a]EME: Established Market Economies
FSE: Formerly Socialist Economies of Europe
IND: India
CHN: China
OAI: Other Asia and Islands
SSA: Sub-Saharan Africa
LAC: Latin America and the Caribbean
MEC: Middle Eastern Crescent

Latin American and Caribbean (LAC) countries indicated the largest number of deaths due to violence (not including war) - about 3 times greater than the world average (3.4% of all deaths in that region). Additionally, LAC countries also lost 2.9 times the average in numbers of years of life lost to violence. Numbers of road injury fatalities in the LAC region were also high in 1990, about 1.8 times greater than the world average and with comparatively greater numbers of premature years of life lost. Although smaller in terms of magnitude, deaths due to alcohol-related psychiatric conditions were also 3 times greater than average. Not surprisingly, at 4.5% of all deaths, LAC countries indicated the highest percentage of deaths attributable to alcohol use compared to all other regions (Murray and Lopez, 1996, see pp.313). With the exception of hypertension (8.1%), the level of death due to alcohol use in LAC countries exceeded all other major causes of death, including; tobacco use (3.3%), malnutrition (4.5%) and poor water supply/sanitation/personal and domestic hygiene (4.5%). It should also be noted that alcohol also imparts an increased risk of developing hypertension (an attributable risk of about 20% in men, Holman *et al* 1990)

Asian areas other than China and India (OAI) (e.g. Indonesia, Vietnam) also indicated higher than average levels of death caused by alcohol (1.8%). This region is characterised by 21% higher levels of road fatalities and 53% higher than average levels of liver cirrhosis (highest of all regions). Additionally, OAI regions have the second lowest level of death from IHD (8.3%). Therefore, since relatively few deaths in OAI are due to IHD, little of the protective effect of alcohol is imparted on overall levels of alcohol-caused deaths.

A further consideration, of no less importance than numbers of deaths and of considerably greater importance in terms of the economic burden of alcohol use to a community, is the number of years of life lost due to premature death (YLL). Regardless of any positive benefit which may be afforded by a reduction in numbers of deaths due to IHD, the overall amount of time lost (in years) due to alcohol-caused premature death is always likely to exceed the number of years saved - even in developed countries. This is because any protective effect on IHD occurs among older persons while death from injury generally occurs among younger people.

Notably, even though EME and FSE regions (includes developed nations) indicated relatively low proportions of alcohol-caused deaths compared to other regions (1.2% and 1.4% respectively), they also indicated some of the highest estimates of years of life lost due to premature death (5.1% and 5.7% respectively). However, as a proportion of overall years of life lost, Latin American and Caribbean countries produced the largest percentage due to alcohol-use (5.9%).

The social and economic costs of excessive alcohol use

The total economic costs of excessive alcohol use in one year have been calculated using formal economic methods. International guidelines have now been developed for estimating health, police, legal and work-related costs (see Single *et al*, 1996). The results of these exercises are summarised in Table 1.1.4 for a number of different countries for alcohol, tobacco and other drugs**.** One of the most recent studies was a French Study (Kopp *et al*, 1999) in which it was estimated that alcohol-related problems cost 1.5% of Gross Domestic Product in 1997, higher than that for tobacco (1.2%) and considerably higher than that for illicit drugs (0.2%). Another recent study from the USA estimated that alcohol cost 2.1% of GDP in 1992, again higher than the 1.6% estimate for the total cost of problems related to illicit drugs in the USA (Harwood *et al*, 1999). Again it should be noted that these estimates do not include the police and legal costs associated with alcohol-related violence nor with a wide range of less visible social problems such as divorce and child abuse.

Table 1.1.4: Comparison of Total Tangible Cost of Substance Abuse Estimates for Various Countries

Study	Country	Year of Data	Original Total Cost Estimate[1] (millions, local currency)	Total Cost Relative to GDP[2] (%)
Tobacco				
Collishaw & Myers (1984)	Can.	1985	5,180	1.9
Raynauld & Vidal (1986)[3,4]	Can.	1986	669	0.1
Rice *et al*. (1990)	U.S.	1980	53,711	2.0
Collins & Lapsley (1994b)	Aus.	1992	5,362	1.4
Single, Robson *et al* (1998)	Can	1992	9,560	1.4
Kopp *et al*, 1999	France	1997	F89,256	1.2
Alcohol				
Adrian *et al*. (1988)[3]	Can.	1984	11,840	2.7
Rice *et al*. (1990)	U.S.	1985	70,340	1.7
Collins & Lapsley (1991)	Aus.	1988	4,538	1.4
McDonnel & Maynard (1985)	U.K.	1983	1,614	0.5
Nakamura *et al*. (1993)	Jap.	1987	664,000	1.9
Single, Robson *et al* (1998)	Can.	1992	7,522	1.1
Harwood *et al* (1999)	U.S.	1992	148,000	2.4
Kopp *et al* (1999)	France	1997	F115,420	1.5
Drugs[6]				
Adrian *et al*. (1988)[3,a]	Can.	1984	11,506	2.6
Rice *et al*. (1990)[a]	U.S.	1985	44,050	1.1
Collins & Lapsley (1991)[6,b]	Aus.	1988	1,232	0.4
Fazey & Stevenson (1990)[3,b]	U.K.	1988	1,820	0.4
Institut Suisse... (1990)[b]	Switz.	1988	514	0.2
Single, Robson *et al* (1998)	Can.	1992	1,371	0.2
Harwood *et al* (1999)	U.S	1992	98,000	1.6
Kopp *et al* (1999)	France.	1997	F13,350	0.2

[1] Total cost includes all indirect and direct costs, as specified by the author, unless otherwise indicated.

[2] Original total cost figure is divided by the national GDP for the year of the study.
[3] Estimates of external costs.
[4] Total costs are given (not the net costs, as in the final totals given by the authors).
[5] a = estimates for illicit + licit drugs; b = estimates for illicit drugs only.
[6] Total tangible costs, without subtraction of benefits of premature mortality.

No rigorous estimates of the economic and social impacts of alcohol have been made in developing countries to date. Given that, as ever, the estimates of alcohol-caused mortality and morbidity using the English *et al* (1995) approach are (or should be) central to such studies. Given the substantial impacts on death and disability in the developing world estimated by (Murray and Lopez, 1996), it can be concluded that the economic value of the overall impact on developing countries would also be substantial.

The value of national data on alcohol use and harm

There are a number of important purposes for which national data on patterns of alcohol consumption and levels of harm can be used. In each case it is important to consider what are the best types of data for that purpose. Major distinctions must be made between the use of data to estimate the magnitude of problems at one point in time and the direction of change over a period of time. A further consideration is the extent to which the data sets used for either purpose can also be used for comparison with similar prevalence and trend estimates from other countries. These issues are discussed below in general terms along with how the present guide can contribute towards these objectives.

(i) Estimates of the prevalence and cost of alcohol-related health, social and other problems.

Even on an occasional or 'one-off' basis such estimates, if credible and disseminated well, can have a major impact on level of awareness of the magnitude and significance of alcohol-related problems. Some of the data sources recommended in this guide will permit estimates of overall prevalence for some types of harm. It is vital that the data sets sourced for this purpose are as comprehensive and representative as possible of the entire population to which the estimates are to be applied. In many developing countries, the only existing data sets that approach the standards required will be data on causes of death. In such countries there are usually no reliable data on causes of illness and injury nor national surveys, whether from health records or national surveys. Methods for estimating the economic costs caused by alcohol use are highly complex. Detailed guidelines for conducting such estimates have been provided elsewhere (Single, Collins *et al*, 1996) and will not be discussed in detail here.

(ii) Comparisons of prevalence and cost estimates between different countries.

There are several conditions that have to be met before it is possible to attempt valid comparisons between different countries for estimates of prevalence and economic costs. A fundamental requirement is that identical methods are used. Even if truly representative samples from national surveys are obtained, say, both in South Africa and Nigeria, if the questions about alcohol consumption and experiences of harm are not identical then no valid comparisons can be made. Among developing countries, it is likely that comparisons regarding broad categories of causes of death are the only ones that will approach validity. Between developed countries, caution must also be exerted regarding comparisons of prevalence estimates of alcohol-related illness and injury since records of these are greatly influenced by patterns and levels of health care delivery. Since estimates of economic costs depend heavily on such data, similar caveats apply to making direct comparisons between country by country estimates of the kind shown in Table 1.1.2 above. For example, Harwood *et al* (1999) did not follow the international guidelines developed by Single *et al* (1996) for such studies and, arguably, over-estimated the overall costs of morbidity and mortality in the USA. Whichever method is the most correct, however, Harwood *et al*'s figures cannot be directly compared with those of Single *et al* (1998) for Canada since different methods were employed. One objective of this guide will be to identify areas where greater consistency can be achieved in the measurement of the prevalence of major social and health consequences of alcohol use.

(iii) Monitoring of trends in consumption and harm in one country.

This objective is considered to be the most directly achievable by the guide such as this given the often inherently different biases operating in health and police data in different countries and the present lack of uniformity in survey measures and sampling techniques around the globe. Monitoring of trends within a country requires principally that the same measurements or records are applied consistently over time and, if biased, the extent of bias does not alter significantly over time. In relation to the use of sales data, for example to estimate adult per capita alcohol consumption it is possible to monitor trends using international data sources (see Chapter 2.1) provided that there has not been large changes in the extent of unrecorded or illicit consumption (as has happened in former Eastern Bloc countries). In relation to health and police statistics it is also vital that there have been no major changes in service delivery or, for police, enforcement policies e.g. relating to drinking and driving or public order. On the plus-side, methods will be described later for the use of partial data sets as 'surrogate' measures of alcohol-related harms e.g. night-time occurrences of assault, road crashes and emergency department attendance for treatment of an injury. While such alcohol harm indicators do not provide a comprehensive picture of the total amount of harm they can be used, if the above conditions apply, for the monitoring of changing levels of harm. The principle of 'triangulation' between different data sources is also important. Different data sets have their own sources of bias and error. However, if two, three or more independent data sets point in a similar direction the greater confidence can be had in the underlying trend. Such an approach has been employed in the Indian sub-continent to good effect (Saxena, 1999). Monitoring of trends in alcohol consumption patterns and related harms is of immense value for the evaluation of alcohol polcies and preventive interventions (see Gruenewald *et al*, 1997).

(iv) Comparing trends in consumption and harm across several countries.

Comparisons between different countries can conceivably be made in relation to the direction of trends in consumption and harm if not always to the level or prevalence of these. Crude estimates at least of the direction of changes in consumption and harm are possible to the extent that they are also internally valid for the individual countries being considered. It is always necessary, to consider carefully whether factors unique to one of the countries being considered have biased the measures employed in a way that renders comparison of trends spurious. For example, comparisons between former Soviet countries during the 1990s and also against other developed countries are not valid due to the rapid rise in unrecorded alcohol production following the collapse of state-controlled systems of supply and regulation. It will be indicated throughout this guide where particular data sets are adequate to the task of monitoring trends and/or describing prevalence at both the national and international levels.

Contents of the guide

Advice will be provided in this document on two major components of national alcohol monitoring systems: alcohol consumption and alcohol-related harms. In each case advice will be provided for countries with different levels of available and/or allocated resources for developing such systems.

(i) Alcohol consumption levels and patterns

Section 2 is concerned with measurement of national volumes and patterns of alcohol use. Volume of alcohol use for a country is best estimated from national sales, production and/or taxation data (Chapter 2.1) since population surveys invariably underestimate total alcohol consumption. Regional variations, on-premise vs. off-premise consumption rates and differences in types of beverages are sometimes available from breakdowns of sales, production or trade data. Chapter 2.1 describes international sources for obtaining national estimates of total alcohol consumption for most countries of the world.

Population-level data cannot, however, identify different drinking patterns in a population e.g. the extent to which alcohol consumption is usually concentrated into a few high consumption occasions (e.g. festivals, Latin-American *fiestas*) or is more evenly distributed evenly across all days. The former pattern will clearly be associated with more acute problems resulting from intoxication. There is also increasing evidence that such a 'binge' drinking pattern also increases the risk of long-term health problems more than does a steadier pattern of consuming the same volume of alcohol (Rehm *et al*, 1996). General population surveys provide valuable information regarding individual variations in level of consumption, temporal pattern of drinking, the settings in which drinking takes place and socio-demographic and other correlates of drinking rates and patterns. Chapter 2.2 provides guidance on the conduct of national alcohol surveys to estimate both volumes and patterns of alcohol use at the individual level. It also discusses how national surveys can complement the use of sales and production data by permitting estimates of imported, duty free and home-produced alcohol. Observational data and ethnographic methods can provide valuable information to supplement these sources.

Some fundamental assumptions regarding estimates of alcohol use from both sales and survey data are discussed in the Chapter 2.3: the typical strengths in a particular country of different alcoholic beverages and also typical serve sizes. It is argued that greater attention should be paid to these factors to get more valid estimates of national alcohol consumption and, thereby, to facilitate valid international comparisons.

(ii) Indicators of alcohol-related harm

Health statistics, crime records, road crash data and national surveys are the main sources of information about alcohol-related harm. There is frequently an unnecessarily negative view taken regarding the potential of official data sources to assist in this regard. Clearly such sources are not designed, except in a few specific cases (e.g. alcoholic psychosis, being drunk and disorderly) to measure alcohol-related harm and fail to mention the involvement of alcohol in a great majority of cases. Although it is known that alcohol use contributes to many varieties of injury, illness, death, accident and crime, official statistics usually fail to record when this is the case. The resources to introduce case by case monitoring of alcohol involvement could not be made available in any country other than in focused research projects. A creative approach, however, is to consider ways in which ‘surrogate’ or ‘proxy’ measures of major alcohol-related harm can be created from existing official information, to experiment with these, test them and then use several in combination to confirm observed trends (the principle of ‘triangulation’). Section 3 describes a variety of types of surrogate harm indicators and how to develop them.

A major potential source of surrogate harm indicators for alcohol involves the use of mortality and morbidity data (when available) to estimate death, injury and illness. As previously mentioned, the alcohol research community is fortunate to have available the extraordinarily comprehensive review of English *et al* (1995) in which the entire international scientific literature on alcohol and health at that point in time was systematically summarised and analysed. This information provides a methodology and a starting point for estimating in many countries the proportions of 38 causes of death, injury or illness proved to be at least partly caused by medium and high risk levels of alcohol consumption. As described in Chapter 3.1, it is also necessarily to have data indicating the prevalence of high risk drinking in the country concerned and, of course, valid data on causes of death and, if available, also causes of injury and illness. Methods for estimating prevalence of drinking using readily available international sources will be described. Methods for calculating alcohol Aetiologic Fractions for particular conditions (i.e. the proportion of cases that can be attributed to alcohol) will be described. Consideration will also be given to the issue of which of the 38 conditions identified by English *et al* (1995) can the international data on links to alcohol consumption be applied cross-culturally and globally. Methods for estimating the number of years of life lost due to premature death from alcohol misuse will also be described.

Mirroring the distinctions made above between volume and pattern of alcohol consumption, the next two chapters concentrate in turn on measurement of the mainly long-term consequences of alcohol consumption (Chapter 3.2) and the mainly short-term consequences (Chapter 3.3). In the case of suicide there are links to both long-term and short-term effects of alcohol use. Furthermore a pattern of occasional binge drinking over the long term will add to the risk of chronic as well as acute alcohol-related problems e.g. in the case of stroke. The view taken here, however, is that these are best viewed as long consequences of high risk drinking. While not absolute, the distinction between long and short-term consequences of consumption is still made. One reason is that the short-term or acute consequences are often overlooked as 'alcohol problems' are often commonly understood to only refer to alcohol dependence and/or liver cirrhosis. Both Single *et al* (1999) and English *et al* (1995) data show that almost half of all alcohol-related deaths and two-thirds of Person Years of Life Lost are mainly from the acute effects of drinking (in Canada and Australia respectively). In developing countries where early loss of life from intentional or unintentional injury tends to be more common and life expectancy shorter, the importance of this distinction will be even greater. Another reason for maintaining the distinction is that different strategies are often required to influence different underlying patterns of risky drinking viz intoxication in high risk situations and long-term high volume consumption. Furthermore, as will be discussed, there are different issues regarding the global transferability of the English *et al* (1995) methodology to short-term and long-term problems. Finally, an important issue for monitoring purposes is that time-lags for achieving significant changes in levels of these types of harms maybe quite different. While immediate impacts on levels of such long-term consequences such as liver cirrhosis have been reported, it might be usually expected that impacts on short-term consequences will be detected earlier than long-term consequences.

Section will also consider harm indicators from other sources. Chapter 3.3 discusses the use of surrogate measures of both alcohol-related violence and road injury. The use of survey instruments for the assessment of alcohol dependence and other problem events is also discussed in Section 3. Representative surveys a good way to measure prevalence of events (e.g. being assaulted by a drunk person) which are usually under-reported in official statistics.

(iii) Summary and recommendations

Section 4 provides a summary of themes to have emerged from the earlier sections and an attempt is made to describe ways in which data collections from all the various domains described above can be used to complement each other so as to strengthen national monitoring systems. Recommendations are made for such systems appropriate for countries with Low, Medium and High levels of available resources. The guide concludes with a case study illustrating some of the problems and solutions available for alcohol researchers in developing countries. The country chosen is Mexico which has by international standards very high levels of alcohol-related harm but also a strong tradition of alcohol epidemiology.

Who should monitor and how should the results be disseminated

It is recommended that responsibility for the monitoring systems described in this guide should lie with an appropriate national health agency working in collaboration with law enforcement, liquor licensing and other organizations involved with alcohol issues. In most countries, this generally involves a wide variety of government ministries or departments, including not only health and human services but also law enforcement, finance, commercial relations, labour and/or regional development.

The dissemination of data from national monitoring systems should be guided by the following principles:

The data should be scientifically validated: In so far as possible, the information in a national data monitoring system should be subject to peer review and validated against alternative sources of information. Where systematic, generalisable data are unavailable and expert opinion must be relied upon, this should be clearly indicated and appropriate caveats included. An important related issue of scientific validity, addressed in detail later in this report, is the promotion of greater standardization of measures of alcohol use, patterns of drinking and alcohol-related problems to enhance the comparability of the results. To some degree the use of data regarded as 'indicators' of alcohol-related harm implies an acceptance that these data are not absolute measures of the harm but useful indications of levels and trends. Confidence in the direction of trends can be enhanced when several sources of data (e.g. levels of alcohol use, levels of night-time road crashes violence) all point the same way.

The data should be made widely available: The information should be made widely available to policy makers, health specialists, law enforcement officials and others concerned with alcohol issues. Unlike monitoring systems for illicit drugs, which necessarily involve some privileged information and limited access to data, there need be nothing 'secret' in monitoring systems for alcohol, provided standard precautions are taken to ensure the confidentiality of individual data. In an ideal world, such information would be available free of charge to agencies at a national level and published at regular intervals. (One important exception involves information on patterns of consumption collected by market research companies which, at least for recent data, can be extremely expensive). At the international level it may be necessary for an international agency to coordinate the collection and distribution of information to facilitate the collection of internationally comparable information.

The methods of dissemination should utilize the most recent advances in technology: In particular, recent enhancements in computer technology and the Internet should be exploited in order to provide ready access of the information to the broad range of interested persons and organizations. Once the national guidelines have been developed and implemented, the development of a special permanent feature on national alcohol monitoring systems, including regional and international summaries and analyses, should be given strong consideration for the WHO Internet web-site.

The information should be presented in a format which is suited to its target audiences: This entails the development of a variety of information products, ranging from technical publications in scientific journals to brief highlight summaries in press releases or briefing documents for policy makers.

In summary the purpose of this document is (1) to provide guidance to WHO Member States on epidemiological monitoring in order to inform and facilitate effective policy formation and (2) to improve the global and regional comparability of data on alcohol use and health consequences in order to improve monitoring and to facilitate research and risk assessment. Some general considerations regarding the nature and potential for national alcohol monitoring have been discussed here. The following chapters will first examine issues around the measurement of alcohol consumption (Section 2) by various means and Section 3 will concentrate on the development of indicators of alcohol-related harm. The final Section will draw together recommendations for establishing a coordinated and integrated set of approaches to national monitoring with specific recommendations for countries with different levels of available resources.

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Section 2:

The measurement of volume and pattern of alcohol consumption

Chapter 2.1

Estimating Per Capita Alcohol Consumption

Summary

Adult per capita consumption data are useful as an indicator of trends in alcohol-related problems. This chapter describes the various national and international sources from which estimates of per capita consumption may be calculated. Data available at the national level are often more reliable than data reported by international sources. Of international sources, the Food and Agriculture Organisation (FAO) is considered to provide the most reliable data.

The need to consider factors not likely to be reflected in the data is stressed such as smuggling, tourism, overseas consumption, stockpiling, duty-free purchases and the exclusion of home- or informally-produced and traded alcohol should be taken into consideration. In some developing countries informal production is the source of most alcohol consumed. It is recommended that questions be added to national and/or regional drinking surveys to provide the bases for estimates of these various sources of unrecorded alcohol consumption.

When making international comparisons of per capita consumption it is also important to consider variations in national drinking and the age structure of populations. In particular rates of abstinence in both men and women, which vary greatly around the world, are important.

It is also recommended that basing alcohol taxes on the alcoholic strength and content of each beverage is not only sound public health policy, but will also assist in improved epidemiologic monitoring.

Why estimate per capita consumption?

To prevent alcohol-related problems, it is important to have a clear view of their magnitude. In the absence of specific problem data, estimates of per capita consumption of alcohol across entire national populations can provide policy makers with some sense of the magnitude and trends likely to be found in alcohol-related problems. Studies done primarily in the developed countries have found that per capita consumption is a fairly reliable proxy for the percentage of heavy drinkers in a population, in the absence of national survey data (Edwards *et al*., 1994). Particularly for alcohol-related problems that arise from chronic heavy drinking, such as alcoholic liver cirrhosis, but also in some countries for other problems such as traffic crashes and suicide, per capita consumption estimates can predict the prevalence of the problem, although time lags and variation by culture as a result of differences in patterns of drinking will also be found.

Per capita consumption figures should be developed for the major categories of alcoholic beverages available within a country. Most international sources limit these to beer, distilled spirits and wine. These should be regarded as a minimum, with other categories added for local beverages (e.g. ciders, fruit wines, *shochu*, *arrack*, *aguardiente*, *samsu*, etc.) that comprise a substantial proportion of local consumption and that have an alcohol content that does not easily collapse into one of the three main categories. Different alcoholic beverages have different relationships with different types of alcohol-related harm. For example, in many countries spirits are the preferred beverage of persons with alcohol dependence, while particularly cheap drinks are favoured by young excessive drinkers. Such patterns can be identified and monitored within and between countries. Thus per capita consumption data can be valuable in combination with data on actual harm in order to assist with identifying High Risk beverages which may require particular attention from policy makers.

Definitions

Total estimated alcohol consumption in a country in a given year

equals total alcohol production plus alcohol imports minus alcohol exports (in that year). From this, the formula given above has commonly been used to estimate per capita alcohol consumption (Smart, 1991).

***Annual per capita alcohol consumption* <u>per adult</u> can be derived as follows:**

$$\frac{\text{alcohol production + alcohol imports - alcohol exports}}{\text{population 15 years of age and over}}$$

Adult per capita consumption is preferable to per capita consumption due to the varying age structure of national populations. Per capita consumption figures based on the total population tend to underestimate consumption in countries where larger proportions of the population are below age 15, as is the case in many developing countries.

A closer approximation of actual drinking patterns may be derived using the following formula combining estimates of adult per capita consumption with estimates of prevalence drawn from a nationally representative survey, if the latter is available.

Consumption-based estimate of the average amount of alcohol consumed per drinker per day equals:

$$\frac{\text{Annual per capita alcohol consumption}}{\text{\% population 15 years of age and over that drinks}} \times \frac{100}{365}$$

Source of data to calculate consumption

In general, retail sales data offer the most accurate means of estimating how much alcohol was consumed by the population in a given year. Governments often closely monitor sales data for tax collection purposes, and these can be obtained from government publications or agencies. Even these data may not necessarily reflect consumption, since beverages purchased in a given year may not be consumed in that year. This is particularly true of higher end products such as quality wines and aged spirits (although such products usually constitute only a small portion of total consumption). Also, outlets selling alcohol may stockpile in anticipation of a tax increase, which can artificially skew the data (Kling, 1991). Such figures will also miss home production and goods smuggled across borders.

Market research firms serving the alcoholic beverage industry are another possible source of sales data. In the United States, for example, M. Shanken Communications maintains the *Impact Databank*. Using its own teams of researchers, Impact estimates the numbers of nine-litre cases of distilled spirits and wine and the number of barrels of beer entering distribution channels in a given year. These data may be prohibitively expensive for government users or public health researchers. Less current data, if still kept, are less sought after for commercial purposes and may occasionally be obtained cheaply. Sometimes the data are collected at the wholesale as opposed to the retail level, increasing the possibility that goods may not actually be consumed in the year in which they are recorded as having been shipped.

Where reliable sales data are not available, consumption may be estimated from data on the production and trade of alcoholic beverages, using the formula described above. Several global statistical sources exist for these data, although they are of varying quality.

Global statistical sources

The Food and Agriculture Organisation (FAO) publishes the most complete set of statistics available on production and trade of beer, wine and distilled spirits. These statistics are easily available to the public on the FAO's website, which permits limited downloading (25 records or less) of its data. However, the FAO data relies on the consistency and accuracy of member nations in reporting data, and the ability of FAO staff to estimate production and trade in the absence of reports from countries. These data at a minimum often underestimate the amount of informal or home production of alcoholic beverages (see Partanen, 1991 for a discussion of Kenya as a case study in the inadequacy of the data). There are approximately 200 countries in the world at this point in time. Most countries produce some kind of alcoholic beverage, or if they do not, they import it. As the table below indicates, there are certainly countries missing from the FAO data; however, it remains the most comprehensive global source.

Table 2.1.1: Number of Countries Providing Alcohol Data to FAO Statistical Databases

YEAR	Product	Production (n)	Imports (n)	Exports (n)
1990	Beer	132	152	125
1990	Spirits	105	152	124
1990	Wine	49	142	103
1991	Beer	132	151	124
1991	Spirits	105	152	124
1991	Wine	49	142	103
1992	Beer	145	168	139
1992	Spirits	119	169	140
1992	Wine	65	156	121

As part of global tracking of flows in production and trade, countries also report the amount of production, import and export of alcoholic beverages to the United Nations Statistical Office, which has recorded statistics on these commodities since the 1950s. These data are often similar to the FAO figures, but tend to be not nearly as complete in their coverage. There are occasionally some countries and years that are missing in the FAO data, and so are useful as a supplement to those data.

If production and trade statistics are to be used, several cautions are in order. First, the numbers generally only quantify formal - i.e. large-scale industrial - production and trade in alcohol, as opposed to the informal, low-technology or home production that comprises as much as 80 to 90% of the output of alcoholic beverages in some African countries (Partanen, 1991). Second, the FAO sometimes fills gaps in the data by estimating, and the method of estimation is often simply by repeating the production figures of the last year reported. With population growing in many countries, this can cause the appearance of a decline in per capita consumption, even when this is not necessarily the case. Gaps in the data may give false impressions of trends.

Alcoholic beverage industry sources

The alcoholic beverage industry has an interest in monitoring trends in global production, trade and consumption. To this end, industry associations and market research firms use a variety of methodologies to estimate market trends. *World Drink Trends* (1997) compiled by the Dutch Distillers' Association, draws nearly 100 published and unpublished sources, including the United Nations and FAO statistics but also figures solicited directly from statistical ministries in particular countries and from alcohol industry associations, to estimate consumption in 57 countries. Only 19 of these are located in developing countries. For the countries that it covers, *World Drink Trends* attempts to estimate consumption from all sources -- home production, illicit production, consumption by tourists, tax-free sales, border traffic in alcoholic beverages, and smuggling. However, beyond its 57 countries, it simply provides production figures taken from the United Nations Statistical Yearbooks described above.

The United Kingdom Brewers and Licensed Retailers Association publishes an annual *Statistical Handbook* providing data on production of distilled spirits and wine in 44 countries, and beer in 136 countries (with many gaps in the data available over time) (Brewers and Licensed Retailers Association, 1997). The *Statistical Handbook* relies on official sources and thus primarily tracks industrially-produced alcoholic beverages.

The global data from some market research companies working for the alcoholic beverage industry have limited coverage and, anyway, are expensive. As in the United States, internationally firms like Shanken Communications, publishers of *Impact*, rely on their own original research, employing teams of researchers and field workers to collect production, trade and sales statistics on alcoholic beverages. *Impact* attempts to provide detailed analyses of sales trends in the markets it monitors. However, its international coverage is limited to major markets in the developed countries and the largest of the "emerging" markets in the South, for a total of 22 countries covered in its 1995 spirits report (Shanken Communications, 1995). Other market research firms working for the industry maintain statistics for regional or national markets (e.g. Datamonitor, 1994; Q-mulative Research, 1996).

Public health compendia

A number of research exercises have tried to use the sources above to summarise world drinking trends from a public health perspective. The Finnish Foundation for Alcohol Studies published the results of a major project to authenticate existing statistics for the years 1960 to 1972 (Finnish Foundation for Alcohol Studies, 1977). The Addiction Research Foundation in Toronto (ARF) did the same for the years 1970 to 1977 (Adrian, 1984). WHO published a summary of trends in global alcohol production, relying solely on UN production data, in 1985 (Walsh & Grant, 1985). A similar analysis of global trends, relying on a similar methodology and data and bringing the analysis forward into 1990, was developed by a US research and policy centre but subsequently abandoned due to the inadequacy of the UN production data as a single source (Jernigan, 1995). In 1994, the Addiction Research Foundation published an *International Profile: Alcohol and Other Drugs* in collaboration with the World Health Organisation (Williams *et al*., 1994). Although it included tables on alcohol consumption, there was little new information presented since the data for the tables came from *World Drink Trends* and the two aforementioned UN sources.

The European Regional Office of WHO recently produced a model set of profiles of alcohol use and problems in European countries to assist in monitoring progress toward the achievement of the goals of the European Alcohol Action Plan (Harkin, 1995). Using national-level informants as well as UN production and trade data and data from *World Drink Trends*, the profiles included estimates of recorded per capita alcohol consumption as well as information on unrecorded production if available. Although other WHO regions have occasionally attempted to review alcohol consumption in their member countries (Pan American Health Organization, 1990), the European Region's success reflects the fact that wealthy countries such as those in Western Europe are more likely to have data available on alcohol consumption. Finally, the World Health Organization (2000) drew on the work of the European as well as other regions to publish the *Global Status Report on Alcohol*, which included estimates of adult per capita consumption for most countries, relying on a combination of national and regional estimates, industry data and data from the FAO and the UN Statistical Office.

National level data

If available, national level data are preferable to data drawn from the international sources. Sales data if available at the national level are usually preferable to data on production and trade for estimating per capita consumption providing they are clearly differentiated from sales of other commodities sold at liquor outlets. Government statistical offices and customs departments often maintain careful records of alcoholic beverage volumes and receipts for tax and customs purposes. These figures may be used to estimate adult per capita consumption as well. Taxes collected at the producer or wholesaler level may introduce a lag into the data, since they do not reflect actual retail sales. Discounted sales to special populations such as the military may not appear in such data. Industry sales data from alcoholic beverage industry sources may also be used, if available. The drawbacks of these are similar to those of the government figures. However, these may be a source for estimates of sales in duty-free shops, which the government sources are less likely to track. Shanken Communications (1995) estimates that duty-free sales accounted for 4% of all sales of globally-available spirits products in 1994. In some markets, the percentage is far greater: For instance, Partanen (1991) estimated that in Kenya in the late 1980s 36% of imported whiskey and 26% of imported cognac were sold tax-free.

In the absence of tax data, production and trade data may be used. These data sometimes exist at the national level although they do not appear in the global sources. In some cases, countries do not place a priority on reporting to global statistical agencies. In some countries with a very small number of alcoholic beverage producers, the national government elects not to report production statistics to protect the competitive status of the local industry. However, these statistics may be available to those within the government, and may be made available to others provided they are reported in a composite format such as adult per capita consumption that masks the production levels of individual companies. Such national level statistics often break out the data into detailed product categories, permitting more accurate estimates of alcohol content by beverage.

A review of a variety of sources for estimating per capita consumption of alcoholic beverages in the United States illustrates the relative reliability of different sources of data. Table 2.1.2 shows adult per capita consumption estimates for spirits consumption from 1970 to 1994, relying on figures from four different sources: the UN Statistical Office, US government-generated estimates based on sales and tax receipts (National Institute on Alcohol Abuse and Alcoholism [NIAAA], 1997), figures from the industry trade group the Distilled Spirits Council of the United States (DISCUS), and data purchased from Shanken Communications (1995). For purposes of comparison, the alcoholic beverage strengths used by the U.S. government source were employed in deriving the estimates from all the sources. Figures for the adult population, defined as age 15 and above, came from United Nations statistical sources, and the same figures were used for all estimates with the exception of the NIAAA, which defines adult per capita consumption as age 14 and above.

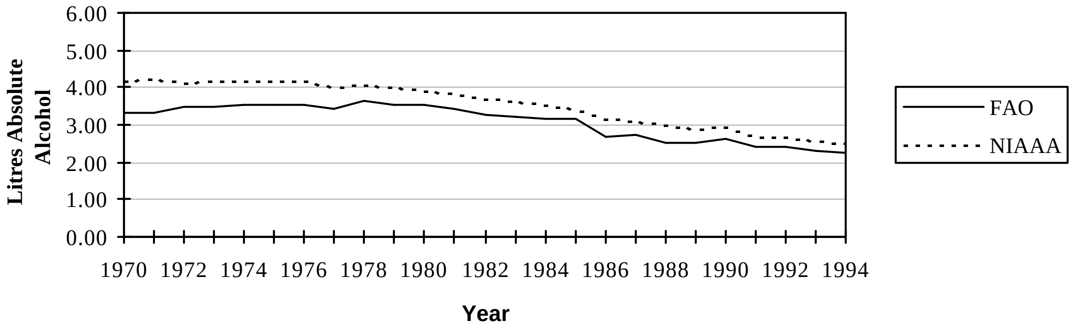
Table 2.1.2: Estimates of Adult Per Capita Distilled Spirits Consumption in the USA, 1970-1994 (litres of absolute alcohol per adult per year)

YEAR	FAO	NIAAA	DISCUS	Impact
1970	3.31	4.20	3.87	3.86
1971	3.30	4.24	3.91	N/A
1972	3.48	4.13	3.95	N/A
1973	3.51	4.16	3.99	N/A
1974	3.55	4.20	4.04	N/A
1975	3.51	4.20	4.03	4.03
1976	3.52	4.16	3.98	N/A
1977	3.41	4.01	3.98	N/A
1978	3.66	4.05	4.03	N/A
1979	3.52	4.01	3.99	N/A
1980	3.56	3.94	3.95	3.95
1981	3.43	3.86	3.89	N/A
1982	3.26	3.71	3.74	N/A
1983	3.22	3.63	3.65	N/A
1984	3.14	3.56	3.56	N/A
1985	3.17	3.41	3.45	3.45
1986	2.70	3.18	3.23	N/A
1987	2.72	3.10	3.15	N/A
1988	2.52	2.99	3.04	N/A
1989	2.53	2.91	2.96	N/A
1990	2.61	2.95	2.96	2.96
1991	2.43	2.69	2.71	2.71
1992	2.39	2.69	2.75	2.76
1993	2.33	2.57	2.63	2.63
1994	2.26	2.50	2.54	2.54

Data sources: FAO Data: FAO Statistical Databases; NIAAA: National Institute of Alcohol Abuse and Alcoholism, 1997; DISCUS: Distilled Spirits Council of the United States; IMPACT: Shanken Communications, 1995.

The NIAAA figures come from the most reliable sources, and can be assumed to be the most accurate. Despite the slight difference in the definition of “adult population”, data kept by the distilled spirits producers, shown in the DISCUS column, come very close to the official government data after 1980. It is apparent from the table that DISCUS and *Impact* rely on the same figures. The greatest variance from the NIAAA figures comes in the UN data. Although the NIAAA data contain a slightly larger cohort than the FAO data (14 and above as opposed to 15 and above), this is probably not sufficient to explain the variance. Figure 1 shows in graph form how the FAO data differ from the NIAAA findings.

Figure 1: Adult Per Capita Spirits Consumption (age 15+)



Over time the FAO numbers do move closer to those of NIAAA, suggesting that the accuracy of the FAO estimates is improving. However, this exercise illustrates the importance of using data directly from national sources if at all possible, rather than relying on the probably less accurate international figures.

Per capita consumption estimates and survey data

National survey data should not be used as a basis for per capita consumption estimates. National survey data, analysing who in the population is drinking and how much and how often they drink, are extremely important to the creation of effective alcohol policies. However, several studies have found substantial discrepancies between per capita consumption estimates based on survey data and those derived from sales data. Per capita consumption estimates derived from survey-generated self-reports of drinking behaviour have tended to yield estimates of per capita consumption at between 40 and 60% of the results obtained from sales data (Pernanan, 1974). Adding atypical drinking or attempting to correct for drinking by persons too young to be included in population surveys has made little dent in this discrepancy (Fitzgerald & Mulford, 1987). Other possible reasons for the discrepancy include seasonal variations in drinking behaviour and the influence this may have over surveys conducted over time periods of less than a year (Lemmens & Knibbe, 1993), difficulties in contacting heavier drinkers through household surveys, inaccurate estimates of drink sizes (see Chapter 2.3), forgetfulness on the part of drinkers, and selective reporting or intentional under-reporting on the part of heavy drinkers or as a result of regional mores or perceived interviewer attitudes regarding drinking (Pernanen, 1974), and also other differences in the way in which self report data are collected. In the US at least it has been found that survey estimates of total beer consumption are closer to actual amounts purchased according to sales data than for other beverages (Rogers & Greenfield, in press).

Some of the basis for the discrepancy may lie with flaws in the estimates derived from sales data. As discussed below, stockpiling at the wholesale, retail or consumer levels and purchases by tourists or other non-residents may both result in over-estimates of how much the population is drinking. However, comparison of self-reports and per capita estimates derived from state sales estimates has shown trends in the two indicators to be highly correlated. Per capita estimates derived from sales data were also significantly correlated with prevalence of self-reported heavy drinking, binge drinking, and drinking and driving (Smith *et al.*, 1990). This underlines the usefulness of these estimates, in the absence of more detailed information about drinking patterns in the population.

Problems inherent in the use of per capita data

Per capita consumption estimates must be used with caution. Problems with these estimates fall into three categories: what they do not measure, what they cannot measure, and whether the data on which they are based are reliable. These problems and suggested strategies for handling them are summarised in Table 2.1.3 and discussed below.

Table 2.1.3: Factors Impairing the Accuracy of Per Capita Consumption Estimates

Factor	Impact	Corrections
Informal production	Omission can lead to under-estimation of adult per capita consumption	Use periodic local surveys to estimate extent of local consumption of informally-produced alcohol, and add this to the numerator of the adult per capita consumption formula.
Tourist consumption	Omission can lead to overstating native consumption, understating consumption in tourists' home countries	I. Correct adult per capita consumption formula in denominator to include estimate of annual tourist population, or II. Correct adult per capita consumption formula in numerator by estimating tourist consumption (via special tax or marking on beverages slated for tourists) and subtracting it.
Overseas consumption	Omission can lead to underestimation of national consumption	Derive estimate through inclusion of question regarding quantity and frequency of overseas consumption in national surveys, and add this to the numerator of the adult per capita consumption formula.
Stockpiling	Can cause national consumption to appear negative, as exports for a given year may exceed the sum of domestic production and imports	Correct adult per capita consumption formula in numerator by adding the difference between additional stocks available at the start of the year and those remaining at the end of the year.
Waste and spillage	Can cause an overestimate of national consumption	Include questions in periodic surveys to gain estimates of amounts of these.
Smuggling	Omission can lead to underestimation of national consumption	Obtain estimate from law enforcement and tax collection officials of amount of alcohol smuggled into the country, and add to numerator of adult per capita consumption formula.
Duty-free sales	Omission can lead to underestimation of national consumption	Derive estimates through inclusion of question regarding quantity and frequency of duty-free purchasing in national surveys, and add to numerator of adult per capita consumption formula.
Variation in beverage strength	Can lead to inaccurate estimation of amount of pure alcohol consumed.	Use domestic market share data to estimate median alcohol strength of each beverage category and significant sub-category.

What per capita consumption estimates do not measure

Per capita alcohol consumption estimates are usually derived from data on the sale, manufacture, trade and taxation of alcoholic beverages. As such, they seldom include measures of informal production and consumption. Parry and Bennetts, (1998) estimated the extent of home-brewed "sorghum" beer in South Africa which accounted for 22.6% of the total alcohol market in that country. In Botswana, Haggblade (1992) conducted a very careful study of home-made alcohol and estimated that 68% of all beer consumed was home-brewed. Also missing are data on the amount of duty-free or smuggled alcohol consumed, as well as how much alcohol residents consume overseas. National surveys can play an important role in filling in these gaps, via the inclusion of questions about the extent of duty-free purchases (that is, alcohol purchased for in-country consumption either in shops in foreign countries or in duty-free shops at domestic points of entry) as well as the quantity and frequency of alcohol consumption overseas. However, in some countries (e.g. Mexico – see Annex 10) drinkers may be unaware that they are drinking illicit alcohol since sometimes packaging and labelling is used to imitate well-known legal brands.

Local economic factors will also influence the strength of the an illicit alcohol market. For example in Nigeria , for some time in the 1980s traditional beverages (palmwine, burukutu, ogogoro) were losing popularity because the economy was strong and beer was relatively cheap. With the devaluation of the Naira the price of beer went up significantly and local beverages gained back some popularity.

Some countries serve as legitimate trans-shipment points for alcoholic beverages. In the case of these nations, it is important to adjust per capita consumption estimates for the amount of imported alcohol re-exported to other nations. There are no reliable estimates of the extent of illegal alcohol trans-shipment and other forms of smuggling. Using the FAO data to analyze the excess of world alcohol exports over imports in 1996 produces an estimate of approximately 2.2% of recorded alcohol production disappearing in international trade (0.81% of beer, 3.10% of spirits, 2.17% of wine). Alcohol industry sources estimate duty-free sales as approximately 4% of total sales of globalized spirits, which are an estimated 46% of the world's available spirits. Thus duty-free does not account for the missing spirits. However, actual smuggling is likely to vary greatly by region. Estimates of the amount of smuggled alcohol consumed within a country can often be obtained through interviews with law enforcement or taxation officials. Law enforcement efforts to reduce smuggling, such as requiring special markings or imposing increased fines, may have the additional effect of improving detection and measurement of smuggling (Tobacco or Health Programme, 1995).

Per capita consumption estimates can also mask the impact of tourism. A correction in cases of tourism is possible if data exist for native as opposed to tourist consumption. Such data sources may be developed by employing separate markings, licensing or taxes for beverages sold to tourists. If these data do not exist and if there are data available on the size of tourism, a rough correction for tourism may be made by estimating the total yearly tourist population (for example by dividing by 365 the total number of days tourists above age 14 spent in the country) and adding this to the denominator in the adult per capita consumption formula.

Finally, the basic formula given above does not allow for the impact of domestic stockpiling, as is common in the production of products requiring ageing such as whisky or cognac. Large producers of such products may have years in which the sum of reported production and imports exceeds reported exports, because a large batch produced in an earlier year may have reached maturity and been released for export. A correction for this may be made by calculating the difference between stocks available at the start of the year and those remaining at year's end, and adding this difference to the numerator of the adult per capita consumption formula to offset the increase in exports. However, the effect of stockpiling on estimates of total alcohol consumption in most countries is likely to be small as it concerns mainly the 'quality end' of the market and for spirits and wines only.

If estimates can be obtained of the extent of consumption of duty-free alcohol and of home or informally-produced alcohol, of consumption overseas, of the extent of tourism, of the volume of imported alcohol re-exported to other countries, and of the amount of stockpiled goods released to the market, the ideal formula for estimating adult per capita consumption would then be:

$$\frac{\text{(alcohol production + alcohol imports + informal alcohol production + consumption overseas + duty-free consumption – tourist consumption - alcohol exports - alcohol re-exports + additional stocks)}}{\text{population 15 years of age and over}}$$

Per capita consumption estimates, drinking patterns and High Risk drinking

Per capita consumption estimates can measure only limited variation within the population. Patterns of drinking within nations or cultures are extremely important. The more knowledge that can be gleaned regarding drinking patterns, as well as per capita consumption, the more accurately policies may be designed to reduce alcohol-related harm.

Rates of abstinence from alcohol are important to know when attempting any kind of international comparisons employing per capita consumption data. Partanen (1990) reviewed a number of surveys from African cities and estimated the following proportions of abstainers for males and females respectively: Harare (36% and 80%), Bulawayo (47% and 82%) and Lusaka (29% and 40%). This suggests that comparing per capita consumption estimates between African countries (even where based on reliable national data) should be interpreted in light of differences in abstinence rates. Of even greater import, comparisons with developed countries such as Australia where abstinence rates are approximately 20% for both sexes should also take account of such radically different proportions of drinkers in the general populations.

Sales data can sometimes be useful in identifying patterns of consumption in terms of levels of consumption of different beverages some of which may be of greater concern than others e.g. low strength versus regular strength beers. Sales data have been used in Australia for this purpose to distinguish between sales of cheap cask wine and higher quality bottled wine as well as beers of different strengths (Stockwell *et al*, 1998). It is not implied here that some alcoholic beverages are intrinsically more harmful than others, only that some (usually the cheaper varieties) are preferred by High Risk drinkers and their sales can be a marker for High Risk consumption. In general terms, the consumption of beer is most associated with rates of serious harm (see also Stevenson *et al*, in press) and low alcohol content beer is least associated. Thus per capita consumption of ‘regular’ strength beer (above about 3.5% by volume) is a useful additional indicator of High Risk alcohol consumption and related harm. In particular countries, where available, estimates of per capita consumption of other beverages known to be High Risk could also be included for national monitoring purposes.

When drawing international comparisons using adult per capita consumption data, it can be important to recall that countries have different social and demographic profiles. Alcohol consumption levels and patterns vary enormously within countries as a function especially of the age of the drinker. Older people tend to drink the least and younger people, especially men in their 20s, tend to drink larger amounts both in total and per drinking day. Age-adjustment of estimated per capita consumption is recommended for some purposes in order to gauge whether observed changes or differences in total per capita are due to underlying differences in the age distributions of study populations. In order to conduct such age-standardised comparisons it is necessary to have data from representative national surveys using comparable methodologies that allow estimates of typical volumes of drinking for each age-group for both men and women.

Other aspects of drinking patterns are best assessed by means of population surveys and ethnographic fieldwork.

Problems with data and assumptions

Finally, the data used for per capita consumption estimates may come from a variety of sources, and may have been gathered using varying methods. Their reliability may be difficult to assess, and they may not be strictly comparable across all countries. The same figure repeated for several consecutive years in a series should be treated with some suspicion, and alternate sources consulted to see if this is a reporting anomaly or reflects an actual steady state of consumption. In the same way large fluctuations in the data from year to year, except as a result of warfare or national catastrophe, should also be viewed with caution.

The formula for estimating adult per capita consumption given above requires that production and trade figures be converted into litres of absolute or pure alcohol. This in turn requires estimates or assumptions about the alcohol content of various beverages. This is a critical issue, and one that is dealt with in greater detail in Chapter 2.3. Ideally, using market share data, periodic efforts should be made in each country to estimate median alcohol content of each beverage category, since these may vary widely from country to country. When there are substantial differences in alcohol content within a beverage category (e.g. high-alcohol and low-alcohol beer), optimally estimates of consumption and content of significant sub-categories should be made. If alcohol taxes are based on the alcoholic strength and content of each beverage (a sound policy from a public health perspective), tax data can then be used to estimate average alcohol content of each beverage category.

In the absence of national-level estimates, the central question remains as to what estimates are to be used. The Finnish Foundation (1977) estimated beer at 5% alcohol. NIAAA (1997) estimates beer in the USA at an average of 4.5% alcohol. In some countries alcoholic strength of beer may range from as little as 0.9% to as high as 12%. Applied to figures in the millions of hectolitres, such a lack of uniformity across countries regarding the strengths of the various beverages can have significant consequences for per capita consumption figures. Deriving an international standard here does not seem possible, due to the great variation in the strengths of these three categories of beverage from country to country, particularly in beverages produced with relatively low levels of technology, as is often the case in the informal economy. Also, the three categories beer, wine and spirits do not capture all of the alcoholic beverages consumed world-wide, nor do they capture the variation in alcohol content that can occur within a category. In this context, international consensus regarding alcohol strength of various beverage categories may not in fact be desirable, being a poor second choice to transparent and well-supported estimates of alcoholic strength made at the country level.

Conclusion: Summary of key points and recommendations

- Adult per capita consumption data are useful as an indicator of the severity and trends in alcohol-related problems, in conjunction with more specific data on alcohol problems (see Chapters 3.2 and 3.3).
- *Estimates of consumption may be calculated from a variety of sources.*
- Data available at the national level are often more reliable than data reported by international sources.
- When interpreting alcohol consumption data, factors not likely to be reflected in the data such as smuggling, tourism, overseas consumption, stockpiling, duty-free purchases and the exclusion of home- or informally-produced and traded alcohol should be taken into consideration.
- Questions should be added to periodic representative national drinking surveys to provide the bases for estimates of the duty-free purchasing, overseas consumption and consumption of home or informally-produced alcoholic beverages.
- Per capita consumption of beverages more frequently associated with harmful outcomes, such as beer with an alcohol content of at least 3.5% or locally distilled spirits in some developing countries, are a useful additional indicator with application for monitoring purposes and should be reported separately.
- Basing alcohol taxes on the alcoholic strength and content of each beverage is not only sound public health policy, but will also assist in improved epidemiologic monitoring of per capita consumption by assisting in the generation of estimates of the median alcohol content of each beverage category.
- Given the important role that adult per capita consumption estimates may play in the planning and assessment of public health policies, international collaborative research should be commissioned to refine methods for obtaining basic information to aid countries to make more accurate per capita consumption estimates.

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Chapter 2.2

Estimating levels and patterns of alcohol consumption from national surveys

Summary

Surveys of drinking behaviour are a key component of national monitoring systems. By estimating rates of abstinence in different population sub-groups and proportions of alcohol consumed from unrecorded sources they are an invaluable adjunct to sales, production and/or taxation data as a means for estimating per capita consumption. In addition they are essential for estimating proportions of deaths and hospital episodes caused using the Aetiologic Fraction method (see Section 3).

This chapter reviews a number of methodological issues concerned with sampling populations, with the measurement of volume and pattern of consumption and with the mode of administering surveys (telephone, face-to-face and mail-back questionnaires).

Recent recall methods for most purposes do not adequately capture episodes of occasional High Risk drinking. The Graduated Quantity Frequency method applied to the last year is the method of choice. For the purpose of estimating sources and amounts of unrecorded consumption however, recent recall methods have particular value. Instruments for assessing alcohol dependence and extent of social and personal problems from drinking are discussed. A range of options are outlined for application in countries with different levels of available resources.

Advantages of survey over sales data on alcohol consumption

Among the many tools that can be used to monitor alcohol use and alcohol problems, national population surveys offer several unique benefits. Survey-based estimates of alcohol consumption can provide many types of information unavailable from sales data. First, they indicate who is doing the drinking. Sales data are usually presented in terms of per capita intake, but many individuals abstain from alcohol altogether. Thus, trends in sales data cannot distinguish changes resulting from increases or decreases in the proportion of abstainers from those that reflect changing volumes of consumption among drinkers. In contrast, periodic collection of survey data permits such a distinction to be made. A second advantage of survey data is that they permit comparison of consumption among various sub-populations of interest, going beyond the regional breakdowns available from sales data to include sub-populations defined by socio-demographic and other individual level characteristics. This information is of importance in targeting prevention and intervention strategies aimed at reducing alcohol-related harm. A third advantage of survey data is that they are capable of describing drinking patterns as well as volume of consumption. Drinking pattern data are required to measure the volume or proportion of alcohol consumed at High Risk levels. A person who consumes one drink per day has the same volume of intake as a person who consumes seven drinks once a week; however, the consequences of these two drinking patterns might be quite different.

This points to a fourth advantage of survey data over sales data, which is that consumption patterns can be linked with consequences at the individual level. Examining this linkage may help to clarify the factors that underlie the associations observed between aggregate consumption levels, as demonstrated by sales data, and the prevalence of alcohol-related problems. Even more importantly, it elucidates factors that modify these associations, for example, characteristics of the drinker or the drinking context.

Although survey estimates of alcohol consumption tend to substantially underreport volume of consumption relative to sales data (Midanik, 1982), for reasons that include sample limitations and inability or unwillingness to recall the total level of intake, they can be used to measure unrecorded consumption not addressed by sales data. This includes alcohol obtained illegally or outside of the country. In countries where unrecorded consumption comprises a significant proportion of overall alcohol intake, changes in the prevalence of alcohol-related harm cannot be properly interpreted without monitoring this aspect of alcohol consumption.

In summary, survey estimates of alcohol consumption provide a valuable complement to sales data, and both are important components of the repertoire of tools that can and should be used to monitor alcohol use. This chapter provides 1) a discussion of sampling and other methodological issues relevant to measuring alcohol consumption in surveys, 2) an overview of some of the issues to be considered in selecting survey questions on alcohol consumption (e.g., recall of specific occasions versus recall of general drinking patterns; length of reference period, etc.), and 3) examples of the types of questions and calculations used to assess the following key measures of alcohol consumption: **current and lifetime drinking status** (current drinker, former drinker, lifetime abstainer), **volume of ethanol intake** (overall, average per day, average per drinking day, volume-based categories of type of drinker—light, moderate, heavy—and volume of unrecorded consumption) and **frequency and volume of High Risk consumption**. Sample questions also are provided for measuring drinking context. The final section of this chapter identifies key consumption items for inclusion in national surveys in order of their priority.

Throughout this chapter reference will be made to three main methods of asking people to estimate their recent alcohol intake. The relative merits of these and other methods will be discussed later but in summary they are:

1. *Quantity-Frequency (QF):* this method asks only two questions – how much alcohol do you usually drink and how often do you drink? To be used only if there is very limited space available in a national survey on more general topics.
2. *Graduated Quantity-Frequency (GQF):* this method asks how often people drink specified amounts of alcohol in one day, usually starting with large amounts and graduating down to smaller quantities so as to encourage full reporting. This is a cost-effective method which can get most of the essential information with 8 questions. This method is also often abbreviated to *GF*.
3. *Last 7 Days:* this method requires people to complete a retrospective 'diary' showing how much alcohol they drank on each of the last 7 days. An optional extra if resources are available (it takes longer) and more detailed information is sought e.g. about drinking settings.

Sampling and other methodological issues

Obtaining a representative sample

Prevalence estimates of different patterns of alcohol consumption should be based on representative population samples. Ideally, these should be national samples, that is, they should represent the total population of a country. Representative samples can be generated from various types of sampling frames, including household listings (for example, those derived from census information), geographic sampling based on aerial mapping (this has been used in Africa), national registries where available or randomly generated telephone numbers in populations where telephone ownership is universal or nearly so. The choice of a sampling frame needs to be evaluated carefully for any possible bias. For example, a sample based on hospital admissions would yield biased estimates of alcohol use because this is associated with the likelihood of being admitted into the hospital. Similarly, household surveys exclude segments of the population (e.g., the homeless and individuals in institutions and the military) that may account for a substantial proportion of a country's alcohol intake.

Types of sampling frame

There are numerous types of samples (Rossi *et al*., 1983; Levy & Lemeshow, 1980). Surveys that use population registries or telephone numbers as their sampling frame typically draw simple random or systematic samples. Systematic samples are those based on selecting every nth case from the sampling frame. Most national surveys based on household sampling frames use complex, multistage samples that select geographically clustered households in order to minimize travel expenses associated with interviewing.

In selecting a complex, multistage sample, the sampling frame first is divided into primary sampling units (PSUs), often metropolitan statistical areas, counties or states. These PSUs may be stratified according to either characteristics of the geographic area itself (urban versus rural) or of its inhabitants (according to the proportions in certain racial or sociodemographic subgroups). The latter type of stratification requires independent (pre-existing) estimates of the population characteristics of the PSUs. Then, either within strata or within the total sampling frame, a sample of PSUs is selected either at random or with probabilities proportional to their size. Often, PSUs with exceptionally large populations are considered as representing the entire population of interest with 100% certainty. These are called self-representing PSUs.

At the second stage of sample selection, a sample of smaller geographic areas—e.g., blocks, census tracts or educational districts—is selected randomly or systematically from within the sample PSUs, following any secondary stratification of the PSUs that may be desired. These small areas are referred to as secondary sampling units or SSUs. Finally, all households or a systematic sample of households is selected from within each SSU. Within sample households, either all members or a randomly chosen household member is then selected to be interviewed.

A sample in which every individual has the same probability of being selected may yield imprecise prevalence estimates for certain rare sub-populations, e.g., racial or ethnic minorities. One way to improve estimates for minority groups such as these is to oversample them—to increase their probability of selection into the sample relative to that of other groups (Massey *et al*., 1989). This can be accomplished either by oversampling geographic areas with high concentrations of the group in question or by oversampling at the household level. For example, PSUs could be stratified into those with and without heavy proportions of the minority group in question. Then in the stratum with a high proportion of minorities, the probability of selection of SSUs could be set to twice as high as in that with a low proportion of minorities. Of course, when making estimates for the population as a whole, data from respondents in this sampling stratum must be down-weighted to avoid over-representation.

Selecting size of sample

The sample size chosen for a survey will determine the precision of prevalence estimates (i.e., the size of confidence intervals surrounding survey estimates) and the statistical significance of observed differences in prevalence among population subgroups. The standard error of a survey estimate is inversely proportional to the square root of the sample size. Thus, a sample of 1,000 will yield standard errors that are twice as large as those for a sample of 4,000. Two worked examples are provided in Annex 1 showing the standard errors for prevalence estimates with particular sample sizes and the significance of differences between different prevalence estimates for men and women. As illustrated by these examples, the desired level of precision and types of comparisons to be made should be taken into account when determining sample size. Also, it is important to remember that many comparisons are not based on the full sample. For example, comparisons of volume of ethanol intake within different ethnic groups may be based only on that portion of the sample identified as current drinkers, reducing the effective sample size. Finally, complex sample designs typically result in standard errors that are at least 20% larger than those that would result from a simple random sample, so that the sample size must be increased accordingly.

Mode of interview: telephone, self-completed questionnaire or face to face interview?

The two major modes of data collection are personal face-to-face interviews and telephone interviews. In general, it is wise to insist that the selected respondents answer for themselves, that is, not to allow proxy respondents. Telephone interviewing is only an option in countries where virtually all households have telephones. In such cases, the costs of telephone interviews are substantially lower than those of personal interviews. A third option is the use of self-administered questionnaires. These can be sent by mail with a postage paid return envelope, but the response rate on mail surveys in most societies is usually unacceptably low. One exception is reported by Gmel (2000) in which 75% of respondents contacted first by telephone mailed back a questionnaire sent through the post. Sometimes a self-administered section is included in a personal interview, in order to collect information that the respondent might be embarrassed to divulge to an interviewer. This option requires a relatively high level of literacy across all segments of the national population included in the survey sample, and response is improved by having the interviewer collect the sealed form as opposed to leaving it for the respondent to mail back. Gmel (2000) also found that higher levels of consumption were reported in the mailed back questionnaires than compared with the telephone interviews. The finding that confidential questionnaires encourage fuller reports of drinking behaviour than do personal interviews is well-established (e.g. Turner *et al*, 1992).

Whereas self-administered questionnaires are usually designed so that respondents complete each question or with a minimum of skips (i.e., instructions to skip past inapplicable questions), interviewer-administered questionnaires—whether personal or telephone—often contain numerous complex skip patterns. One option for facilitating these skips is through the use of computer-assisted interviews, in which the appropriate questions are generated in sequence on the computer screen where the responses are keyed. Computer-assisted interviews thus may require less interviewer training regarding questionnaire skip patterns. On the other hand, they require that the interviewers be computer literate, they require a substantial up-front investment in developing the program that drives the interview and they require a back-up form of interview in case of computer failure. Moreover, the machines may be susceptible to theft, endangering the interviewers, or may create distrust or distraction in populations where computers are not common.

Dealing with non-response bias

Non-response is a potentially serious source of bias in survey estimates of alcohol consumption. Alcohol consumption surveys typically yield response rates of between 60% and 80% (Rehm, 1998). If sample persons who do not respond (either because they refuse to respond or cannot be located) differ from respondents in terms of characteristics that are associated with consumption, then the consumption estimates derived from the survey cannot be considered representative of the overall population. One way to minimise this source of bias is to take steps to keep the response rate as high as possible. Examples include guaranteeing the confidentiality of responses, budgeting for multiple attempts to reach respondents and providing financial incentives for survey participation. If, as is usual, some basic demographic data (e.g., age, sex, race/ethnicity) are available for the national population, then another way of reducing bias is to weight the survey data to compensate for differential non-response. This provides some assurance that the sample matches some ‘gold standard’ (e.g., census estimates) of the distribution of the population in terms of those demographic characteristics. However, it may not protect against bias caused by under-reporting from persons who are absent from their homes for a good deal of time and have a different drinking pattern from those (of same age and gender) who are more likely to be home when the interviewer calls. In order to minimise this source of bias it is recommended that multiple attempts (10 or more and at different times of day) are made to secure an interview from a single telephone number.

It should be noted that the current literature on differences in alcohol consumption and other characteristics of respondents versus non-respondents has produced mixed results. Gmel (2000) provides a brief overview noting some studies that failed to find higher levels of consumption among persons who initially were non-respondents to a survey, and others that did. The results of his own recent study are also unclear on this point: 17.6% of non-respondents to a mail-back questionnaire were hazardous drinkers according to a prior telephone interview, compared with only 9.6% of respondents. However, this finding failed to reach statistical significance, perhaps due to insufficient statistical power.

In addition to weighting to correct for non-response, the survey data must be weighted to reflect the overall probability of inclusion in the sample (the product of the probabilities at each sampling stage in the case of multistage sample designs) and any oversampling of specific population subgroups. The products of all these weights are a single weight factor for each case. When the sample data are weighted by this weight factor, they will produce a more accurate estimate of the total population represented by the sample. All consumption estimates derived from a national survey should be based on weighted data except in the rare cases where a simple random sample is utilized.

For household surveys, correction for non-response bias should also be conducted by weightings calculated at the Secondary Sample Unit level. Suppose, for example, that only half the eligible households within an SSU respond to the survey, the adjustment weight for household non-response for all data from that SSU is 2. If the response rate was 33%, the adjustment weight would be 3 and so on ie the adjustment weight is the *inverse* of the household response rate. The final weights to be applied are a product of this weight and others calculated e.g. weighting by sex-specific age groups to make the age and sex distribution of the sample equivalent to that of the applicable general population.

The nature and magnitude of non-response bias can also be estimated by the simple procedure of recording the number of attempts that are required to contact each respondent and relating this number to variables of key interest.

Table 2.2.1 summarises the advantages and disadvantages of each of the various modes of conducting alcohol consumption surveys as discussed in this and the previous section.

Table 2.2.1: Relative merits of different modes of conducting alcohol consumption surveys

Mode of interview	Expense incurred	Response rates	Self-reported alcohol use
Telephone	Low	60-80%	Moderate
Mail-back	Low	30-60%	High
Telephone-introduced mail-back	Low	50-60%	High
Face-to-face household	High	60-80%	Moderate
Face-to-face plus sealed envelope	High	60-70%	High

General issues related to measuring alcohol consumption

Length of reference period

One critical factor that will affect the approach used to measure alcohol consumption in surveys is the length of the reference period, that is, the length of the time period for which the respondent is asked to describe his or her drinking. A short reference period such as the week preceding the date of interview permits the use of the so-called 'exact recall' or Last 7 Day method which asks respondents to enumerate and describe the actual number of drinks consumed on each day of the preceding week, whereas longer reference periods preclude this approach. The advantage of using the Last 7 Day method is that it *may* yield more reliable reporting, resulting in higher consumption estimates, than the alternative approach of having respondents summarize their usual drinking patterns over a longer period (e.g. Lemmens *et al*., 1992). It has also been shown that methods which ask respondents to summarise their 'typical' intake provide lower estimates because they tend to not allow for occasional heavy drinking days. However, a recent study contrasting QF, GQF and Last 7 Day methods found that there were marked differences and a clear superiority for GQF in terms of not underestimating High Risk drinkers or over-estimating abstainers (Rehm *et al* ,1999).

The disadvantage of using the Last 7 Days method over a short reference period is that this approach is very sensitive to the frequency and regularity of individuals' drinking patterns (e.g. see the case study of Mexico in the Annex 10). The less frequently an individual drinks, the greater is the likelihood that any one-week period will fail to represent his or her overall volume or pattern of consumption, and hence the consumption of some infrequent drinkers may be missed altogether by such an approach. In fact this is only a serious problem if the main purpose of the survey is to estimate the proportions of *individuals* who drink in particular patterns and at different levels. For some other purposes, such as estimating the *proportion* of all alcohol consumed in an entire community at any given point in time that is 'High Risk', there is only a problem if the time at which the survey is conducted is atypical in terms of the number of holidays and festivals at which drinking is likely to occur.

An alternative is to ask people who did not drink in the week preceding the interview to describe their intake during the most recent week in which they did consume any alcohol, but the ability to exactly recall this information decreases as a function of time since last drink. In order to accurately estimate volume, the date of or duration since the last drink also must be obtained, and both of these are subject to recall error for infrequent drinkers. Another approach, first developed in Finland, is to ask about the last four drinking occasions if these occurred over a longer period than 7 days or the Last 7 Days approach if this included the last four drinking occasions (e.g. Stockwell *et al*, 1993).

The alternative approach of asking respondents to describe or summarize their usual drinking patterns can be used for any length of reference period, although most studies have chosen to ask about either the month or year preceding interview. Although the shorter period of one month might be thought to be less susceptible to recall error, according to Room (1990) there is no consistent evidence to indicate that one or the other of these periods is associated with more reliable reporting. In general, the longer the reference period, the more likely is the possibility of changes in drinking patterns that may make it difficult to describe usual quantities or frequencies of drinking. On the other hand, longer periods may be more likely to match those used for outcome (problem) measures, which are often so rare that their prevalence cannot be reliably estimated over a short reference period. If the intent of a study is to assume that consumption may be a predictor of alcohol-related problems at the individual level, then it makes little sense to use consumption over the past month to 'predict' problems measured over the course of the past year, i.e., that may have occurred almost a year earlier than the reported consumption level. While this is not critical for a national monitoring exercise, it would be wasteful of resources to conduct a survey which did not also allow for an analysis and description of individual drinking patterns and their relationship to problem events.

In summary, the factors that should be considered in choosing a reference period are the regularity of drinking in the country where the survey will be conducted, the time periods that have meaning or cultural referents within the society and for which recall thus will be easiest and also the reference period for questions about problem events. If the outcomes to be studied include chronic diseases whose etiology is related to past rather than current drinking, then questions on alcohol consumption during past periods should be considered for inclusion. The approaches to measuring past consumption include detailed lifetime drinking histories (see review in Lemmens, 1998) and questions for the period of heaviest drinking are all based on the approach of the general summary of drinking. This, however, is likely to be the topic of a longitudinal research project than of a national monitoring exercise. For the latter it is recommended that the ideal is for enquiries about general patterns of drinking over the previous 12 months employing the Graduated Quantity Frequency method (as discussed later in this chapter).

Beverage specific versus overall questions

Past research has demonstrated that asking beverage-specific questions yields higher volume estimates than those based on global questions, that is, questions for all types of beverages combined (Dawson, 1998). The disadvantage of beverage-specific questions, at least when a Quantity Frequency approach is used, is that if a pattern of drinking more than one beverage type in a day is quite common then the responses cannot be summed to provide an estimate of overall drinking frequency nor of usual consumption per drinking day. Thus a separate set of questions for all beverages combined needs to be included. This increases the length of the questionnaire and may seem annoyingly repetitive to respondents. This problem does not apply when a last 7 day approach is used though beverage specific questions will still make this procedure longer than a beverage-specific Quantity-Frequency approach.

Quantity per drinking day versus quantity per drinking occasion

One other general issue to be considered is whether to base quantity reports on the quantity consumed per drinking day or per drinking occasion, of which there may be more than one per day. In countries where drinking typically occurs in conjunction with both the midday and evening meal, then the amount consumed per drinking day may be misleading if interpreted as if the drinks were consumed in a single sitting. This is of importance primarily in linking quantity with short-term consequences such as impaired driving. The main problem in asking quantity per drinking occasion is in how to define such an occasion. How far apart can drinks be and still be part of the same drinking occasion? Surveys usually leave the task of defining a drinking occasion to the respondent rather than or simply ask for quantity per drinking day instead. An additional option is to also ask about frequency of 'drunkenness' which also avoids the problem of defining the length of a drinking 'sitting' or occasion but also gets information about the short-term impact of the consumption. Of course, different cultures may understand 'drunkenness' in different ways and the same culture may change its understanding over time and so caution is advised in using this for monitoring or comparative purposes.

Cultural issues in measuring quantity of drinks

Number of drinks is a deceptively straightforward concept. As discussed in Chapter 2.3, even if the respondent believes they know how many drinks they consumed in one sitting, it can be hard to estimate the size of these drinks. In fact, in many social drinking settings it is hard to know even how many drinks (of unknown size) have been consumed because of strong culturally embedded traditions such as hosts topping up glasses, drinking from a communal container of home distilled beverage (e.g. in African countries) from a 'pitcher' (USA) or 'jug' (Australia) of beer or cocktail mixture. In situations such as this, which are analogous to communal use of other drugs such as marijuana or opium, the best approach is to ask for an estimate of the total amount of beverage consumed and the number of participants. From this, the average volume per participant can then be determined. Other cultural issues are illustrated in the case study of Mexico in the Annex 10.

Reported drink size versus standard drinks

There are two approaches to measuring the amount of ethanol contained in a drink. Where beverage-specific data on intake have been collected, the preferred approach is to ask for the amount of beverage alcohol typically consumed for each type of beverage (e.g., a 330 ml bottle of beer or a 200 ml glass of wine) and to multiply this by the ethanol conversion factor i.e. the proportion of the beverage's total volume that is alcohol. Ethanol conversion factors differ by country (see Chapter 2.3) but generally are about 4-5% percent for beer, about 12 percent for wine and about 40 percent for distilled spirits. Thus the ethanol content for a bottle of beer might be calculated as (330 ml.) x (0.04) = 13.2 ml of ethanol. In many countries, ethanol conversion factors are used to convert the volume of beverage directly into grams (g) of ethanol. In other countries, volumes of alcohol may be recorded in 'ounces'. Relevant conversion factors for these different measures are provided in the chart below.

Common alcohol conversion factors:

1 ml ethanol = 0.79 g

1 UK fluid oz = 2.841 cl = 28.41 ml = 22.30 g

1 US fluid oz = 2.958 cl = 29.58 ml = 23.22 g

In addition to articles such as those cited above that have described the ethanol contents of different types of beverages (see also DISCUS, 1985; Kling, 1989; Modern Brewery Age, 1992; Williams, Clem & Dufour, 1993), the beverage industry is the best source of information as to the ethanol content of beverages that are sold in a given country. In many countries this information is printed on the labels of beverage containers. In countries where a substantial proportion of the alcoholic beverage consumption is uncontrolled, e.g., produced at home, it may be challenging to estimate ethanol content accurately. Laboratory testing may be required to assess the strength of home-brewed products, and the possibility of regional variation in alcohol content must be taken into account.

Estimating drink size may be challenging for many survey respondents, particularly in the case of wine and liquor. Wine glasses are not standard in size, and the levels to which they are filled vary. Distilled spirits often are mixed with nonalcoholic beverages and/or ice and may be mixed by someone other than the respondent (e.g., a bartender). Graphic devices such as pictures or actual glasses of different sizes may be used to help the respondents estimate drink size. Alternatively, it may be easier to provide the options such as a small, medium or large glass/drink and assign volumes to these based on knowledge of customary serving sizes. As outlined in Chapter 2.3 it is recommended that empirically based estimates are derived for typical serve sizes in the home and in licensed premises for the country in question.

The second approach to measuring drink size is to define a 'standard' drink for the respondent and ask them to report their quantity of intake in terms of standard drinks, e.g.:

> *On the days when you drank in the last month, how many drinks did you usually have in a single day? By "drink" I mean a 330 ml bottle or glass of beer, a 120 ml glass of wine or a drink containing 40 ml of distilled spirits.*

The use of pre-defined standard drinks offers one important advantage when asking questions for all types of alcoholic beverages combined (as opposed to beverage-specific questions). It ensures that the quantity measures will be roughly comparable across respondents, regardless of the particular mix of beverages that they consume. The disadvantage of using this approach in measuring alcohol consumption is that it forces respondents to translate their actual drink sizes into standard drinks. Thus the usual problem of estimating actual drink size is compounded by a mathematical challenge, which is likely to produce less accurate results than recording actual drink sizes (which can be subsequently converted to standard drinks, if desired, at the time of analysis). A better solution is to offer respondents a limited range of glass types and/or containers to indicate the kind they normally use for particular beverages. Independent investigation (see Chapter 2.3) can provide estimates of the usual size and alcohol content of these for that population.

Criteria for being a drinker or non-drinker

Drinking status, from which the prevalence of drinking and number of drinkers in a country are estimated, may consist of the simple abstainer/drinker dichotomy, or abstainers may be subdivided into former drinkers and lifetime abstainers. A drinker is most commonly defined as an individual who has consumed any alcohol within a specified time period and this formulation is recommended here. For example, current or past-year drinkers are often defined as individuals who have consumed one or more alcoholic drinks in the year preceding interview. A few studies have defined current drinkers as individuals who have consumed at least 12 drinks during the previous year. While this can avoid asking infrequent, low-volume drinkers a large number of questions about very few drinks, it is not recommended as it is open to the misinterpretation of whether 12 drinks have ever been drunk on *one occasion*.

A dichotomous measure of drinking status during a fixed period such as the past month or past year can be derived from the following type of question:

> *In the past year, have you consumed at least one alcoholic drink of any kind? This includes beer, wine, spirits or any drink containing alcohol.*

A response of 'yes' defines the respondent as a drinker, and a response of 'no' defines the respondent as an abstainer for the period in question. Alternatively, using an overall frequency of drinking question, abstainers can be defined as those who report no drinking in the reference period, e.g., those who select the final response option in the following question:

> *How often, if ever, did you drink alcoholic beverages during the past 12 months? (PROVIDE RESPONSE OPTIONS)*

A measure of lifetime drinking status can be derived by using two questions:

> *In the past year, have you consumed at least one alcoholic drink of any kind?*
> *(IF NO): Have you ever consumed at least one alcoholic drink of any kind?*

An individual is defined as a current drinker (past-year or past-month, depending on the reference period specified in the first question) if he or she answers yes to the first question, as a former drinker is he or she answers no to the first question but yes to the second, and as a lifetime abstainer if he or she answers no to both questions.

Translation of such questions to different language and cultural groups can often pose problems. For example in Zambia, it became apparent in field work that a direct question as to whether a person had ever drunk any alcohol was often understood to mean having 'felt the effects of alcohol' i.e. become intoxicated (Haworth and Acuda, 1998).

Reliability and validity of survey instrument

There has been recent criticism of the field of alcohol epidemiology for failing to test the validity and reliability of survey instruments widely used and for a lack of international standardisation (Rehm, in press). The issue of validation is difficult since there is no generally accepted 'gold standard' against which to compare self-reports with. One candidate for such a gold standard, however, is direct observation of drinking behaviour and comparing this with subsequent self-reports. Perrine *et al*

(1997) report such a study with observations of amounts consumed in a public bar followed by personal interviews soon afterwards. It was found that self-reported consumption was significantly lower than that observed. This may reflect the lower levels of reports made in personal interviews or it may reflect a general memory failure that afflicts all self-report methods. At least studies using multiple methods in general find high correlations between amounts reported for different styles of instrument which suggests a degree of concurrent validity. One interesting example was reported by Hilton (1989) in which responses to two types of self-report instruments (QF and beverage-specific QF) were compared with a prospective self-completion diary. High inter-correlations were found for measures of alcohol consumption.

Few studies have conducted test-retest reliability tests on alcohol survey instruments and this gap needs to be filled by future research.

Volume of ethanol intake

Volume of ethanol intake is most commonly expressed in terms of a respondent's volume of ethanol intake during a specified reference period, that is volume per week, month or year. This may be aggregated across respondents to produce estimates of total consumption that can be compared to sales data or other sources. Individual volume of intake also may be described in terms of average intake per day (the total volume for the reference period divided by the number of days in the period) or average intake per drinking day (the total volume for the reference period divided by the number of days on which the respondent consumed any alcohol) and may be used to create categories of light, moderate and heavy drinking. Volume usually can be expressed in terms of grams, ounces, litres, millilitres or some other measure of ethanol, i.e., absolute alcohol. It is recommended for sake of comparability that grams are used as a standard and also that if a conversion formula from millilitres has been applied that this is clearly stated (see Annex 2).

The volume of ethanol consumed during a specified period is a function of 1) the number of drinks consumed during that period and 2) the amount of ethanol contained in each drink. As discussed above, the number of drinks consumed during a specified reference period can be estimated by asking respondents to recall their exact intake for a short period (typically the preceding week) or by asking them to summarize their general pattern of intake for a longer period (typically the month or year preceding interview), and the amount of ethanol contained in each drink may be assumed to equal a standard drink or may be calculated by multiplying the reported drink size by an ethanol conversion factor.

a) Estimating volume by Last 7 Day method

The first approach, the one-week daily recall (LAST 7 DAY), leads respondents through each day of the preceding week, asking how many drinks were consumed on each day.

How many drinks did you have on Sunday?
(REPEAT FOR EACH DAY OF THE WEEK.)

The overall volume of ethanol for the week is the sum over all days of the number of drinks times the grams of ethanol assumed to be in a standard drink.

The following example uses a definition of 10 g for a standard drink:

Day of the week	Number of drinks	Ethanol content of drinks
Monday	1	1 x 10 g = 10 g
Tuesday	0	0 x 10 g = 0 g
Wednesday	0	0 x 10 g = 0 g
Thursday	1	1 x 10 g = 10 g
Friday	3	3 x 10 g = 30 g
Saturday	5	5 x 10 g = 50 g
Sunday	2	2 x 10 g = 20 g
Total week	12	12 x 10 g = 120 g

In this example, the weekly volume of ethanol consumption is 120 g. The annual volume of consumption can be estimated as the weekly volume times 52, or 6,240 g. To calculate average daily ethanol intake, the weekly volume is divided by 7 yielding 17.1 g per day. To calculate average ethanol intake per *drinking* day, the weekly volume is divided by 5, the number of days on which any drinking took place, resulting in a value of 24 g.

Applying the categories described above, this level of drinking, at least for that particular week, would be classified as 'Low Risk' level for long-term health problems whether for a man or woman though the amount consumed on the Saturday (50g) would not be classified as Low Risk for acute harm (see criteria for risk below).

Within the LAST 7 DAY approach, respondents optionally may be asked to specify type of alcoholic beverage, drink size for each drink, drinking location and source by which the alcohol was obtained. A worked example illustrating such an approach is provided in Annex 3.

b) Estimating volume from QF and Graduated QF methods

The second approach estimates total quantity of intake on the basis of a general description of the frequency and quantity of drinking during the reference period. The two most common examples of this approach are the usual quantity/frequency (QF) method and the graduated frequency (GQF) method. These will be described in greater detail below. A third option, the period specific normal week (PSNW), uses questions similar to those described above for the LAST 7 DAY but asks respondents to describe a *typical* week of drinking rather than to enumerate the consumption during the preceding week. Calculation of volume of intake from responses to the PSNW is identical to that already described for the LAST 7 DAY and will not be repeated here.

The QF method asks for the overall frequency of drinking during the reference period and the usual number of drinks consumed on days when drinking took place:

How often, if ever, did you drink alcoholic beverages during the past 12 months: would you say about every day, about four to five times a week, two to three times a week, once a week, two to three times a month, once a month or less than once a month?

On those days when you drank, how many drinks did you usually have? (RECORD EXACT NUMBER OF DRINKS)

In order to estimate volume of ethanol intake from Q/F questions such as these, the categorical frequency responses must be converted to number of drinking days per month or year (whatever the reference period is). The midpoint of the category is typically used as the frequency value, e.g., to estimate days/year for each of the categories.

The usual QF method can be extended to include beverage-specific questions, often preceded by a filter question that determines whether or not the specific type of beverage was consumed at all, to ask for the largest as well as usual quantity of drinks consumed and to ask for the size of drink. This approach is illustrated in Annex 4.

The graduated frequency (GQF) method asks separately for the frequencies of consuming various quantities of drinks, usually grouped into categories. This is recommended as superior to the usual QF method as it will also capture a category of drinking which is known to be associated with a very large amount of alcohol-related morbidity and mortality i.e. occasional heavy drinking days above levels defined as 'High Risk' (see below in this Chapter). A worked example of the approach can be found in Annex 5.

c) Estimating volume of unrecorded consumption

Many countries are interested in knowing how much of the reported volume of alcohol consumption is made up of alcohol that is produced at home (either legally or illegally), that is procured from any illegal source, that is purchased at duty free outlets or abroad or that is consumed abroad. Others may simply need to know the prevalence of these aspects of consumption, that is, the proportion of individuals who have consumed any alcohol from these sources or under these circumstances. This sort of information is useful in reconciling survey estimates of consumption with sales data and in monitoring the success of policies that restrict alcohol availability (e.g. opening hours and days).

The questions required to obtain this information are readily adaptable to the LAST 7 DAY approach to measuring consumption, because the source and locale where consumed can be asked for each drink consumed during the reference week. However, this method is not recommended for countries in which unrecorded consumption is believed to be rare. It can be used in developing countries where unrecorded consumption tends to be high so long as a) the purpose is only to estimate the *proportion* of all alcohol consumed that is derived from such sources not the number of *individuals* who ever access alcohol this way, and b) the population is sampled over a typical period for drinking.

How did you get this beverage? (RESPONSE OPTIONS CAN INCLUDE: purchased from legal source within country, purchased from illegal source within country, made at home, purchased at duty free outlet, purchased abroad and legally brought into country, purchased abroad and illegally smuggled into country, etc.)

Where did you drink this beverage? (RESPONSE OPTIONS CAN INCLUDE 'outside the country.')

When consumption is measured on the basis of usual drinking patterns, i.e., through the usual QF or GQF approach, the best approach to measuring these aspects of consumption is through a series of lead-in questions, followed by the desired level of detail when a positive response is obtained:

e.g. In the past year, have you drunk any alcoholic beverages that you believe were home- made?

(IF YES, FOLLOW BY EITHER FREQUENCY AND USUAL QUANTITY OR A SINGLE ITEM ASKING FOR THE ESTIMATED NUMBER OF DRINKS OF HOME-MADE BEVERAGES CONSUMED DURING THE REFERENCE PERIOD)

Repeat for other unrecorded sources of interest such as purchased from illegal source within country, made at home, purchased at duty free outlet, purchased abroad and legally brought into country, purchased abroad and illegally smuggled into country, etc.)

The calculations of volume for these specific types of consumption follow the same methods already described for general volume of consumption. The prevalence of any of these types of consumption is simply the weighted percentage of respondents who reported any amount of the type of consumption in question.

Measures of High Risk drinking for acute problems

a) Criteria for risk of acute problems

The most commonly used measures of High Risk drinking for acute problems are: 1) the number or proportion of drinkers or of the total population drinking at a level deemed to be High Risk—i.e., at or above some threshold number of drinks/grams of ethanol per day—with a specified frequency during a given reference period, e.g., the proportion of drinkers who ever drank 5+ drinks on any one day in the past month or the proportion of adults who drank >6 drinks at least once a week during the past year, and 2) the volume of consumption that is consumed on 'High Risk' drinking days. From the volume of High Risk consumption, the proportion of total intake that exceeds the High Risk threshold or is consumed on High Risk drinking occasions may also be estimated.

The thresholds used as indicators of High Risk drinking typically have a scientific basis (e.g., the number of drinks that would correspond to a blood alcohol level at which psychomotor impairment has been documented) and may reflect a country's moderate drinking guidelines. Indeed, one purpose for measuring High Risk consumption is to determine adherence to moderate drinking guidelines, i.e., to monitor the success of prevention programs.

The most commonly used cut-off for High Risk drinking in the research literature is the mainly North American tradition of '5 plus drinks' in a day i.e. between 49+g and 56+g of alcohol depending on whether a standard drink is defined as 12g (usual for USA – though it is sometimes defined as 14g) or 13.6g (Canada). In Australia and New Zealand, more than 60g of alcohol or 6 standard drinks in a day tends to be used for men and 40g for women. In the UK, some studies have used 8 'units' or 64g in a day for men. These apparent disparities in drink numbers still permit the recommendation for an international cut-off for High Risk drinking as greater than 60 g of ethanol on any given drinking day for men. Given that this measure is intended mainly as a point at which risk of an acute problematic occurrence is increased significantly and the evidence that women tend to experience greater intoxication from a given amount of alcohol, it is also recommended that the lower cut-off of greater than 40g of ethanol is used for women. If it is considered desirable to have more levels of risk by daily volume (Low-, Moderate- High-, Very High Risk), suggested levels are illustrated below. A number of important caveats must be born in mind in relation to these recommendations:

(i) while based on some evidence from developing countries (e.g. McLeod *et al* ,1998), they should not be interpreted as implying invariable risk levels across all individuals and all drinking settings but rather average risk for a population;

(ii) it is not intended to imply that the Low Risk categories denote drinking which is risk-free;

(iii) these risk levels must be clearly distinguished from those which apply to typical daily drinking i.e. average intake of alcohol across all days which will usually be a lower figure;

(iv) these suggested risk levels are provided in order to provide reference points for making comparisons of drinking patterns both within and between different countries.

(v) they are not intended as levels to be applied in advice for Low Risk drinking advice to the public which will, of necessity, also need to consider cultural sensitivities and also the optimal means of communicating simple advice about Low Risk drinking.

Criteria for risk of consumption on a single drinking day – for comparative research purposes only

	Males	Females
Low Risk	1 to 40g	1 to 20g
Medium Risk	41 to 60g	21 to 40g
High Risk	61 to 100g	41 to 60g
Very High Risk	101+g	61+g

The number of standard drinks corresponding to these thresholds varies slightly from country to country, largely because of differences among countries in the ethanol content of a standard drink (again, refer to Chapter 2.3 in this volume for more information on this topic).

b) Measuring High Risk drinking using the Last 7 Day approach

This method is not recommended as a method for calculating proportions of populations drinking in excess of certain daily thresholds e.g. 60g on a day. As shown by Rehm *et al* (1999) proportions of individuals with such a patterns are greatly underestimated.

c) Measuring High Risk consumption using the QF approach

In surveys utilizing the usual QF approach, the prevalence and volume of High Risk drinking cannot be measured adequately. The problem is that it will only get reports from individual drinkers about their 'usual' daily drinking level and will miss their occasional, or even sometimes quite frequent, periods of greater than usual consumption. Thus it is recommended to supplement these questions with those asking about frequency of high-intake occasions, as in the GQF approach below.

d) Measuring High Risk drinking using the graduated quantity frequency (GQF) approach

In the context of graduated quantity-frequency (GQF) questions, the proportion of High Risk consumption can be estimated without any additional questions being added as long as the threshold for High Risk drinking forms either the *lower* limit of one of the quantity categories if the threshold translates to x+ drinks or the *upper* limit of one of the quantity categories if the threshold translates to >x drinks. For example, if 5+ drinks is considered High Risk, then a response category that asks for the frequency of drinking 5-7 drinks will indicate whether or not the respondent ever drank at a High Risk level, whereas a category asking for the frequency of drinking 4-5 drinks will not. Alternatively, if >6 drinks is considered High Risk, asking for the frequency of drinking 4-6 drinks will work whereas asking for the frequency of drinking 6-7 drinks will not. (Again, each separate threshold required for men and women or to establish Moderate Risk as well as High Risk drinking must form the boundary of a quantity category.)

Assume that a standard drink equals 12 g, that the threshold for High Risk consumption is >60 g ethanol for men, and that the threshold for Moderate Risk consumption is >40 to 60 g ethanol for men. Here the first standard drink contains grams 1 to 12, the second grams 13 to 24, the third grams 25 to 36, the fourth grams 37 to 48, and the fifth grams 49 to 60. Thus the following GQF categories will capture the thresholds for both Moderate and High Risk drinking suggested for men: the frequencies of drinking 1-3 drinks, of drinking 4-5 drinks, of drinking 6-8 drinks, of drinking 9-11 drinks and of drinking 12+ drinks.

Further assume that a respondent reports that he never drank 12+ drinks, drank 9-11 drinks on 2 days in the past year, drank 6-8 drinks once a month (annualized to 12 days per year), drank 4-5 drinks 2 to 3 days a month (30 days per year), and drank 1-3 drinks 3-4 days a week (182 days per year). This respondent's frequency of High Risk drinking is the sum of the days when he drank 6-8 drinks and 9-11 drinks, 12 + 2 = 14 days per year.

Thus the volume of his drinking on *High Risk drinking days* = ([2 days x 10 drinks x 12 g] + [12 days x 7 drinks x 12 g]) = 1248g. The volume of his drinking that *exceeds the High Risk threshold* for any one day discounts the first 60g consumed on these days i.e. = ([2 days x 10 drinks x 12 g] minus [2 days x 60 g]) + ([12 days x 7 drinks x 12 g] minus [12 days x 60 g]) = 408 g.

In either of the above instances, if these calculations are repeated for all respondents to a survey and contrasted with estimates for total volume consumed it is then possible to calculate the proportion of all drinking that is High Risk. This summary statistic should be calculated after the data have been weighted so as to be more representative of the wider population of interest.

Measures of High Risk drinking for chronic harm

a) Criteria for risk of chronic harm

Following the quantification methods employed by English *et al* (1995) and Single *et al* (1996) described in Section 3, average ethanol intake per drinking day can be usefully classified as Low Risk, "hazardous" or "harmful" according to specific cut-offs for men and for women. In this guide we will refer to these same cut-offs as "Low", "Medium" and "High" Risk for long-term alcohol-related harm. The change in terminology is suggested on the basis that the term 'harmful' drinking implies that harm will invariably arise from such drinking when in fact it is only probable. The cut-offs employed in the above reviews are illustrated in Table 2.2.2 below.

Table 2.2.2: Low, Medium and High Risk average daily consumption levels for men and women long-term risk of serious illness (English *et al*, 1995)*

GENDER	LEVEL OF RISK		
	LOW	MEDIUM	HIGH
Male	1-40g	41-60g	61+g
Female	1-20g	21-40g	41+g

* NB. For comparative research purposes only.

The scientific data underpinning these definitions are summarised from English *et al* (1995) in the Table below which is based on an analysis of pooled data on all-cause mortality from 16 cohort studies which met their strict inclusion criteria.

Table 2.2.3: Relative Risks for All-cause mortality for different average daily intakes of alcohol (from English *et al*, 1995)

Sex	Average daily intake							
	None	0.1-9g	10-19g	20-29g	30-39g	40-49g	50-59g	60+g
Male RR	1.00	0.88	0.84	0.93	1.01	1.06	1.20	1.37
(95% CI)		(0.86-0.90)	(0.82-0.86)	(0.91-.095)	(0.98-1.04)	(1.03-1.10)	(1.15-1.26)	(1.33-1.40)
Female RR	1.00	0.88	0.94	1.13	1.33	1.47	1.47	1.58
(95% CI)		(0.86-0.90)	(0.93-0.96)	(1.10-1.16)	(1.27-1.39)	(1.39-1.56)	(1.33-62)	(1.49-1.69)

Whether volume of drinking is measured by the Graduated QF or the Last 7 Day method, it is straightforward to apply these criteria to the average consumption of individual drinkers and then to estimate the proportions of drinkers in the wider population which can be found in these categories of risk from their drinking.

It is important to stress that, as with the recommended levels of risk for acute harm discussed above, these cut-offs are proposed as a means to enable more direct international comparisons of drinking levels, patterns and related problems. Agreement as to these risk levels is crucial for the purposes of estimating alcohol-related morbidity and mortality employing comparable methodologies across different countries. As discussed in Chapter 3.1 the calculation of Aetiologic Fractions for chronic alcohol-related harm requires prevalence estimates of Medium and High Risk drinking – hence international uniformity of the definitions of these is essential.

b) Estimating the proportion of all alcohol consumed in a population that is High Risk for long term harm

The proportion of drinking that is medium or High Risk in the long-term for serious illnesses can also be calculated using these cut-offs. It is recommended that either QF or Graduated QF measures are used for this as the Last 7 Day approach may fall upon a temporary period of abstinence for an otherwise heavy drinker or merely an unusually heavy (or light) week for others. Measures of degree of risk for longer-term health problems are best based on more measures which apply to longer periods of drinking such as the last 12 months instead of the last 7 Days. This problem is, once again, off-set if the only aim is to extrapolate all estimates to the entire drinking population as an overall estimate of the proportion of all drinking which is low, medium or High Risk: the only issue then is how representative of the whole year are the few weeks selected for the particular survey.

Measures of drinking context

Measures of drinking context are important in interpreting the associations between drinking and its consequences. Impaired driving, for example, is not likely to occur after an evening of drinking at home, regardless of the amount consumed. Typically, measures of drinking context focus on where and with whom drinking takes place. When a Last 7 Days approach is used to measure alcohol consumption for a limited reference period, these factors can be specified for each drink consumed. When assessing generalized drinking patterns, there are three general approaches to measuring drinking context. Each of these can apply to either drinking venue or companions.

1) The respondent can be asked to identify his or her main drinking context or, alternatively, all the contexts that apply:

During the past year, where did you USUALLY drink: in your own home, in the homes of friends or relatives, or in public places such as bars, restaurants or sports arenas?

During the past year, where did you drink (CHECK ALL THAT APPLY): in your own home, in the homes of friends or relatives, or in public places such as bars, restaurants or sports arenas?

2) The respondent can be asked to identify the proportions of time spent in different drinking contexts:

During the past year, approximately what percentage of the time did you drink:

a. By yourself in your own home? _______%
b. With friends or relatives in your own home?
c. With friends or relatives in their homes? _______%
d. In public places such as bars, restaurants or sports arenas? _______%

3) The respondent can be asked for the frequencies with which he or she drank in various contexts. These need not be exhaustive — frequencies may be asked only for those contexts that are thought to act as a risk factor for the types of outcomes to be studied:

During the past year, how often did you drink in public places such as bars, restaurants or sports arenas
During the past year, how often did you have more than two drinks before driving a car or other motor vehicle

The Canadian 1989 National Survey asked about quantity and frequency of alcohol consumed in each of several commonly used drinking settings (Single and Wortley, 1993). This resulted in substantially higher estimates of alcohol consumption than did quantity-frequency alone. This and the more detailed approach of number 3 above will provide more reliable information about consumption at different settings.

Recommendations for drinking questions in national surveys

Surveys of alcohol consumption need to contain items for measuring drinking status, volume of consumption and the prevalence and volume of High Risk consumption. Other highly desirable items include measures of unrecorded consumption, drinking context and Moderate Risk consumption. In recognition of the fact that many countries have limited resources for conducting alcohol surveys and that this topic may constitute just one component of a more broadly based survey (e.g., a general survey of health problems or health care utilization), this section presents suggestions for alternative alcohol consumption modules of varying length. Following each set of questions is a brief discussion of issues affecting question wording and the measures of alcohol consumption that can be estimated from the items included in the module.

A. Module containing minimum required items (3 Questions)

The following items are shown in full along with response options in Annex 8.

1. *In the past year, how often did you drink any alcoholic beverage?*
2. *How many drinks did you USUALLY have on days when you drank alcoholic beverages in the past year*
3. *In the past year, how often did you drink five or more drinks of any alcoholic beverage or combination of beverages in a single day?*

The following issues must be considered in using these questions:

1) In Q.1, the beverage types listed for the respondent should be revised as necessary to reflect the main types of alcoholic beverage consumed in the country where the survey is to be administered.
2) In Q.2, the drink sizes should be revised to reflect the size of a standard drink that is desired. Regardless of what size that is, and taking into consideration the ethanol content of different beverages in the country in question, the drink sizes presented in the example should all contain approximately the same amount of ethanol.
3) In Q.3, the number of drinks whose frequency is asked should represent the threshold for High Risk consumption for acute harm. If this threshold is set at >60 g ethanol, then the number of standard drinks that corresponds to >60 g ethanol should be substituted for 5+ (see above). If there are separate thresholds for men and women, these will require an additional question reflecting the second threshold. Alternatively, the interviewers can be given instructions to vary the wording of Q.3 depending on whether the respondent is a man or woman.

Drinking status can be ascertained from Q.1, with abstainers defined as those who reported never drinking any alcoholic beverage in the past year and drinkers defined as all others. A crude measure of volume can be calculated as a product of the overall frequency of drinking (days per year as estimated from the midpoints of the frequency categories in Q.1) x the number of drinks usually consumed (Q.2) x the assumed ethanol content of a standard drink. A slightly more accurate estimate of volume can be calculated as the sum of two products: ([the overall frequency of drinking (Q.1) minus the frequency of drinking 5+ drinks (Q.3)] x the number of drinks usually consumed (Q.2) x the assumed ethanol content of a standard drink) plus (the frequency of drinking 5+ drinks (Q.3) x the assumed number of drinks consumed on days when drank 5+ drinks x the assumed ethanol content of a standard drink). In the absence of any pre-existing information on the consumption distribution, an estimate of six drinks may be used as the assumed quantity consumed on days of drinking 5+ drinks. An assumption of five drinks on each of those days would represent the most conservative possible estimate, and countries with patterns of very heavy consumption may choose a number considerably higher than six drinks.

Using the techniques described above, the volume of consumption on High Risk days can be estimated as (the frequency of drinking 5+ drinks x the assumed number of drinks consumed on days when drank 5+ drinks x the assumed ethanol content of a standard drink). The volume of alcohol in *excess of the daily thresholds for High Risk consumption* will subtract from this: (the frequency of drinking 5+ drinks x 60 g). In both cases the *proportion* of total consumption that is High Risk then needs to be calculated.

B. Module containing minimum required items with some additions (8 Questions)

The following items are also shown in full along with response options in Annex 8.

1. *In your entire life, have you ever consumed 1 or more drinks of any type of alcoholic beverage?*
2. *In the past year, have you consumed 1 or more drinks of any type of alcoholic beverage, for example, beer, coolers, wine, spirits or fermented cider?*
3. *Counting all types of beverages combined, what was the LARGEST number*
4. *In the past year, how often did you drink 12 or more drinks of any type of alcoholic beverage on a single day*
5. *In the past year, how often did you drink 8 to 11 drinks of any type of alcoholic beverage on a single day*
6. *In the past year, how often did you drink 5-7 drinks of any type of alcoholic beverage on a single day*
7. *In the past year, how often did you drink 3 or 4 drinks of any type of alcoholic beverage in a single day?*
8. *In the past year, how often did you drink 1 or 2 drinks of any type of alcoholic beverage in a single day?*

With this expanded module of questions, the following issues must be considered:

1) In Q.1, the beverage types listed for the respondent should be revised as necessary to reflect the main types of alcoholic beverage consumed in the country where the survey is to be administered.
2) In the instructions preceding Q.3, the drink sizes should be revised to reflect the size of a standard drink that is desired. Regardless of what size that is, and taking into consideration the ethanol content of different beverages in the country in question, the drink sizes presented in the example should all contain approximately the same amount of ethanol.
3) In Q.3 - 7, the quantity categories whose frequency is asked should be designed to permit estimation of the proportion of Low Risk, Moderate Risk and High Risk consumption.

The measure of drinking status that can be derived from this module of eight questions has three categories: current drinker (yes to Q.1), former drinker (no to Q.1 and yes to Q.2) and lifetime abstainer (no to Q.1 and Q.2). Both the total volume of consumption and also that which is High Risk for chronic harm can be estimated using the techniques outlined above.

C. Expanding the preceding module

The preceding module of eight consumption questions can be expanded to include any or all of the types of questions discussed earlier in this chapter, e.g., beverage specific questions, questions on unrecorded consumption, and questions on drinking context. These can be asked in the context of generalized patterns of intake and/or based on recent recall of all alcohol consumed in the week preceding interview (Last 7 Day method).

An expanded survey should also include some questions on alcohol-related problems. It is recommended that a) if space is limited the AUDIT is used as this has been extensively used internationally or b) the WHO problem scale is used in combination with the SADQ-C if there is space for the required additional 34 items. The alcohol section of the CIDI-C is another alternative which yields estimates of numbers of persons in ICD diagnostic categories (such as ‘severe alcohol dependence’ or ‘alcohol abuse’).

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Chapter 2.3

Some additional methodological issues for national monitoring of alcohol consumption

Summary

Whenever estimates are made of amounts of alcohol consumed by a population it is necessary to know the typical strength of the main categories of alcoholic beverages. In addition when such estimates involve surveys in which people are asked how many 'drinks' they consume' it is also necessary to know typical serve sizes if estimates of pure alcohol consumption are to be made. Studies of national and international variation in beverage strengths and serve sizes are reviewed. It is concluded that insufficient attention is generally paid to the need to accurately estimate and monitor these variables, that often estimates are not empirically based and that this hampers the tracking of changes in consumption over time and place. Several methods are suggested for developing local empirically-based estimates.

This chapter will consider some additional methodological issues that are sometimes taken for granted in alcohol research. These relate to fundamental assumptions about how much alcohol is contained in the drinks people buy and consume in different countries. These issues are raised here largely in relation to the objective of increasing the international comparability of both population surveys of alcohol consumption and estimates of level of per capita consumption from sales or taxation data. Chapters 2.1 and 2.2 have provided more detailed guidelines for collecting these two important types of data on drinking. It is recommended that national monitoring studies pay more heed to these basic methodological issues in the future and recommendations are provided for how this might be achieved with different levels of resources. It is not intended that addressing these issues should be regarded as a pre-requisite for any country wishing to initiate national monitoring. Improved methodology here will, however, have some benefits for both national and international monitoring exercises.

The importance of estimates of typical beverage strength and serve size

Beverage alcohol is a complex set of products which is available in most countries in hundreds if not thousands of different brands and many container sizes. Even within the main beverage varieties of beer, wine and spirits there is substantial variation in the typical beverage strength in terms of percentage of alcohol by volume. Statistics on production and sale of alcohol are usually only available as litres (or gallons) of major beverage varieties and hence calculations of alcohol consumption require estimates to be made regarding typical percentage alcohol by volume of these beverage varieties. This chapter will consider the means by which such estimates should be made so as to minimise the clear potential that exists for error.

Assumptions regarding typical beverage strengths are also necessary in the analysis and presentation of survey data. It is extremely unusual for surveys to inquire into the precise brand of each alcoholic beverage reported in consumption surveys and even when this has been attempted respondent's recall is not complete (e.g. Lang *et al*, 1992). Consumption surveys usually ask people to report numbers of 'drinks' of beer, wine and spirits. These 'drinks' may be defined as 'standard drinks', a concept which has currency in some countries e.g. Australia where all containers are labelled with their alcohol content in terms both of percentage alcohol by volume and the number of 'standard drinks' defined as 10g of ethyl alcohol. In any case, for estimates to be made of consumption of alcohol per se it is necessary to make assumptions not only about typical beverage strength but also the typical units of consumption or serve sizes.

It may be thought that being precise about serve sizes and alcohol content is not an important issue for survey research since, after all, surveys are about understanding patterns of drinking and should not be expected to provide accurate estimates of consumption levels. Certainly, surveys are not generally a good basis upon which to estimate national per capita consumption estimates (see Chapter 2.1). However, as discussed in Chapter 2.2 a key measure recommended for use in surveys of drinking behaviour is the frequency of drinking five or more "drinks' in one day. It will become clear in the present Chapter that what is considered to be a 'drink' in one country can differ considerably in its alcohol content from that in another country and that this can render international comparison of drinking pattern data potentially misleading if not corrected for.

It will be argued in this chapter that these key assumptions are frequently made without reference to sound empirical data, that they are not updated and that this leads to significant and avoidable error in the reporting of alcohol statistics. We will make recommendations as to how to minimise these sources of error by adapting a range of possible approaches to the unique situation of each country. International comparability of data requires that every effort be made to maximise validity within each country, though it is not always necessary that the methods used to achieve this be identical.

Variations in different types of alcohol beverages

Published research on alcohol consumption typically categorises alcoholic beverages into three, four or five of the following categories: beer, wine, fortified wine, ciders and distilled spirits. In many countries, a potentially significant proportion of alcohol consumption does not readily fit into any of these categories. This may not be obvious from aggregate sales data, as this may relate to homemade beverages such as *pulque* in Mexico, *palmwine* in some African countries and *sake* in Japan which may or may not have been classified as beer or wine and have their own unique properties. Even in developed countries, new products such as wine and spirit "coolers" or 'alcopops' introduced by the alcohol industry in recent years also are not easily categorised. Thus, at the very least, information on a residual "other" category should be routinely collected and reported, along with a description of the nature and strength of these beverages—whether one is presenting alcohol sales or self-report data. It is recommended that close inquiries are made regarding the precise meanings of the categories reported in official statistics and how these are used and interpreted by both the liquor industry suppliers and government compilers of the data. Changes in definitions commonly occur and the dates and nature of such changes should be documented so that adjustments can be made in calculations or, at least, interpretations of the resulting figures.

Research on variation in alcoholic strengths within beverage types

In this section, the issue is discussed of how well the 'strength' of different alcoholic beverages can be estimated. The 'strength' or alcohol content will be described here in terms of the percentage of the *volume* of a beverage that contains alcohol and is recommended as a standard for comparison between countries. In some countries, 'strength' is also measured in terms of percentage alcohol contained by *weight*. Because the specific gravity of alcohol differs from that of water (by an amount influenced also by the prevailing temperature) this results in a different percentage figure and so it is necessary to apply a conversion formula if comparisons are to be made. Some worked examples of this are provided in Appendix 4.

There is only limited published research describing the variation in beverage strengths within beverage varieties. A 1977 WHO study (Finnish Foundation for Alcohol Studies, 1977) reported some results from a questionnaire sent to 139 national statistical authorities in order to obtain time series data on national per capita alcohol consumption. A 58% response rate for useable information was obtained. One of the questions concerned the typical strength of beer, cider, wine and spirits in that country. Minimal guidance was provided on how to make these estimates. A wide variety of estimates of strengths was obtained which fell between 2% and 5% ethanol volume by volume for beer, 10.5% and 18.9% for wine, between 24.3% and 90% for spirits, and from 1.1% to 17% for cider. With such wide variation and little standardisation in the methods for making these estimates, the international comparability of estimates of per capita alcohol consumption which use a standard assumption of typical beverage strength for all countries must be open to question.

Information on alcohol content is not always readily available. For homemade beer, wine and other products, the alcohol content may simply be unknown and/or it may vary considerably between producers or even between different batches produced by the same company. In some countries, the alcohol content may be known, but this information may not be provided or may even be prohibited on container labels. Most notably, legislation in the U.S. until recently used to prohibit beer producers from the presenting of information on alcohol content. The apparent motivation for this policy was to prevent the information from being misused by persons seeking to maximise their ethanol intake at the lowest possible cost. While some drinkers, particularly adolescents and young adults, undoubtedly would use information on alcohol content to get "the biggest bang for the buck", the lack of information on beverage strength also prevents responsible drinkers from monitoring their consumption in situations where they seek to avoid intoxication e.g., when driving a vehicle. Indeed, the notion of denying drinkers information they could use to drink responsibly on the grounds that they might misuse that information runs counter to the trend in public health towards providing citizens with information required to make responsible choices. Prohibiting information on alcohol content on containers also represents a significant barrier to research. The US prohibition on providing beverage strength data on beer has now been lifted but it is still not mandatory to provide this and some major producers still do not provide this valuable information (for consumers and researchers).

In those countries where the alcohol content is presented on containers, a visit to a liquor store in most countries will reveal a great range of strengths of different alcoholic beverages. A British study examined the ability of drinkers to estimate the alcohol content of different strength drinks including beers ranging from 1% to 10.9%, 'lagers' from 0.9% to 8.6% and wines from 7% to 13% (Stockwell and Stirling, 1989). A US study examined the drinking behaviour of college students at specially organised social gatherings at which the strength of the (free) beer was either 3% or 7% strength (Geller *et al*, 1991). A Canadian study used sales data obtained from the Ontario alcohol monopoly, weighted by the alcohol content of each brand, to estimate the net alcohol content of all beer (5%), wines (13.2%) and spirits (40%) sold in that province (Single and Giesbrecht, 1979). An Australian study documented the variation in alcoholic strengths of different beverage varieties available from a large chain of liquor stores (Stockwell and Honig, 1990). It was reported that beers varied between 0.9% and 11%, wines between 7% and 14% and spirits between 37% and 75.9%. This study also examined the percentage of total sales within each beverage category attributable to examples of particular strengths. It was therefore possible to estimate median and mean strengths for each beverage class—albeit for one kind of liquor store in one Australian city.

Whether alcohol consumption is to be estimated within a single country or across several countries, the conclusion is inescapable that an objective and empirical basis for estimates of 'typical' beverage strength is highly desirable. In particular, it is not possible to make standard assumptions regarding typical beverage strength to be applied internationally.

Examples of variations in typical strengths over time and country

It is sometimes argued that even if assumptions about typical beverage strengths are incorrect, the extent of inaccuracy will be constant over time and hence will not affect the analysis of trend data. Unfortunately there is ample evidence from a variety of countries that demonstrates that such optimism is unfounded. Dramatic changes occur in patterns of consumption of different types and strengths of alcoholic beverage. For example, in recent times there has been an increase in various 'designer' drinks otherwise referred to as 'alcopops' or alcoholic sodas. These do not fit neatly into the traditional beverage varieties and may cause distortions of per capita consumption estimates. In Western Australia this was dramatically illustrated by an apparent increase of about 1700% in the per capita consumption of 'reduced alcohol wine' (defined as wine of less than 6.1% alcohol/volume) over four financial years (WA Government, 1995). Further inquiry of the WA Office of Racing, Gaming and Liquor revealed that this category of beverage actually included cider and alcoholic soft drinks, both of which tended to have different typical beverage strengths to low alcohol wine and hence were misclassified as such.

The previously mentioned WHO study (Finnish Foundation for Alcohol Studies, 1977) obtained annual data from some countries regarding typical beverage strengths. These countries were mostly those with government controlled alcohol monopolies and/or an alcohol taxation system based on alcohol content also tended to have the most precise and comprehensive data systems. Thus between 1950 and 1972, in Denmark there was a change in the typical strength of wine from 14.3% to 13.5%, of cider from 16% to 17%, beer 3.2% to 4.4% and of spirits from 39.1% to 42.3%. In Finland, typical beer strengths increased from 2.7% to 4.4% and so on. In Ontario, Canada, fortified wines were the predominant type of wine consumed in the 1950s and 1960s and the typical strength of wine was estimated at 16% until an analysis of 1972 sales data for Ontario found that the alcohol content of wine had decreased to 13.2% due to increased consumption of table wines (Single and Giesbrecht, 1979).

A major trend in drink sales and marketing has occurred in some countries in relation to the consumption of lower strength beers. This trend is especially marked in Australia probably as a direct consequence of new laws regarding drink driving and high levels of enforcement e.g. reduced permissible blood alcohol levels and random breath testing of drivers. A large range of lower strength beers has emerged in Australia in recent years with numerous examples between 2.5% and 3.5%. Most Australian States have taxed these ‘reduced alcohol’ beers at a lower level than ‘regular’ strength beers, usually around 5% alcohol/volume. In the Northern Territory a levy on all alcoholic drinks above 3% alcohol by volume was introduced in the early 1990s which has resulted in a dramatic increase in consumption of reduced alcohol beers of less than 3% (Crundall, 1995).

Another Australian trend which has greatly complicated efforts to estimate per capita consumption has been the increasing popularity of spirits sold in 375ml cans pre-mixed with soft drinks. The usual strength of such drinks (e.g. gin and tonic, whisky and coke) has been 5%. Liquor licensing authorities report wholesale sales data of alcoholic drinks such as distilled spirits in litres of the final product. Industry information on spirit sales by volume revealed that the proportion of spirit sales that were pre-mixed increased from 37% to 50% over a four year period in the early 1990s (Stockwell *et al*, 1998).

It should be noted that recent trends have not been entirely in the direction of lower strength beverages. For example, in many countries, particularly the UK, there is a trend away from lower strength ales to higher strength lagers. It can be concluded that whatever methods are employed to estimate typical beverage strengths, these need to be updated at regular intervals if reliable and internationally comparable time series of alcoholic consumption estimates are to be produced.

Unrecorded alcohol production and consumption

A particular difficulty exists in relation to knowing the beverage strengths and serve sizes of unrecorded sources of alcohol. These include illicit importation, legal imports of small quantities for personal use, illicit production, legal home production and production in specialty (“u-brew” or “make your own wine”) stores which assist persons in producing their own beer or wine. Informally produced beverages from local, natural ingredients will almost inevitably result in a different strength beverage every time it is made. In Nigeria, the *palmwine* brought down form the tree in the morning has less alcohol than when it arrives in the market in the afternoon as there has been more time for fermentation to occur.

Allowance may also be desirable in some countries for purchases by visitors for consumption elsewhere. These unrecorded sources of alcohol can only be estimated by conducting representative surveys of the population. These would at least permit an estimate of how comprehensive the government sales data are as a representation of all alcohol consumed in that country and permit the calculation of confidence limits around those estimates. Estimates of the typical strengths of these missing varieties of alcohol clearly require additional data collection exercises. In relation to home-made beverages, this might involve the difficult task of testing samples of home made drinks for actual alcohol content. Unrecorded sources of alcohol tend to be unregulated or under-regulated. Thus public health and other government regulatory agencies have an interest in estimating these sources of alcohol. Consideration might be given to conducting collaborative projects to estimate average volume and alcohol content of unrecorded sources of alcohol and also variations in these. This would enable a more precise estimate of the proportion of total alcohol consumption contained in such drinks.

A methodology for regularly updating estimates of typical beverage strength

Ideally, the best available sources in any country should be tapped for making the most accurate estimate of typical beverage strength, and these estimates should be updated on a regular basis, e.g. annually if at all possible. A range of options for this will be briefly outlined starting with an ideal scenario and then moving on to situations where information is more limited. In each instance, the methodology, however limited, allows for the possibility of replication at regular intervals so as to update estimates as alcohol markets change. It should be borne in mind that these methods are proposed against a background in which demonstrably inaccurate assumptions are applied regarding typical beverage strength. An example of this is in the annual publication ‘World Drink Trends’ which appears to assume that the average strength of beer drunk in Australia in 1996 was about 5% when at least 20% of the Australian beer market comprises low to mid-strength beers (2.5% to 3.5%) and the great majority of popular varieties are just under 5% in strength (World Drink Trends, 1997). The publishers do not divulge details of their conversion factors but have informally advised that they do adjust these assumptions for different countries year by year.

OPTION 1: *Where government information is available on sales of all brands of alcohol.*

This situation only applies in those few remaining countries, e.g. in Nordic countries and in Canada, where government monopolies supply the great bulk of alcohol to the community. These government bodies restrict the range of products, have precise sales data on each one and the actual beverage strengths will usually be listed or otherwise easy to obtain. Typical beverage strength is then simply calculated by the formula:

$$\text{Typical strength} = \frac{\text{Sum(Litres of sales of each brand X its \% alcohol content)}}{\text{Total litres of beverage category}}$$

It should be noted, however, that having precise data about home produced and/or purchased alcohol can also be accompanied by substantial levels of unrecorded production or importation. Sweden is an example of a country with a government monopoly of retail alcohol sales but where high retail prices encourage significant levels of importation of cheaper alcohol from neighboring countries.

***OPTION 2**: Available for countries where major alcohol suppliers collect and make available market share information about leading brands of each beverage.*

A methodology employed in Australia has been to access marketing information collected by multinational alcohol suppliers (Stockwell *et al*, 1998). In this study, a company which wished not to be identified supplied market share information identifying percentage market share of each of 200 leading brands of wine that collectively accounted for over 50% of all wine sold in one State in a year. These data were not current and so were not very commercially sensitive or otherwise valuable financially. The task of identifying the alcohol content of these brands was relatively straightforward. The same formula as under Option 1 was used to estimate typical beverage strength. Clearly the confidence in such estimates will be increased according to the extent of coverage possible for all the brands in each category. Again, cross-border sales and home production were not taken into account.

In some countries, retail chains make sales data available on a regular basis. Increasingly, businesses make computerised records of all sales transactions and distinguish the brand name of all products sold. Stockwell and Honig (1990) accessed a database of the complete annual returns of one large retail chain of liquor stores in Western Australia. Their existing database identified the brand name and container size of every single alcoholic drink they sold (approximately 1500 varieties) each year. It was only necessary to collect by observation the alcohol contents of the market leaders in each beverage category to arrive at estimates of typical beverage strength.

Clearly there are issues here about market coverage and sampling of stores. The confidence of resulting estimates will be increased by improving either the completeness of the coverage of the data (of all stores and all brands) and also the adequacy of the sampling technique. The sampling technique must be capable of replication on a regular basis.

Again it is worth remembering that assumptions about typical beverage strength are often made which are clearly inaccurate and which are then repeated year after year for the sake of comparability. Almost any empirically based approach to deriving this assumption has to represent an improvement even if it falls short of some of the standards outlined in the above options. Thus it may not be possible to conduct a national survey but one of a particular area or region may be possible; sales data may be only available for some beverages and not others; it may only be possible to identify the top three or so brands of a beverage in terms of popularity; a representative household survey may be too expensive but convenience sampling at a busy shopping precinct (e.g. Gual *et al*, in press) could be another alternative. It is recommended that an approach as close as possible to one of the above be adopted and applied consistently so as to reflect the changes in typical beverage strengths that may be occurring over time.

Definitions of standard drinks used in different countries

The interchangeable terms ‘standard unit’ and ‘standard drink’ are important concepts for both alcohol research and other public communication of health information about drinking. We will briefly consider the extent to which international standardisation of the meaning of these terms is possible or even desirable, whether for research or more general communication purposes.

A 'unit' or 'standard drink' of alcohol has become a central concept in alcohol education campaigns over the past two decades in many parts of the world. Whenever advice is given to the public regarding Low Risk levels of use, whether for general health or safety reasons, almost invariably levels of daily and/or weekly alcohol consumption are provided in 'units' of alcohol, 'standard drinks' or just ‘drinks’. Such advice is usually accompanied by an illustration of typical servings of beer, wine, spirits and sherry or port etc which contain approximately the same amounts of alcohol and comprise one 'unit' or 'standard drink'. In different countries, health educators tend to employ different definitions of a standard unit supposedly reflecting typical serving sizes in that country. For example a unit or standard drink in Canada is usually defined as 13.6 grams, in the UK it is 8 grams, in the USA it is between 12 and 14 grams and in both New Zealand and Australia it is thought to be 10 grams of alcohol.

Standard drinks or units of alcohol are also employed by researchers to communicate results of drinking surveys. Turner (1990) analysed the size of these units used in 125 published epidemiological studies. While these were mostly between 9 and 14grams they were also as low as 6 grams, and as high as 28grams in one Japanese study.

For the purpose of estimating actual alcohol consumption whether from survey or sales data, the critical issue is whether the standard drinks employed by either health educators or researchers relate to actual drinking behaviour. Turner’s study (1990) revealed great variation in estimates of standard drink sizes both within and between countries. It cannot be assumed that definitions of standard drinks used in health education campaigns are accurate reflections of what people actually drink. For example, there would appear to be arbitrary decisions made as to whether to define a standard drink of beer as that which is contained in the widely used 12 fluid ounce can or bottle (North America), in a half pint beer glass in the UK (a full pint is more usual) or in standard glass (Australia and New Zealand); a standard drink of wine may be defined as an unrealistically low volume (e.g. as 100ml as in Australia and New Zealand), as unrealistically high (e.g. some US literature) while the amounts actually poured in different countries may or may not be so different; home measures of spirits are particularly likely to be larger than legislated pub measures (Lemmens, 1994, Gual *et al*, in press). These and other relevant studies are discussed briefly below. They underscore the need for using the standard drink concept with great caution when attempting to estimate actual alcohol consumption of populations.

Research on variation in serve sizes and container sizes

Consideration will now be given to the validity of another important assumption that needs to be made in much alcohol research: how large are the 'serves' or glasses of different beverages which people typically drink?

A number of empirical studies have attempted to estimate typical serve sizes used in both private and public drinking settings. Studies of the size of home measures have been conducted in both Holland and Australia. Lemmens (1994) describes a study in which respondents to a household survey were required to pour water into a glass similar to that which they normally used for drinking wine or spirits. It was found that the average amount of spirits poured was 26% greater than the established 'standard drink' quantity, the amount of fortified wine poured was 14% greater while for table wine it was only 4% greater. Carruthers and Binns (1992) also report significant overpouring of wine, beer and spirits in comparison with standard drinks in a similar experiment with 356 Australian drinkers interviewed in their homes. The overpouring was most marked in males and in younger drinkers.

A Spanish study also examined the issue of typical serve sizes of popular drinks across a variety of geographical regions (Gual *et al*). Drinkers were approached in shopping precincts in a variety of localities and asked to pour the size of drinks they normally poured themselves at home. They also collected data on serve sizes used in a variety of licensed premises in each locality. Complicating the issue still further, they report some minor differences between typical serve sizes in private and public settings and some quite marked variations across locality, especially for wine and spirits. Thus geographic and sub-cultural variation appears to be another important variable in some countries.

Two Australian studies have systematically measured the serve sizes of wine on licensed premises. The serve sizes for beer and spirits on licensed premises are standardised by law but wine is not covered by this legislation. A representative survey of 90 Perth bars found that the mean serve size for a glass of wine was 70% higher than the supposed standard and varied up to 250% higher (Stockwell, 1992).

The issue of container size is especially important for drinks such as alcoholic sodas and beers which are usually not drunk from the same container by more than one person (unlike wine or spirits). In North America a 330-350ml beer bottle (12 fluid ounces) is the reference point for a standard drink. One Australian study suggests beer drinkers recall their consumption in terms of the number of small bottles or cans of beer rather than the number of glasses (Stockwell *et al*, 1990).

A methodology for estimating the alcohol content of 'standard drinks' in surveys

Surveys of alcohol consumption invariably assess alcohol using respondents' estimates of the number of 'drinks' of beer, wine, spirits and, sometimes, other alcoholic beverages consumed on recent drinking occasions. In order to convert these 'drinks' into amounts of ethyl alcohol it is necessary to know, a) the typical serve size, and b) the typical alcohol content of the drink concerned.

A country specific approach is required in each case to ascertain the most convenient, comprehensible and accurate method of determining alcohol intake. In essence, a natural history of drinking behaviour needs to be conducted to ascertain common drinking styles with particular attention to serve sizes (if drunk in a glass) and container sizes (if drunk from bottles or cans which are not shared with other drinkers) for different drinking settings. It is important to establish the units of alcohol consumption which are most meaningful to respondents and, sometimes, this will involve providing them with choices. Rather than providing a universal pre-defined set of standard drink sizes, it is recommended that as much information as possible be collected on the following:

- beverage type (including brand) and size of container from which beverage is typically drunk
- alcohol content or strength of the beverage.

In so far as possible, information should also be obtained on the setting in which the alcohol is consumed and on whether the beverage is mass produced or made at home. Some surveys of alcohol consumption do collect data on drinking settings (see Chapter 2.2) and so such estimates could be directly applied to make estimates of volumes of alcohol consumed in each setting. Even when alcohol surveys do not inquire about setting-specific consumption, as is usually the case, making estimates of typical serve size, for example, based on a sampling of only one kind of setting (e.g. licensed premises) would not result in a truly representative estimate. The choices for the types of setting to be investigated need to be pre-determined by preliminary research that identifies the major beverage varieties, serve or container sizes, sources of production and types of drinking settings. For the purposes of making more accurate estimates of alcohol consumption from survey respondents, the variation of serve/container size across drinking setting and beverage type is critical to determine.

To ascertain typical serve size in private settings it is recommended that drinkers be sampled either at home or in public places. They should be asked to indicate typical serve sizes by selecting a glass close in appearance and size to one which they normally use, and to indicate how much alcoholic beverage they normally drink by pouring water into that glass (e.g. see Carruthers and Binns, 1992). In licensed settings, it is frequently the case that some serve sizes are predetermined by law, particularly for spirits. Where this not the case it becomes necessary to conduct field work to determine typical serve sizes. A random selection of licensed premises should be made that is also stratified by main license category (i.e. includes sufficient numbers of restaurants, taverns, nightclubs, cafes etc). Field workers should then visit these premises in order to purchase a sample glass of the beverages of interest. The contents of these need to be poured into a measuring cylinder so that the total number of millilitres of liquid in each serve can be calculated. In the case of beer, it is best to find out the size of glass used and how far they are filled (excluding the 'head' or froth) and to fill the glass up with water to that point and measure that volume.

The above information on typical serve sizes for main beverage varieties can be combined with the information on typical beverage strength (see above) in order to calculate typical alcohol content of different drinks reported in alcohol consumption surveys. These then need to be reported in an internationally standard fashion. We recommend at the very least that units of alcohol consumption are defined in terms of both millilitres and grams of ethyl alcohol. The conversion from millilitres to grams requires application of the constant 0.79 i.e. grams = millilitres X 0.79 (Miller *et al*, 1991). Consideration of the use of 10g 'units' or standard drinks as a means of reporting drinking data is also recommended as an aid to international communication of epidemiological and other scientific research. At present international scientific journals utilise different definitions of typical drink sizes which sometimes results in confusion in readers mind as well as in the reporting of findings in the popular press. At the very least, if terms such as 'units', 'drinks' or standard drinks' are used their size should be defined in terms of grams of alcohol. In the absence of any international consensus it may be preferable to simply report alcohol consumption data in terms of grams of alcohol.

Conclusions

It needs to be stressed, once more, that the methods recommended above for achieving greater precision in the measurement of alcohol consumption are not intended as pre-requisites for conducting national monitoring. This especially true for the situation of starting up monitoring in a developing country where there are no national survey data available and it is necessary to rely on international sources for estimates of per capita consumption.

The methods described here represent ideals for improving the validity of national data collections and hence also their international comparability. There is also a strong case for paying attention to these issues when long time series of data are examined, even for a single country. In essence it is recommended that local information and local knowledge are employed to make the most accurate local estimates of both typical strengths and serve sizes of alcoholic drinks consumed in one country, or in major regional areas of that country. Obtaining this information need not be costly and different methods for different budgets and contexts have been outlined. However, few developed countries have attempted to adjust for these factors systematically and failure to do so should not be regarded as an impediment to starting the system of national monitoring outlined in the previous two chapters.

Researchers in developing countries may still have an interest in attempting to determine typical beverage strengths and serve sizes of different locally available drinks to aid the analysis and interpretation of regional or more local surveys. If reporting international estimates of per capita consumption, it is usually possible to calculate the conversion factors that were used for beer, wine and spirits for any particular country (see Chapter 2.1). Data on volume of beverage as well as estimated volumes of alcohol for each main beverage are generally available and enable the conversion factors to be calculated and compared with locally available data on beverage strengths.

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Section 3:

Measures and indicators of
alcohol-related harms

Chapter 3.1

How to develop indicators of alcohol-related harm from health, police and other official statistics

Summary

In this chapter an outline of several key methods is provided which will be utilised in the next two chapters in relation to mainly long-term and mainly short-term alcohol-related harms. The chapter opens with a discussion of what is commonly seen as a major barrier to monitoring alcohol-related harms: most official sources of data do not record whether or not alcohol was involved in each particular case. A number of solutions to this apparent problem are provided. These include the creation of surrogate measures which comprise sub-sets of such data sets described in terms of time and place of occurrence for which it is known from independent research that there is a high degree of alcohol-involvement. Night-time road crashes and night-time assaults occurring in or near licensed premises are examples.

The major approach described is to estimate the proportion of different types of death, illness and injury that are caused by drinking alcohol. These estimates are made on the basis of international research and local data on the prevalence of conditions and also of drinking at Medium and High Risk levels. Methods for estimating these 'Aetiologic Fractions' (AFs) are described. It is highly recommended that individual countries develop their own research and data sets to develop the most reliable and valid estimates of AFs but some methods are described for combining international estimates of Relative Risk from drinking alcohol with local prevalence data to yield local estimates of alcohol-caused cases. A method for adjusting estimated AF on the basis of annual per capita consumption data is provided – an important adjustment when examining trends in data over time. The advantages for monitoring purposes, of developing composite indicators based on collections of conditions that are variously alcohol specific, of high alcohol causation, medium and low causation plus all conditions combined are discussed.

Finally, two methods are described for estimating the total years of life lost by alcohol-caused conditions, one of which is relatively simple but which may yield an over-estimate and a more complex though accurate method. This chapter provides worked examples and explains some of the technical concepts and methods applied in the next two chapters.

Introduction: the problem of case identification

As mentioned in the Introduction (Chapter 1.1), it is easy to be dismayed at first by the challenge of using official data sources to derive indicators of alcohol-related harm. An apparently insuperable problem is often seen to be the fact that while independent research shows high levels of association between certain problem events and alcohol this fact is rarely noted by official police or hospital case records. One common reaction to this problem, aside from abandoning the enterprise altogether, is to establish routine systems that do attempt to record alcohol's involvement in crime, injury and hospital admissions. Under some unlikely circumstances (especially in developing countries) such as when well-trained staff using strict protocols are available around the clock for this purpose it may be possible to achieve improved records. A commonly reported experience, however, is that even if recording systems contain a specific box for recording if in a nurse or police officer's opinion alcohol was implicated, such information is still recorded incompletely and inconsistently (e.g. Brinkman *et al*, 2000). In reality, the judgement as to whether alcohol caused an injury or criminal event is hard to make, the persons required to make these judgements may apply different criteria and are anyway usually busy dealing with the immediate presenting problem.

Creative solutions

A number of solutions and partial solutions to this dilemma are recommended in this guide.

(i) Concentrate only on the alcohol-specific cases

Firstly, most countries do record limited numbers of alcohol specific cases and conditions. Health statistics provide some of the best examples. The English *et al* review (1995) identifies 12 ICD-9 diagnostic categories which are alcohol specific e.g. alcoholic liver cirrhosis, alcoholic gastritis. One of these, Aspiration, is not always considered to be wholly alcohol attributable e.g. Shultz *et al* (1991) considered 25% of cases alcohol-caused. The equivalents from police and crime data sets would be drunken driving, drunk and disorderly and public drinking offences where these exist. As will be discussed in the next two chapters these types of conditions present their own problems from a measurement point of view e.g. failure to diagnose to protect family members from stigma, changing patterns of law enforcement. It will also be argued that they have their place as part of an overall battery of harm indicators.

(ii) Identify sub-sets of recorded events or conditions which are known to be highly alcohol-related

For the purpose of monitoring trends in problem occurrences as opposed to precise prevalence (the major preoccupation of traditional epidemiology), it is sufficient to routinely identify types of cases which local research has shown to be highly alcohol-related. The classic case is the use of single-vehicle night-time road crashes on road safety research as a proxy measure of alcohol-related crashes (e.g. Holder and Wagenaar, 1993). Independent research has repeatedly shown that in many alcohol consuming countries these are frequently associated with the consumption of alcohol (e.g. Hingson *et al*, 1993). While alcohol’s involvement in many events is rarely if ever reliably recorded the time of occurrence frequently is. In Chapter 3.3 the case is made for the use of night-time occurrences of assaults and emergency room attendances for injury as proxy measures of acute alcohol-related harm. Significant changes in service delivery, police enforcement practices and reporting systems need to be considered, but otherwise such ‘proxy’ or ‘surrogate’ measures also merit a place in a battery of alcohol harm indicators.

(iii) Utilise control indicators of events recorded in same official statistics which are rarely or not at all alcohol-related

Surrogate measures clearly have the potential to be biased by a variety of other factors than alcohol consumption. It is possible to at least partially control for such bias if it is possible to create control variables comprising cases known not to be alcohol-related, or at least only rarely. This approach has been applied in the Northern Territory of Australia, a remote largely rural area with a high Aboriginal population. Morbidity and mortality data were accessed both for alcohol-related conditions and also a set of non-alcohol conditions (Chikritzhs *et al*, 1999). Different trends were observed over the four year study period between the alcohol and non-alcohol related cases suggesting that the reductions observed in alcohol cases were genuine and not due to other spurious factors. Control conditions were also used to make contrasts between low and high alcohol-related road injuries viz day-time weekday injuries versus night-time weekend (and payday) cases.

(iv) Use research data to estimate alcohol's unique contribution to problem events and adjust indicators accordingly

There is an outstanding example of this approach in relation to the development of country or region-specific 'Aetiologic Fractions' (AFs) for health statistics on known alcohol-related causes of death (English *et al*, 1995). The idea is to take all observed cases of morbidity and mortality known to be at least partially alcohol-related and estimate the number that are alcohol related by applying the AF's calculated for each age and gender sub-group. The methods involved are a little complex and the remainder of this chapter will provide some guidance on how to apply this approach to available national statistics on mortality and/or morbidity. The reader is also strongly recommended to read the methods sections in English *et al* (1995) as well as to have ready access to the results sections of that report.

(v) Develop composite indicators

The prevalence of any one condition that is partly caused by alcohol is clearly influenced by variations in other risk factors. Pooling rates of several such conditions after adjusting by AF and creating a composite measure will increase the number of sources of bias but, almost certainly, dampen their overall impact on the indicator since it is usually highly improbable that all will distort the measure in the same direction, ie different biases will tend to cancel one another out. Thus variation in composite measures of alcohol-related conditions will be more likely to reflect the extent to which drinking alcohol is contributing to such harms.

The use of death, injury and illness data to develop alcohol harm indicators

While the adverse health consequences are only part of the total burden of harms borne by alcohol consuming countries, they are also among the most significant and costly. For national and even international monitoring purposes, the use of health statistics to develop indicators of alcohol-related harm are attractive for several reasons:

i Most countries in the world have some form of data on causes of death which apply the diagnostic categories contained in comparable international classifications of diseases (ICD-9, ICD-10, DSM-IVR).

ii In developed countries and some others it is also possible to utilise hospital records of admissions and discharges which, again, almost universally apply standard international classification systems to causes of illness and injury.

iii The existence of the comprehensive review of English *et al* (1995) in which the entire international scientific literature on alcohol and health at that point in time was systematically summarised and analysed. This information provides a methodology and a starting point for estimating the proportions of 38 causes of death, injury or illness proved to be at least partly caused by alcohol. No similar review or methodology has been developed for other major types of alcohol-related harm e.g. for social and personal problems.

The Aetiologic Fraction method for quantifying alcohol-caused morbidity and mortality

The aetiologic fraction or AF is the proportion of the cases recorded in a population with a particular condition that is estimated to be solely caused by a particular risk factor such as, in this context, alcohol consumption after controlling for the confounding effects of demographic variables and other risk factors such as smoking. This varies from country to country as a consequence of a number of factors such as differences in the levels and patterns of drinking.

Estimates of alcohol AFs for disease, injury and death ideally require three primary sources of data: (1) estimates of Relative Risk from meta-analyses of large scale epidemiological studies of drinking at defined levels of intake, (2) estimates of the prevalence of drinking alcohol at these levels in the population of interest and 3) health statistics on the actual number of deaths and hospitalizations for each condition. Estimates of AFs for conditions associated with acute alcohol intoxication (most forms of injury) in practice have been made using a simpler 'direct method' that does not require local survey data on the prevalence of levels of alcohol consumption. Instead, English *et al* (1995) and also Single *et al* (1999) estimate AFs for such causes of injury as road crash and drowning by pooling data from case series studies which have systematically investigated the proportions of such cases known to involve alcohol . Table 3.1.1 presents a list of all health problems that have been attributed to alcohol, categorized by ICD-9 code, with the "aetiologic fractions" (i.e. the proportions estimated to be directly caused by drinking alcohol) according to three major international reviews published to date (English *et al*, 1995; Shultz *et al*, 1991; Single, Robson *et al*, 1999). Table 3.1.1 is further divided into those conditions which are largely caused by the long-term effects of drinking and those mostly caused by short-term effects i.e. episodes of intoxication. When studying this Table the reader is cautioned that English *et al*'s (1995) AFs for partly alcohol attributable conditions tend to be lower because they estimated the risk of Medium/High Risk consumption versus Low Risk consumption whereas the Canadian and US reviews estimated risks for drinkers versus abstainers. The arguments for and against these two approaches are discussed below.

- **How to calculate alcohol AFs for alcohol-related morbidity and mortality**

The calculation of the proportion of illnesses and deaths in a country which are attributable to alcohol depends critically on being able to estimate the increased risk of that outcome which is caused by alcohol consumption at a particular level i.e. the Relative Risk.

Table 3.1.1 Proportion of deaths attributed to alcohol in major reviews of the epidemiological literature from Australia, the USA and Canada

Disorder	**ICD-9 Codes**	**English *et al* (1995)**	**Schulz *et al* (1991)**	**Single *et al* (1999)**
Country		**Australia**	**USA**	**Canada**
Conditions caused mainly by long-term or chronic effects of alcohol consumption				
Respiratory tuberculosis	011-012	not applicable	0.25[1]	not applicable
Lip Cancer	140	not applicable	0.50[3]	added to next entry
Oropharyngeal Cancer	141-143-146 148,149	0.21(m), 0.08 (f)	0.50[3]	0.29(m), 0.15 (f)
Oesophageal Cancer	150	0.14 (m), 0.06 (f)	0.75[3]	0.38 (m), 0.22 (f)
Stomach Cancer	151	not applicable	0.20[3]	not applicable
Colorectal Cancer	153,154	not applicable	0.20[3]	not applicable
Liver Cancer	155	0.18 (m), 0.12 (f)	0.15[3]	0.29 (m), 0.16 (f)
Laryngeal Cancer	161	not applicable	0.50[3]	0.41 (m), 0.26 (f)
Female Breast Cancer	174	0.03 (f)	not applicable	0.04 (f)
Diabetes	250	not applicable	0.05[3]	not applicable
Alcoholic Psychosis	291	1.00 (m & f)	1.00[2]	1.00 (m & f)
Alcohol Dependence	303	1.00 (m & f)	1.00[4]	1.00 (m & f)
Alcohol Abuse	305.0	1.00 (m & f)	1.00[4]	1.00 (m & f)
Epilepsy	345	0.15 (m), 0.15 (f)	not applicable	0.15 (m & f)
Alcoholic Polyneuropathy	357.5	1.00 (m & f)	1.00[4]	1.00 (m & f)
Hypertension	401-405	0.11 (m), 0.06 (f)	0.08[3]	0.05 (m), 0.01 (f)
Ischaemic Heart Disease	410-414	0.005 (m & f)	not applicable	not applicable
Alcoholic Cardiomyopathy	425.5	1.00 (m & f)	1.00[4]	1.00 (m & f)
Supra ventricular cardiac Arrhythmias	427.0, 427.2, 427.3	0.08 (m), 0.05 (f)	not applicable	0.26 (m), 0.13 (f)
Heart Failure	428-429	not applicable	not applicable	0.004 (m),0.002(f)

[1] Age range 35-85 or older.
[2] Age range 15-85 or older.

Table 3.1.1: Proportion of deaths attributed to alcohol in major reviews of the epidemiological literature from Australia, the USA and Canada

Conditions caused mainly by long-term or chronic effects of alcohol consumption(continued)				
Disorder	**ICD-9**	**English *et al* (1995)**	**Schulz *et al* (1991)**	**Single *et al* (1998)**
Country		**Australia**	**USA**	**Canada**
Stroke	430-438	0.14 (m), 0.16 (f)	0.07[3]	0.023 (m), 0.001 (f)
Oesophageal Varices	456.0-456.2	0.54 (m), 0.43 (f)	not applicable	0.388 (m), 0.217 (f)
Pneumonia and influenza	480-487	not applicable	0.05[3]	not included
Gastro-Oesophageal	530.7	0.47 (m & f)	0.10[3]	0.47 (m & f)
Peptic Ulcer	531-534	not applicable	0.10[3]	not included
Alcoholic Gastritis	535.3	1.00 (m & f)	1.00[4]	1.00 (m & f)
Alcoholic Liver Cirrhosis	571.0-571.3	1.00 (m & f)	1.00[4]	1.00 (m & f)
Unspecified Cirrhosis*	571.5-571.9	0.54 (m), 0.43 (f)	0.50[3]	0.54 (m & f)
Cholelithiasis	574	-0.05 (m), -0.02 (f)	not applicable	no cases
Acute Pancreatitis	577.0	0.24 (m & f)	0.42[3]	0.24 (m & f)
Chronic Pancreatitis	577.1	0.84 (m & f)	0.60[3]	0.84 (m & f)
Spontaneous Abortion	634	0.04 (f)	not applicable	0.20 (m & f)
Low Birthweight	656.5, 764, 765	-0.02 (m & f)	not applicable	no cases
Psoriasis	696.1	0.03 (m), 0.01 (f)	no cases	no cases
Ethanol Toxicity	980.0	1.00 (m & f)[4]	1.00[4]	1.00 (m & f)
Methanol Toxicity	980.1	1.00 (m & f)[4]	not applicable	1.00 (m & f)
Road Injuries	E810-E819	0.37 (m), 0.18 (f)	0.42[5]	0.43 (m & f)
Other road accidents	E826,E829	not applicable	0.20[5]	0.20 (m & f)
Water transport accidents	E839-E838	not applicable	0.20[5]	0.20 (m & f)
Air/space transport accident	E840-E845	not applicable	0.20[5]	0.20 (m & f)
Alcohol Bev. Poisoning	E860.0	1.00 (m & f)	1.00[4]	1.00 (m & f)

*Includes both specified and unspecified cases of liver cirrhosis in estimates made by English e*t al* and Single *et al.*

[3] Age range 35-85 or older.
[4] Age range 15-85 or older.
[5] Age range 0-85 or older.

Table 3.1.1: Proportion of disorders attributed to alcohol in major reviews of the epidemiological literature (continued)

Conditions caused mainly by short-term or acute effects of alcohol consumption				
Disorder	**ICD-9**	**English *et al* (1995)**	**Schulz *et al* (1991)**	**Single *et al* (1999)**
Country		**Australia**	**USA**	**Canada**
Other Ethanol Poisoning	E860.1- E860.2	1.00 (m & f)[4]	1.00[4]	1.00 (m & f)
Fall Injuries	E880- E888	0.34 (m & f)	0.35[4]	0.238 (m), 0.152 (f)
Fire Injuries	E890- E899	0.44 (m & f)	0.45[5]	0.375 (m & f)
Accidental excessive cold	E901	not applicable	not applicable	0.25 (m & f)
Drowning	E910	0.34 (m & f)	0.38[5]	0.299 (m),0.227(f)
Aspiration	E911	1.00 (m & f)[4]	0.25[4]	0.25 (m & f
Work/machine injuries	E919- E920	0.07 (m & f)	.25[4]	0.07 (m & f)
Accidents with firearms	E922	not applicable	not applicable	0.25 (m & f)
Suicide	E950- E959	0.41 (m), 0.16 (f)	0.28[4]	0.272 (m),0.168(f)
Assault	E960,65,66,68,69	0.47 (m & f)	0.46[4]	0.27 (m & f)
Child Abuse	E967	0.16 (m & f)	not applicable	0.16 (m & f)
All-Cause Mortality	All of above	0.07 (m), 0.04 (f)	not calculated	0.034 (m & f)

<u>Estimation of Relative Risk (RR)</u>:

1. From cohort studies:

$$RR = \frac{I_e}{I_o}$$

where,

RR = an estimate of the magnitude of the association between exposure and disease, indicating the likelihood of developing a disease in the exposed group relative to those who are not exposed.

I_e = incidence of disease in the exposed group.

I_o = incidence of disease in the non-exposed group.

and where,

$$\frac{I_e}{I_o} = \frac{a/(a+b)}{c/(c+d)}$$

a = the number of individuals who are exposed and have the disease

b = the number who are exposed and do not have the disease

c = the number who are not exposed and have the disease

d = the number who are both non-exposed and non-diseased.

<u>Estimation of Relative Risk (RR)</u>:

2. From case-control studies:

The RR can be approximated by calculating the ratio of the odds of exposure among cases to that among controls using the following formula;

$$OR = \frac{a/c}{b/d} = \frac{ad}{bc}$$

Alcohol aetiologic fractions should estimate total proportions attributable to the misuse of alcohol, rather than just those deaths, illnesses and injuries associated with dependence on alcohol or heavy use. The availability of data to estimate morbidity and mortality is often related to how clearly a death, illness or injury is related to alcohol use. In many cases a death or hospitalisation is definitively recorded in administrative records as due to or related to alcohol consumption. All conditions which are by definition related to substance abuse may be reasonably included in estimates of morbidity and mortality attributable to alcohol, e.g. alcoholic liver cirrhosis, alcohol psychosis (i.e. the AF is 100% or 1.0). For example, all cases of alcoholic psychosis, alcoholic dependence syndrome and alcohol dependence are wholly attributed to the use of alcohol.

For those cases where alcohol is only a partly contributing cause, the extent to which a particular consequence can be attributed to the use of alcohol varies according to setting, both for epidemiological reasons and due to variations in the institutional arrangements for dealing with adverse consequences. Thus, for example, the apparent proportion of all liver cirrhosis which can be attributed to alcohol is influenced not only by the risk of developing cirrhosis at a given level of consumption and the rate and patterns of alcohol consumption in a society, but also by the incidence of cirrhosis not caused by alcohol, the availability of treatment and the reporting practices of health authorities.

For those conditions where alcohol consumption is a contributory cause, there are two methods for assigning an Aetiologic Fraction (or AF).

(i) Calculation of AFs by the direct method

The first and most straightforward method is to directly attribute alcohol use on the basis of case series studies in which alcohol's involvement is systematically investigated either by BAC or self-reported drinking prior to injury event. For some causes such as alcohol-related impaired driving injuries and fatalities, special case series studies are required to estimate the proportion of total traffic injuries and deaths which may be reasonably attributed to alcohol use. The findings of these studies are country-specific, i.e. it would generally be difficult to apply the results to another society unless it could be claimed the two settings are very similar, e.g., with respect to road conditions, vehicle use patterns and alcohol consumption. A Table is provided in Chapter 3.3 that identifies the countries from which English *et al*'s (1995) pooled estimates of AFs by the direct method were conducted (Table 3.3.2). It is recommended that countries develop the capacity to estimate their own AFs on the basis of local case series studies and use such data whenever possible. Failing that a judgement may be made as to whether the countries used by English *et al* (1995) for their pooled estimates are sufficiently similar in terms of other prevailing risk factors for the type of injury in question and drinking prevalence to apply directly.

(ii) Calculation of AFs by the indirect method

It should be noted that the 'direct' method above is essentially based on a series of uncontrolled (though careful) observations and investigations of case series. There is an implicit assumption that the presence of significant amounts of alcohol (e.g. BACs in excess of 0.05%) is invariably associated with direct causation. Clearly these will always result in over-estimates of alcohol's contribution to some degree. The second and most preferred method (where the required data exist) for estimating an AF where alcohol is a contributory but not sole cause of morbidity or mortality is the 'indirect' method whereby estimates of the Relative Risk of particular disorders for different levels of alcohol use are combined with prevalence data on the number of persons consuming at different levels of use. This method is generally applied to conditions partly caused by the effects of long-term consumption, mostly diseases. Ideally, Relative Risk estimates should be based on cohort, case-control or cross-sectional prevalence studies which link long-term patterns of alcohol use with the development of particular diseases.

To calculate AFs by this indirect method the following formula should be used when the exposure variable represents a dichotomy (ie abstainers versus all drinkers):

$$AF\,p = \frac{p_e(RR-1)}{p_e(RR-1)+1}$$

where,

***AF**$_p$* = estimated population alcohol aetiologic fraction for the population of interest.

***p**$_e$* = the estimated prevalence of alcohol consumption in the population of interest (age and sex specific).

RR = Relative Risk or an estimate of RR, the likelihood of developing a specific condition in the exposed relative to the unexposed population (often sex specific).

Where the exposure variable involves more than two categories categorical (e.g. abstainers, low, medium and high level consumption, as in English *et al*., 1995) the following formula should be applied:

$$AF_i = \frac{p_i(RR_i-1)}{\sum_{i=0}^{k} p_i(RR_i-1)+1}$$

where,

i=0 = is the baseline category (non-exposed)

***AF**$_i$* = population aetiologic fraction for a particular category of exposure i (e.g. hazardous, harmful),

***P**$_i$* = the estimated prevalence of the ith category of exposure in the total population,

***RR**$_i$* = the Relative Risk (or estimate of Relative Risk), for the ith category of exposure to the reference category.

Where the exposure variable is categorical the aetiologic fraction due to all other categories of exposure is simply the sum of the partial aetiologic fractions.

Again, following English *et al* (1995) separate AFs should be calculated for both men and women, for both Medium and High Risk (where separate RRs exist) alcohol use and for different age groups of drinkers. Tables have been provided in Chapter 3.2 reproducing the latest available RRs for conditions caused by long-term alcohol use calculated by Single *et al* (1999) on the basis of sound international studies available when that review and meta-analyis was conducted. As will be explained in that chapter, in the main, liver cirrhosis presents the only major problem regarding transferability of RR estimates for countries where there are other common causes of this disease - such as tropical conditions and hepatitis. These calculations are not demanding but are numerous and spread-sheets need to be created carefully to cope with the large volume of information.

A worked example for Mexico

It is desired to calculate the alcohol AF of liver cancer for men aged 25 to 29 in Mexico where national survey data show that prevalence of abstinence is 25%, Low Risk drinking is 56%, Medium Risk drinking (on average 20 to 39g every day) is 11% and of High Risk drinking to be 8% of all men in that age group. Referring to Table 3.3.1 in the next chapter, and using abstainers as the reference group (RR=1), the RRs for liver cancer are; 1.45 for Low Risk drinkers, 3.03 for Medium Risk drinkers and 3.60 for High Risk drinkers. Applying the formula for AFs above (converting the percentage prevalence figures to proportions) yields estimates of AFs for the various consumption levels (contrasted against abstainers):

Liver cancer AF for Low Risk male drinkers aged between 25 and 29 years;
= [(0.56*(1.45-1))]/[((0.25*(1-1)) + (0.56*(1.45-1)) + (0.11*(3.03-1)) + (0.08*(3.6-1))) + 1]
= 0.15 or 15%

Liver cancer AF for Medium Risk male drinkers aged between 25 and 29 years;
= [(0.11*(3.03-1))]/[((0.25*(1-1)) + (0.56*(1.45-1)) + (0.11*(3.03-1)) + (0.08*(3.6-1))) + 1]
= 0.13 or 13%

Liver cancer AF for High Risk male drinkers aged between 25 and 29 years;
= [(0.08*(3.60-1))]/[((0.25*(1-1)) + (0.56*(1.45-1)) + (0.11*(3.03-1)) + (0.08*(3.6-1))) + 1]
= 0.12 or 12%

The aetiologic fraction due to all categories of exposure using abstinence as a reference point is approximately 40% (15% + 13% +12%).

In other words it is estimated that of all cases of liver cancer involving Mexican men aged 25 to 29 years, about 15% are caused by Low Risk drinking, 13% by Medium and 12% by High Risk alcohol consumption.

Had it been desired to calculate AFs using Low level of consumption as the reference group, the respective Relative Risk estimates for Medium and High Risk drinkers would have been 2.09 (ie, 3.03/1.45) and 2.48 (ie, 3.60/1.45).

Unless there are compelling reasons to rely on a single study (e.g., if that study is particularly robust, has a large sample and was conducted in the country under investigation), the Aetiologic Fractions are generally based on pooled estimates of Relative Risk rather than relying on single studies. For some causes of disease and death, whenever there are available studies to permit this, separate estimates of the Relative Risk of morbidity and mortality should be calculated.

(iii) (iii) Adjustment of AFs using per capita consumption data

Many countries especially from the developing world will not have access to regular national survey data on patterns and levels of alcohol use. When it is desired to monitor alcohol-related mortality and/or morbidity over time in one country, it is possible to make some adjustment to AFs on the basis of annual per capita consumption data. For this purpose it is necessary to have estimates of AF by age and gender for at least one year which are considered to be reliable. Usually this will mean they have been estimated by the indirect method or from local case series data. Reliable per capita consumption data are required for the year that the survey prevalence estimate pertains and then for all other years for which estimates of alcohol-related mortality and morbidity are needed. A formula has been developed for this purpose by Chikritzhs *et al* (1999):

$$AFx = \frac{((F * AF_{ref}) + AF_{ref})}{(((F * AF_{ref}) + AF_{ref}) + (1 - AF_{ref}))}$$

where,

AF_x = estimated population alcohol aetiologic fraction for the population of interest.

AF_{ref} = population aetiologic fraction for reference year

F = change factor in per capita consumption from reference year to year of interest

for,

$$F = \frac{(PCC_{ref} - PCC_x)}{(PCC_{ref} * -1)}$$

where,

PCC_{ref} = per capita consumption for reference year (ie, 1989/90 if applying English *et al* (1995) AF estimates)

PCC_x = per capita consumption for year of interest

Adjusting alcohol AFs with annual per capita consumption data: a worked example for the Northern Territory, Australia

In 1992, the alcohol AF for assault in Australia was estimated by English *et al* to be 0.47. That year in the Northern Territory per capita consumption was 17 litres per adult per year. A time series analysis is required on data on assault injuries between 1980 and 1999 and per capita consumption data are available for each of those year. To illustrate application of the formula, estimated alcohol AF for 1993 in the Northern Territory when per capita consumption fell to 15 litres, results in an estimated alcohol AF:

$$AF_{NT,1993,Assault} = ((-0.117*0.47)+0.47)/(((-0.117*0.47)+0.47)+(1-0.47))$$
$$= 0.439 \text{ or approximately } 44\%$$

The calculation of population rates of alcohol-related harm

For most monitoring and epidemiological purposes, it is desirable to calculate population rates of problems of interest to enable direct/comparisons across time and place allowing for simple changes in population. It is advisable to use the "population at risk" (ie drinkers) rather than total population for the calculation of these rates. For most countries, where adults consume the vast majority of alcohol, it is best to base rates of alcohol-related harm on the estimated population aged 15 years of age or more (e.g. cases per 10,000 adult persons). Alcohol-related health problems do affect a small number of children from their own or, more usually, other people's consumption. Most adverse health outcomes affect drinkers themselves and an artificially low rate of problems is created by including what, particularly in developing countries, is a large proportion of the population that is relatively unaffected by these conditions. In addition, when making comparisons of rates whether over time or place, it is strongly recommended that age-standardisation is applied to correct for differences in age distributions in populations of interest. For example, countries with a large proportion of persons aged over 65 years tend to have lower rates of alcohol-related problems per total population since consumption in this age group tends to be low. Procedures for conducting age-standardisation are described in most basic epidemiological text books (e.g. Hennekens and Mayrent, 1987).

Abstinence or Low Risk drinking as the base for estimates of Relative Risk?

It should be noted that the Relative Risk estimates quoted in Tables 3.2.1 and 3.3.1 are all calculated using zero consumption (abstinence) as the reference point. That is because the Single *et al* (1999) study from those estimates were designed to estimate the overall economic costs of alcohol and other drugs in Canada. The English *et al* (1995) review used Low Risk consumption as the reference point for Relative Risk estimates. It is simple to convert the former to the latter: the Medium and High Risk RRs against abstinence are divided by the RR for Low Risk drinking. In the example of young Mexican drinkers above and liver cancer the Medium and High consumption RRs are divided by 1.45 – the Low Risk RR. This yields new estimates of RRs of 2.09 (Medium) and 2.48 (High) and, as mentioned above, an estimated AF of 21.3%.

There are arguments for and against using either reference point. Low Risk drinking does in fact carry an elevated risk of death and illness for some conditions e.g. breast cancer. However, Low Risk drinking is also thought to be associated with protection against ischaemic heart disease. The latter is such a major cause of death in developed countries that some calculations estimate that more lives are saved than lost. Against using abstinence as the yardstick against which to compare risk of morbidity and mortality is the argument that Low Risk drinking is normative in some countries (at least by overall volume if not by pattern) and abstainers, being in the minority, may have other additional risk factors. Furthermore, it can also be argued that Low Risk drinking is the major public health goal for the prevention of alcohol-related harm and should therefore be the standard against which to compare risks of illness and death. Including estimates of lives saved from Low Risk drinking may also sometimes be misinterpreted as implying that all alcohol consumption is healthy. These arguments also illustrate the value of calculating Person Years of Life Lost (PYLLs, see below) and Disability Adjusted Life Years (DALYs) to move beyond simple counting of numbers of deaths. These measures make clear that the overall human costs of Medium and High Risk alcohol consumption greatly outweigh the benefits.

Two recommendations are made here: (i) that it is always made very clear which method is used to facilitate comparisons and avoid confusion (ii) where abstinence is used as the reference point estimates of lives saved and lives lost are kept quite separate. A net of lives saved or lost overlooks both sides of the equation and the fact that quite different drinking patterns almost invariably underlie both the apparent health benefits and the very real health costs (iii) where possible estimates of PYLLs or DALYs are made.

The value of using composite alcohol harm indicators

A further issue to consider in the application of these epidemiological methods to the task of monitoring trends over time is the extent to which the variance in levels of a particular condition is likely to be due to causes other than alcohol. For example, only 4% of cases of breast cancer were estimated by Single *et al* (1999) to be alcohol-related i.e. an Aetiologic Fraction of 0.04. This means that 96% of the total variance is explained by other causes and so trends in estimated breast cancer prevalence using the Aetiologic Fraction approach could not be reliably attributed just to variations in Medium and High Risk drinking – even if actual variation in prevalence of Medium and High Risk drinking is taken into account. There are two approaches recommended for tackling this measurement issue.

Firstly, it is recommended that data on alcohol-related mortality and morbidity are categorised according to the size of the estimated Aetiologic Fractions. This has been done in Table 3.2.1 for mainly long-term conditions and Table 3.3.1 for mainly short-term conditions in the next two chapters. Thus in each case conditions are divided into alcohol specific conditions (AFs = 1.0), high alcohol causation (AFs >0.49 and <1.0), medium alcohol causation (AFs >0.24 and <0.5) and low alcohol causation (AFs >0 and <0.25). Clearly this particular measurement problem is less serious when AFs are higher and trends in these data should be interpreted accordingly with more weight placed on conditions which are more highly alcohol-related. One disadvantage of some of the alcohol specific conditions, is that some are likely to be under-reported because of the stigma attached to alcohol problems in most societies. As a consequence it also useful to examine the medium and high alcohol causation conditions which are much less likely to be influenced by such biases.

Secondly, it is recommended that ‘composite’ measures are created from several diverse alcohol-related conditions on the basis that the sources of variance in these data other than from alcohol will be unlikely to be constant and so a composite measure is more likely to reflect genuine underlying trends in alcohol-related harm. Such composite measures can be made up from collections of conditions with low, medium, high and total alcohol causation and trends in these observed and compared. Again more weight should be given to trends displayed by the higher alcohol causation categories. Consistent trends across different categories would, by the principle of triangulation, be the strongest evidence of a genuine underlying trend in alcohol-related mortality and morbidity.

The impact of converting from ICD-9 to ICD-10

Increasingly countries are converting over to the latest version of the International Classification of Diseases, ICD-10. It is important to realise that the data presented here and estimates of RRs and AFs for various countries have all been based on diagnostic categories defined by ICD-9. There are important differences introduced by ICD-10 which limit the transferability of some of the information presented here but also, from a monitoring point of view create some advantages as well.

In order to facilitate use of the information provided here a conversion Table has been created and can be found in Annex 6[6]. It will be seen that while a straightforward translation from ICD-9 to ICD-10 is possible, there are many instances where, due to the creation of new disease classifications and codes, this results in an incomplete set of ICD-10 codes for some alcohol-related conditions. An additional complication is that WHO records suggest that 131 out of 191 countries using ICD only utilise the first three digits of the codes thus losing much information on specific types of condition. Table 3.1.1 provides ICD-9 codes and it will be seen that while some only require 3 digits to fully identify the reference condition, others require a 4th digit e.g. 570 for all liver cirrhosis versus 570.3 for alcoholic liver cirrhosis. In ICD-10 all types of alcoholic liver disease are denoted by the three digits K70, however it is not possible to identify all categories of liver cirrhosis per se (all cases) without having a fourth digit available. The advantage at least is that cases of alcoholic liver disease are identified with only 3 digits which, as discussed in the next chapter, is useful for monitoring purposes.

[6] Readers are alerted to the fact that further work is underway in determining optimal conversion methods and an update can be obtained from the National Alcohol Indicators Project team based at the National Drug Research Institute, Curtin University, Western Australia, 6845, Australia. Fax: +61 8 9486 9477; email tim@ndri.curtin.edu.au.

Estimating years of life lost due to premature death: Person-Years of Life Lost (PYLL)

Once numbers of alcohol-caused deaths have been identified for each specific alcohol-caused condition, (through the application of condition specific aetiologic fractions), it is possible to estimate the amount of time lost (in years) to people who died prematurely due to High Risk alcohol consumption. This is recommended as a highly impactful way of estimating alcohol's contribution to premature mortality. A particular advantage is that it accommodates the fact that some alcohol caused conditions result in deaths of young people e.g. most causes of injury, while others reduce life expectancy in later years.

Several different statistical methods have been devised which attempt to estimate loss of life-years due to premature death, most of which have their shortcomings. The simplest of these methods, and the easiest to conceptualise, merely involves subtracting the age at which a person died, from an estimate of average life expectancy applicable to the population of interest The formula provided in the Global Burden of Disease by Murray and Lopez (1996) for the straightforward calculation of years of prematurely lost life has been presented below and is referred to here as APYLL (approximate person-years of life lost). $APYLL = \sum_{x=0}^{L} d_x(L-x)$

where,

$APYLL$ = approximate number of years of life lost due to premature death.

L = an arbitrary limit to life.

d_x = the number of deaths in a population at each age.

Source: Murray and Lopez (1996)

Unfortunately, this straightforward method ultimately overestimates life-years lost because it does not take into account the fact that at any age, individuals always face some risk of death and that risk of death varies with age. Essentially, had they not died, people who succumb to alcohol-caused death prior to reaching old age, would in any case, have faced the possibility of death from other causes, that is - there remained a level of residual mortality. The likelihood of a person surviving to reach average life expectancy also varies depending on the time period during which the individual was born and on the sex of the individual.

Therefore, in order to obtain a realistic estimate of person-years of life lost (PYLL) it is necessary to utilise a method of calculation that incorporates the use of current life tables. One such method is that described by Hakulinn and Teppo (1976), and derived from Chiang's (1961, 1968) original approach. This was also the method used by Holman *et al* (1990) and English *et al* (1995) to calculate PYLL and is the method of choice as outlined below.

Employing a life table method for calculating PYLL requires several assumptions about causes of death:

1) Individuals are subject to a number of mutually exclusive and competing causes of death which act as independent risks.
2) The average time (t) that a person dying in a particular age interval will live in that interval is not altered by elimination of a cause of death, that is, the rate of change of the death rate with age is assumed to remain constant.
3) The probability of dying before t is equal to the probability of dying after t in the relevant age interval.
4) A person "saved" at t and dying in the same age interval, dies on an average at the middle point of the remainder of the interval (Holman *et al* 1990).

In order to calculate PYLL, alcohol-caused deaths (ie crude numbers of alcohol-related deaths which have been multiplied out by alcohol aetiologic fractions) must first be arranged into five year age groups beginning at 0-4 years and presented separately for males and females. The maximum age group to include in the calculation of PYLL may vary but should generally reflect average life expectancy in the region of interest. For instance, past research estimating PYLL due to alcohol-caused death in Australia have included all deaths occurring up to age 70 years, ie. the maximum age group included in PYLL calculations was 65-69 year olds (Holman *et al* 1990, English *et al* 1995). At the time, this was sufficient since the average life expectancy in most developed countries was around 70-74yrs. However, as gains in average life expectancies are made, it may be preferable to include older age groups.

A further consideration in determining which ages should contribute to estimates of premature mortality is whether to include persons aged between 0 and 15 years of age. Deaths occurring among children and infants due to alcohol misuse generally only contribute to a very small proportion of all alcohol-cause deaths, but due to the fact that such deaths occur at a very young age, the resultant PYLL may be large by comparison. While not a problem in itself, when PYLL are used to rank causes of death by the level of burden they place on a community, causes mainly affecting only children and infants (e.g. low birth weight) may be weighted disproportionately to those affecting middle aged and young adults. For this reason, some researchers prefer to ignore deaths occurring before the age of 15 years, ie age categories 0-4yrs,5-9yrs,10-14yrs and thereby calculate PYLL for deaths between 15 and 69 years (or whatever the upper limit may be) (Holman and Shean 1986).

Estimates of premature mortality are quite flexible in that they can be calculated for individual conditions, for "all cause" mortality or for any combination of conditions. However, it should be noted that once PYLL have been derived for individual conditions they cannot be added together. For example, in order to estimate PYLL due to all causes of alcohol-caused mortality, the total number of sex and age group specific deaths (adjusted by alcohol aetiologic fraction) must first be summed and then applied to the relevant formula. The reason for this is because PYLL calculated for two or more conditions, when analysed as a group, always exceed the sum of the individual PYLL calculated for each condition separately. This arises because the more causes of death that are removed the lower the residual mortality - or risk of dying from other conditions becomes. As the residual mortality declines, the PYLL that are ascribed to the combined set of conditions are increased.

The formula for calculating PYLL is shown in Annex 7. Notably, the formula is numerically complex and requires a spread sheet application. In their 1995 publication, English *et al* utilised computer software specifically developed for the project by Dr Jim Codde of the Western Australian Health Department to estimate PYLL based on the life table method. Codde has since adapted this program and created the Rates Calculator software (1999). Calculations for PYLL are currently based on the latest available life tables suitable for an Australian population, however it is possible to substitute alternative life tables where necessary.

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Chapter 3.2

Indicators of problems mainly attributable to long-term use of alcohol

Summary

In this chapter the approaches described in Chapter 3.1 are applied to problems and conditions that are mainly caused by the long-term effects of Medium and High Risk alcohol use.

Evidence for the association between sustained high levels of alcohol intake and a number of major conditions is briefly reviewed for liver disease, mental health problems, effects of maternal alcohol use on the unborn child, cancers, cardiovascular disease and a range of other conditions.

A summary of estimated Aetiologic Fractions derived three major reviews is provided in Table 3.2.1 as an indication of the size of alcohol's contribution to these problems in developed countries. While no equivalent data are available for other countries, the estimates of Relative Risk provided in Table 3.2.2 are mostly 'transportable' to other countries given both the international spread of studies reviewed to make the estimates and that basic physiological effects of alcohol underlie the observed associations. Problems exist in relation to transposing Relative Risk estimates, however, for some cancers that are also associated with smoking and also for liver cirrhosis for countries with high rates of liver disease caused by Hepatitis B and C.

Issues regarding the measurement and monitoring are considered for each major group of conditions considered. Survey measurement of rates of alcohol dependence and of personal and social problems are also considered. Recommendations are provided for applying this information for national alcohol monitoring in countries with different levels of available resources.

A long-standing concern in alcohol epidemiology has been with the relationship between levels of long-term exposure, over several or many years, to the toxic effects of alcohol and the risk of a variety of illnesses. A related tradition in psychiatric epidemiology has been with prevalence of alcohol dependence (previously referred to more loosely as "alcoholism") and High Risk alcohol use. Developments in alcohol epidemiology now enable a more complete picture of alcohol's overall contribution from long-term consumption patterns to the full range of human illness and social problems, though it is a picture which still needs some features drawn in more precisely.

The primary focus of this chapter will be on the long-term consequences of alcohol consumption on health. It has been discussed in Chapter1.1 how alcohol-caused injury and illness contribute greatly to overall disability in social, psychological, physical and occupational spheres. The methods used to estimate this impact in terms of Disability Adjusted Life Years (DALYs) in the "Global Burden of Disease" study (Murray and Lopez, 1996) were applied to 8 major regions of the world and are difficult to apply to individual countries outside of those with established market economies. There will, however, be discussion of the use of survey instruments for the measurement of alcohol dependence and also various personal and social problems caused by alcohol.

It would be impractical to review in detail the evidence linking alcohol use at different levels to the risk of an individual contracting a particular illness. Instead in this chapter, the evidence will be briefly summarised regarding the main conditions to have been identified in the recent major reviews. These are considered under the following headings: cirrhosis of the liver, alcohol-related mental health problems, fetal alcohol syndrome, cancers, cardiovascular disease, other chronic conditions and composite measures of all of these. In relation to each condition, consideration will be given to the possibilities for epidemiological monitoring of the prevalence of cases. For each type of condition considered it is important to bear in mind that it is recommended that only data on the main cause of hospital admission or of death is utilised. It is usual for other contributing causes to be identified on death certificates and in hospital records, however the main epidemiological reviews that have been used to estimate Relative Risks and which are quoted in this guide have relied on principle diagnosis alone. One good reason for this is that while this method results in a conservative estimate of alcohol's contribution to morbidity and mortality, the secondary or contributory diagnoses are known to be only inconsistently recorded.

It is recognised that mortality data are available in most countries of the world but that data on morbidity are only recorded reliably in developed countries. In many cases, therefore, reliance will need to be made on mortality data alone.

While this and the next chapter have divided conditions designated as being related mainly to the long-term (Chapter 3.2) and short-term (Chapter 3.3) consequences of drinking alcohol, it is important to note that there are some conditions for which this distinction becomes blurred in that they are caused by a combination of these patterns of drinking. This is likely to be true of suicide which is categorised here as mainly a short-term consequence of drinking, though there is known to be a complex link between heavy regular drinking and the experience of depression. It is also true of strokes the risk of which is contributed both by single episodes of intoxication and also sustained heavy drinking. Despite these important exceptions, the decision to consider them separately is to emphasise the important and separate contributions to alcohol-related harm of the two main High Risk patterns of drinking alcohol: drinking to intoxication and sustained intake over many years.

The use of alcohol-related mortality and morbidity estimates for national monitoring

To date the main studies discussed in this guide have been used to make careful estimates of the total prevalence and costs to one country in a designated year from alcohol-related mortality and morbidity (i.e. English *et al*, 1995; Single *et al*, 1996). It is proposed in this guide that national alcohol policy units begin the somewhat different task of continually updating these estimates yearly, or even more frequently, as part of a comprehensive national monitoring exercise.

In order to apply these estimates to compare levels of harm across time it becomes highly desirable to update estimates of the prevalence of Medium or High Risk drinking in the population of interest via regular population surveys. As explained in Chapter 3.1 estimates can be made of the proportions of cases observed for conditions which are sometimes by calculation of the alcohol Aetiologic Fractions. The calculation of these Aetiologic Fractions includes an estimate of the prevalence of Medium and High Risk drinking (as defined here – see Chapter 2.3) and hence this should be updated as frequently as is practical. In most countries, reliable population surveys with adequate sample sizes will not be conducted annually. It is recommended, therefore, that survey data are supplemented with annual per capita consumption data to adjust survey prevalence estimates for each time period of interest (see chapter 3.1 for a worked example). Examples of alcohol Aetiologic Fraction estimates for chronic alcohol conditions are provided in Table 3.2.1 for one country (Canada) for one year (1992) for purposes of illustration. Of more general utility in the same Table is the summary of Relative Risk estimates for partly alcohol-caused conditions used by Single et al (1996) based on an extensive review of published literature. As will be discussed further, arguably these are relatively 'transportable' for most conditions to other countries and for other times.

Prior to recommending how to develop effective national indicators, important individual conditions associated with long-term alcohol use will be discussed in turn.

Diseases of the liver

Prevalence of alcohol-related cases

Cirrhosis is a chronic disease of the liver characterised by an increase in the connective tissue and alteration in gross and microscopic make-up. Deaths from liver cirrhosis have long been used as the primary measure of the rate of severe alcohol-related health problems or of the proportion of high consumers in populations from alcohol consuming Western countries, and also for comparisons between such countries (Bruun *et al*., 1975; Edwards *et al*., 1994).

Table 3.2.1: Relative Risks and Aetiologic Fractions Associated with Conditions mostly caused by effects of long-term alcohol use (chronic), for Canada, 1992 (compared to abstainers)

Cause of disease or death:								Aetiological Fractions as				
		Low Risk		Medium Risk		High Risk		Mortality		Morbidity		Age
Alcohol-related Conditions:	ICD-9	M	F	M	F	M	F	M	F	M	F	Range
Alcohol specific causation:												
Alcoholic Psychoses	291	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.000	1.000	1.000	1.000	0+
Alcohol Dependence Syndrome	303	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.000	1.000	1.000	1.000	0+
Alcohol Abuse	305.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.000	1.000	1.000	1.000	0+
Alcoholic Polyneuropathy	357.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.000	1.000	1.000	1.000	0+
Alcoholic Cardiomyopathy	425.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.000	1.000	1.000	1.000	0+
Alcoholic Gastritis	535.3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.000	1.000	1.000	1.000	0+
Alcoholic Liver Cirrhosis	571.0-571.3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.000	1.000	1.000	1.000	0+
Excess Blood Alcohol	790.3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.000	1.000	1.000	1.000	0+
Medicolegal Blood Exam alc/dr	V70.4	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.000	1.000	1.000	1.000	0+
Screening for Alcoholism	V79.1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.000	1.000	1.000	1.000	0+
High alcohol causation:												
All Liver Cirrhosis	571.0-571.9	1.26	1.26	9.54*	9.54*	9.54*	9.54*	0.540	0.430	0.540	0.430	15+
Noxious Influences via	760.7	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.500	0.500	0.500	0.500	0-4
Pancreatitis, chronic	577.1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.840	0.840	0.840	0.840	15+
Medium alcohol causation:												
Lip & Oropharangyeal Cancer	140-141, 143-146, 148-149, 230.0	1.45	1.45	1.85	1.85	5.39	5.39	0.295	0.152	0.297	0.163	15+
Oesophageal Cancer	150, 230.1	1.80	1.80	2.37	2.37	4.26	4.26	0.379	0.216	0.381	0.220	15+
Liver Cancer	155, 230.8	1.45	1.45	3.03	3.03	3.60	3.60	0.289	0.161	0.294	0.172	15+
Laryngeal Cancer	161, 231.0	1.83	1.83	3.90	3.90	4.93	4.93	0.411	0.256	0.415	0.273	15+
Specific Cardiac Dysrhythmias	427.0, 427.2-427.3	1.51	1.51	2.23	2.23	2.23	2.23	0.265	0.133	0.280	0.155	15+
Oesophageal Varices	456.0-456.2	1.26	1.26	9.54	9.54	9.54	9.54	0.388	0.217	0.416	0.282	15+
Gastro-oesophag. Lac.-Haemorrhage	530.7	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.470	0.470	0.470	0.470	15+
Low alcohol causation:												
Hypertension	401-405	1.02	0.85	1.43	1.27	2.05	1.79	0.048	0.009	0.053	0.013	15+
Breast Cancer	174, 233.0	n.a.	1.09	n.a.	1.31	n.a.	1.68	n.a.	0.039	n.a.	0.042	15+
Epilepsy	345	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.150	0.150	0.150	0.150	15+
Heart Failure and Ill-defined	428-429	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.004	0.002	0.011	0.007	15+
Stroke	430-438	0.60	0.58	0.92	0.48	1.79	1.32	0.023	0.001	0.025	0.002	15+
Pancreatitis, acute	577.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.240	0.240	0.240	0.240	15+
Spontaneous Abortion	634	n.a.	1.20	n.a.	1.76	n.a.	1.76	0.020	0.020	0.020	0.020	15-49
Poor fetal growth during pregnancy	656.5	n.a.	0.89	n.a.	1.62	n.a.	1.62	n.a.	n.a.	n.a.	n.a.	15-49
Psoriasis	696.1	1.58	1.58	1.60	1.60	2.20	2.20	n.a.	n.a.	0.303	0.183	15+
Effect of Spontaneous Abortion	761.8	1.20	1.20	1.76	1.76	1.76	1.76	0.020	0.020	0.020	0.020	0-<1
Slow Fetal Grwth/Low Brthweight	764-765	0.89	0.89	1.62	1.62	1.62	1.62	0.000	0.000	0.000	0.000	0-<1

*NB Separate Relative Risk estimates applicable to Medium and High Risk drinking are not available

There is no doubt that the risk of liver cirrhosis increases with increasing levels of alcohol consumption. Chronic excessive alcohol use is the most frequently cited cause of illness and death from liver disease and long-term heavy drinkers are over-represented in cirrhosis cases. The International Classification of Diseases (both 9th and 10th editions) distinguishes between cirrhosis directly attributed to alcohol (alcoholic liver cirrhosis) and cirrhosis which may or may not be attributed to alcohol (unspecified liver cirrhosis). In ICD-10 all K70 conditions are types of specifically alcoholic liver diseases and K70.3 is alcoholic liver cirrhosis. ICD-9 requires a fourth digit to identify alcoholic liver cirrhosis and also unspecified liver cirrhosis. Greatly varying estimates are available regarding the proportion of cirrhosis deaths without specific mention of alcohol that may be attributed to alcohol. Clearly it cannot be assumed that all cirrhosis cases are due to alcohol. The review by Shultz *et al* (1991) estimated that 50% of unspecified liver cirrhosis cases in the US were due to alcohol while the English *et al* (1995) review concluded that 54% of unspecified cirrhosis in males and 43% of such cases among females in Australia could be attributed to alcohol. However, this estimate will not apply to all countries, especially where many cirrhosis deaths are caused by viral infections and where alcohol consumption is relatively low. For example, it has been estimated that only 7.6% of liver cirrhosis in China is caused by drinking alcohol (Zhou Shisi, 1984). Conversely, in some countries much higher estimates have been made of alcohol AFs for liver cirrhosis, such as 90% in Finland (Mäkelä, 1999). It is unclear the extent to which this difference is due to the relative absence of other causes of cirrhosis, different drinking patterns or recording requirements in that country (e.g. death certificates are not public documents in Finland which may eliminate one reason for under-reporting – protecting family members from social stigma).

Liver cirrhosis is a significant cause of death in many countries. In Finland between the years of 1987 and 1993, alcoholic liver diseases accounted for 13.9% of alcohol-caused deaths (Mäkelä *et al*, 1997). In Canada during 1992, alcoholic liver cirrhosis contributed to 14.3% of all alcohol-caused deaths and 6% of hospitalisations. It is the second largest cause of alcohol-related death in that country. During 1999, alcoholic liver cirrhosis was the single largest cause of alcohol-related death among Australian men and the second most common cause of death among women (Chikritzhs *et al* 1999).

Measurement issues

It generally takes a long period of high alcohol consumption for an individual to develop liver cirrhosis, and most high consumers do not develop this disease, for unknown reasons. In spite of this, rather rapid changes have been found in the rates of liver cirrhosis mortality when per capita alcohol consumption has changed. This is because, at any given time, there are subjects with liver cirrhosis of different severities, and with different probabilities of dying from their cirrhosis within specified time periods. The most important single factor affecting the individual risk of mortality in cirrhotic patients is alcohol consumption. Empirically, several studies have shown that consumption among high consumers also is changed in the process of a change in per capita consumption. Skog has put forward the descriptive term “the collectivity of drinking cultures” (Skog, 1985) for this process. This constitutes a general explanation of the sometimes rather rapid change in liver cirrhosis mortality rates when there is a change in per capita consumption.

Cirrhosis mortality data can be obtained from death certificate information, which generally includes date and time of death, a primary classification of cause, and place of death. Alcohol-related conditions tend to be under-reported on death certificates, especially those that are contributing rather than direct causes of death (Stinson & DeBakey, 1992). Even when alcohol use is the direct cause of cirrhosis, it may be difficult for a physician to make a definitive diagnosis of the cause of death as alcohol without knowledge of an individual's drinking history. Other problems include bias in reporting alcoholic causes of death among certain segments of the population, lack of a specific laboratory test to measure chronic alcohol consumption, and reluctance on the part of health care providers to record such conditions for fear of stigmatizing the patient or family as alcoholic (Dufour & Caces, 1993).

Clearly the above points to problems with the reliable measurement of the prevalence of alcoholic liver cirrhosis in a single country and, hence, in the comparability of rates of alcoholic liver cirrhosis between countries. Nonetheless, alcoholic liver cirrhosis is a prevalent condition in Western countries with a drinking culture and it may be useful to monitor trends in rates over time. Rates of both alcohol specified and of unspecified cirrhosis should be reported though if AFs are applied these should be to all cases combined, not just those that are ‘unspecified’ (see English *et al* 1995). Hepatitis C is increasing in prevalence in countries with a significant number of injecting drug users and will become an increasingly significant contributor to rates of unspecified liver cirrhosis. Thus rates of Hepatitis C should also be considered when interpreting trends in rates of unspecified liver cirrhosis. In tropical climates in which sanitation is not good there is also a greatly increased incidence of other kinds of liver disease and this too will influence the proportion of cases of cirrhosis that should be attributed to alcohol.

In summary, the estimates of Aetiologic Fractions by English *et al* (1995) for liver cirrhosis may only be applicable in those developed countries where there is not a significant number of cases caused by viral infections. These are issues which limit the utility of this measure as an internationally comparable standard, other than between such countries.

Mental health problems

Prevalence

Alcohol is by definition a causal factor in alcoholic psychosis, alcohol dependence syndrome and harmful alcohol use. For example, of all alcohol-caused deaths in Canada in 1992, 10% were due to alcohol-related mental disorders. It should be noted, though, that citing such conditions probably implies the person died while in some kind of psychiatric treatment facility or, possibly, died of a serious physical complication of alcohol dependence (e.g. liver cirrhosis) or alcoholic intoxication. It was also estimated for Canada in 1992 that of all alcohol-caused hospital separations, 6% were for alcoholic psychosis, 16.6% for alcohol dependence syndrome and 3.6% for non-dependent abuse of alcohol. In many countries such prevalence data are unreliable as they reflect more the uneven spread of general and psychiatric treatment facilities as they do actual levels of alcohol dependence. In Russia, officially recorded rates of alcohol dependence and alcoholic psychosis combined were 1.8% of the population while epidemiological surveys suggest the higher rate of between 3% and 3.5 % (Vroublevsky and Harwin, 1998).

Alcohol-related problems have been defined in various and often ambiguous ways. The concept of alcoholism has been replaced with the terms alcohol dependence and alcohol abuse/harmful use of alcohol. In their most recent versions, revisions of ICD-9, ICD-10 and DSM-IV were coordinated to make the diagnostic criteria more consistent. Alcohol dependence is coded as 303 (ICD-9) or 303.90 (DSM-IV); alcohol abuse/harmful use is coded as 305.0 in both ICD-9 and DSM-IV systems.

Alcohol dependence refers to a disease that is characterised by abnormal alcohol-seeking behaviour that leads to impaired control over drinking. Diagnosis of alcohol dependence focuses on an interrelated cluster of psychological symptoms, such as craving; physiological signs, such as tolerance and withdrawal; and behavioural indicators, such as the neglect of social, occupational, or recreational activities in favour of drinking.

The diagnostic criteria focus on patterns of use that lead to clinically significant impairment or distress. ICD-9 and ICD-10 requires evidence of either physical or psychological harm, while DSM-IV requires that at least one of the following is present: (1) failure to fulfil major role obligations at work, school, or home; (2) recurrent drinking in situations in which use is physically hazardous; (3) recurrent alcohol-related legal problems; and (4) continued use despite a social or interpersonal problem caused or exacerbated by the effects of alcohol.

Measurement issues

(i) Health statistics

Mortality data can be obtained from death certificate information, which generally includes date and time of death, a primary diagnosis of cause of death, and place of death. Alcohol-related diagnoses tend to be under-reported on death records, because of physicians' lack of awareness of a patient's alcohol problem or reluctance to label an individual, even in death, as alcoholic.

Hospitalisations and treatment for diagnoses of alcohol dependence and abuse can be reported by hospitals and substance abuse treatment facilities. Such data report morbidity caused by heavy, problematic alcohol use. Admissions and discharge records from hospitals are usually coded using the ICD classification system, while alcohol treatment facilities, at least in North America, often use the DSM classification system.

To the extent that the diagnoses are purposely or unintentionally under-utilized, this indicator underestimates the prevalence of alcohol dependence and abuse. In addition, the magnitude of alcohol abuse and dependence is underestimated because many who need treatment do not obtain it. Estimates of the ratio of treated to untreated individuals needing treatment range from 1:3 to 1:13 (Sobell, Sobell, & Toneatto, 1991).

(*ii) Survey measures of alcohol dependence and problems*

There are several survey instruments designed to assess alcohol use disorders as defined by the ICD-10 (World Health Organization, 1993) and DSM-IV (American Psychiatric Association, 1994) criteria for dependence, abuse and High Risk drinking. These instruments include the CIDI (Composite International Diagnostic Interview), AUDADIS (Alcohol Use Disorder and Diagnostic Interview Schedule) and SCAN (Schedules for Clinical Assessment in Neuropsychiatry). All of these instruments have been tested for reliability and validity in a number of different countries as part of a project conducted by the World Health Organization (Cottler *et al.*, 1997). Although designed for administration by lay interviewers, these semi-structured diagnostic instruments are based on lengthy interview schedules that lie outside the scope of many alcohol surveys, especially those where limited resources cap the number of questions that can be devoted to the consequences of drinking. There is a reduced form of the CIDI (the "CIDI C") which has a section on problems which could be included as part of a national alcohol survey though this has not been extensively field-tested as yet (Wacker *et al*, 1990).

There are, however, several screening instruments which have been widely used and which are short enough to include in a population survey. These include the CAGE, which asks only four questions about *lifetime* experiences with alcohol and hence is of little value for monitoring purposes, though it could be adapted for monitoring purposes by referencing the four questions to the past 12 months instead; the 11 item AUDIT which includes questions relating to dependence as well as quantity and frequency of consumption. The AUDIT has been employed in several countries in international collaborative research projects (e.g. see Mexican case study in Annex 10).

One questionnaire in wide usage and which has been translated into several languages, the Severity of Alcohol Dependence Questionnaire, has been adapted for use in community surveys as well as clinic samples (Stockwell *et al*, 1994). The 20 items take about 5 minutes to complete. It has been shown to have high test-retest reliability and high consistency with an experienced clinician's ratings of degree of alcohol dependence. The questionnaire thus has the potential for use in national surveys where estimates of the prevalence of alcohol dependence at different levels are a major interest.

Lists of dependence symptoms and social consequences of drinking (or scores derived from counts of positive responses) have been used as measures of alcohol problems in the series of national alcohol surveys conducted in the United States (Hilton, 1991), but the reliability and internal consistency of these items is not established. Although some of these problem items may be of interest in themselves, scores based on these items cannot be used as proxies for alcohol use disorders in the formal sense of these diagnostic classifications. It should be noted, moreover, that the formal application of these criteria will frequently be by non-specialist medical practitioners and that their judgements may themselves also lack a degree of reliability and validity.

Both the AUDIT and the CIDI mentioned above include items about specific alcohol-related consequences which can be analysed separately. The WHO-coordinated international study "Community responses to alcohol-related problems" (Ritson, 1985) developed and applied a scale of 14 self-reported personal and social problems associated with alcohol and reported these for samples drawn from Zambia, Mexico and Scotland. This scale has been widely used and adapted in other countries. Responses collected in that study from different regions of Zambia are presented in Annex 9. In the absence of resources to adequately measure alcohol use disorders, surveys should perhaps focus instead on these more discrete outcomes.

Fetal alcohol syndrome

Prevalence

Of particular recent concern in some countries are the effects of maternal alcohol consumption on the development and overall health of the fetus and the child. A variety of studies support the conclusion that chronic heavy maternal drinking is a necessary causal factor in "fetal alcohol syndrome" (FAS) (Sokol *et al*, 1988; Knupfer, 1991; Stratton *et al*. 1996). FAS is a cluster of abnormalities occurring in children born of women having histories of relatively high levels of alcohol consumption during pregnancy. A diagnosis of FAS can only be made when signs of abnormality exist in *each* of the following categories: growth retardation (weight or length below the 10th percentile when corrected for gestational age), central nervous system involvement (neurological abnormality such as hearing disorders, developmental delay, behavioral dysfunction or deficit, intellectual impairment such as a learning disability or mental retardation, and/or structural abnormalities such as brain malformations); and a characteristic face (narrow eye openings, elongated and flattened mid-face, thin upper lip, and/or an underdeveloped groove between the upper lip and the nose).

Estimates of the incidence of FAS may be influenced by a number of factors. Diagnosis is difficult. The individual features of FAS may result from a variety of adverse influences (e.g., poor nutrition, family violence or substance abuse, mother's history of obstetric problems) independent of alcohol consumption or interacting with alcohol during pregnancy. Alcohol consumption is difficult to measure accurately at any time and is particularly difficult to measure during pregnancy. In addition, there is no consensus on what level, apart from very heavy drinking (e.g., five standard drinks or more per day during the first trimester), or what pattern of drinking results in such serious damage. Because of these factors, estimates of the incidence of FAS are highly varied and controversial. Estimates in a number of different countries range from 0.33 cases to 9.7 per 1000 live births (Single *et al*, 1999; Abel, 1995). These estimates do not, however, include minority ethnic groups. Limited studies of indigenous populations, for example, suggest that their rate may be 10 to 15 times higher. Although English *et al* (1995) concluded in their review that high levels of alcohol consumption were associated with a higher risk of birth defects, they also concluded that the prevalence of heavy drinking among Australian women was so low that it would not measurably contribute to the overall incidence of fetal damage or birth defects.

In sum, it is reasonably well established that the consumption of large amounts of alcohol among pregnant women is associated with a set of adverse consequences to the fetus, known as fetal alcohol syndrome (FAS). Another set of adverse effects to the fetus, known as fetal alcohol effects (FAE), has also been suggested, but there is no consensus as yet on the defining diagnostic criteria or the incidence of FAE. The phenomena of FAS and FAE have only been described in the research literature relatively recently and the actual incidence is unknown. In addition, there is insufficient data at this time to establish the Relative Risk of FAS and FAE associated with different levels of consumption. Nevertheless, it is clear that excessive drinking during pregnancy can cause birth defects and the research literature should be closely monitored for new information on FAS as it becomes available.

Measurement Issues

Attempts to estimate the prevalence of FAS have occurred since 1979 when the ICD-9 introduced code 760.71 for the syndrome. As discussed above, FAS is often difficult to diagnose, even for experienced specialists. All of the abnormalities are associated with other causes, and some of the characteristics appear in otherwise normal children or as part of other birth defect syndromes (Aase, 1994). Diagnosis of FAS depends on an overall pattern of abnormalities that becomes more evident as the child ages. Consequently, diagnoses based exclusively on hospital diagnoses shortly after birth are likely to underestimate the syndrome's prevalence. In general, no matter the importance of alcohol-related birth defects, the infrequency of FAS and inconsistency of ICD coding make this indicator problematic.

Cancers

Prevalence

Cancer is a leading and growing cause of death and hospitalization in most countries. For example, it is the second leading cause of death among Canadians. There are several major reviews of the evidence regarding the relationship between alcohol consumption and risk of cancer. The International Agency for Research on Cancer (1988) reviewed studies of cancers for 22 different sites and concluded that alcohol is a significant risk factor for cancers of the oral cavity, pharynx, larynx, oesophagus and liver. The same conclusion was reached by Duffy and Sharples (1992), although the authors indicate that drinking may also be a cause of cancers of the large bowel and stomach, as well as breast cancer in women. Doll *et al* (1993) also concluded that alcohol plays a causative role in the development of oropharyngeal and oesophageal cancers.

While there is a reasonable consensus that alcohol consumption is a significant risk factor for cancers of the oral cavity, pharynx, oesophagus and liver, there is a lack of consensus regarding the size of the risks. In general, the recent English *et al* (1995) review tends to be considerably more conservative with regard to the proportion of cancer which can be attributed to alcohol consumption when compared to American estimates. With regard to orapharyngeal cancer, the English *et al* (1995) review in Australia concluded that 21% of male deaths and 8% of female deaths due to orapharyngeal cancer in that country are caused by alcohol. The Shultz (1991) review of epidemiological studies on the impact of alcohol consumption concluded that 50% of all oral cancer deaths, male and female, are due to alcohol. Recent supporting evidence for the conclusions drawn in these two reviews was provided in a report by Jaber *et al* (1998) which showed a positive association between alcohol and dysplasia of the oral epithelium.

With regard to cancer of the oesophagus, the English *et al* (1995) review concluded that 14% of male deaths and 6% of female deaths in that country are due to alcohol. The U.S. Centers for Disease Control and Prevention (Shultz *et al*, 1991) review of epidemiological studies on the impact of alcohol consumption concludes that 75% of all oesophageal cancer deaths, male and female are due to alcohol.

The English *et al* (1995) review found that there was “sufficient evidence” of a causal relationship between alcohol and liver cancer, thereby attributing 18% of liver cancer deaths to alcohol. Similarly, Shultz *et al* (1991) attributed 15% of such deaths to alcohol. English *et al* (1995) noted that a causal link is “factually coherent with the known association of liver cancer with liver cirrhosis (Villa *et al* 1988) and biologically coherent with the hepatotoxic effects of alcohol on the liver." (pp. 95). Some years earlier, the International Agency for Research on Cancer (IARC) (1988) also concluded that alcohol caused liver cancer based on consistent monotonic relationship and biological plausibility. However, in a more recent review by Farber (1996) it was concluded that there was no convincing evidence that alcohol played a direct causal role in the development of liver cancer. Alternatively it was concluded that alcohol probably plays an indirect role in the development of liver cancer possibly via cirrhosis as a promoter of tumours and other metabolic effects on the clearance of the carcinogens. There is also some relatively new interest in the possible confounding effects of Hepatitis B infection on the association between alcohol and liver cancer (Thomas, 1995). Yet, a more recent cohort study from Japan found a positive but week association between total alcohol intake and liver cancer (Goodman *et al* 1995).

There is a lack of a clear consensus in the research literature regarding a causal connection between alcohol and other types of cancers. Whereas the U.S. Centers for Disease Control and Prevention (Shultz *et al*, 1991)) estimates that 20% of stomach cancer deaths, 50% of lip cancer deaths and 50% of laryngeal cancer deaths are attributable to alcohol consumption, the English *et al* (1995) review concludes that there is insufficient evidence to conclude that alcohol is causally linked to any of these cancers. The Australian finding of no causal link between alcohol intake and gastric cancer has been supported by a more recent case-control study by Gammon *et al* (1997). Both the American and Australian reviews conclude that there is insufficient evidence to conclude that alcohol is a causal factor in colorectal cancer, pancreatic cancer, lung cancer, endometrial cancer, ovarian cancer, bladder cancer or renal parenchymal cancer.

The potential risk of female breast cancer deserves special attention because of it is a major cause of death among women in most Western societies. Over the past twenty years, researchers have suspected an association between female breast cancer and alcohol. In 1991, the U.S. Centers for Disease Control and Prevention (Shultz *et al*, 1991) did not include female breast cancer among alcohol-related diseases. A review of the evidence by the WHO Regional Office for Europe (Anderson *et al*, 1993) found mixed evidence. Eleven of 17 studies showed a significant positive relationship, finding a significant risk of breast cancer associated with alcohol consumption while six found no significant association. The English *et al* (1995) review of Aetiologic Fractions associated with alcohol consumption found "limited evidence" that alcohol is a causal factor in breast cancer and attributed a modest 3% of total breast cancer morbidity and mortality to High Risk alcohol consumption. A meta-analysis by Longnecker (1994) also showed a modest but consistent linear relationship, while Howe *et al* (1991) found a stronger association between heavy drinking and breast cancer.

Notably, a more recent expansion of research has significantly added to the weight of evidence affirming a direct causal relationship. Several recent meta-analyses and critical reviews have all confirmed that there is sufficient evidence to determine that alcohol is a cause of female breast cancer (Single *et al*, 1999; Smith-Warner *et al*, 1998). In particular, from their review of seven prospective studies, Smith-Warner *et al*, (1998) found that the risk of breast cancer increased by almost 10% with each additional 10g of alcohol consumed per day. In an overview by Hunter and Willett (1996) they suggested that alcohol is "probably the best-established dietary risk factor for breast cancer." (pp 63). Of three very recent studies reporting Relative Risks, two indicated significantly elevated risks of breast cancer due to alcohol (Enger *et al,* 1999; Farronini *et al,* 1998) while another failed to show any association (Zhang *et al,* 1999).

Several possible casual mechanisms between alcohol and female breast cancer have been suggested, including hormonal influences and circulating levels of acetaldehyde (e.g. Ringborg, 1998). However, at present, there is no definitive evidence arising from clinical studies as to the causal mechanism and there remains no clear consensus.

Particularly in light of recent reviews, it appears that there is little doubt that alcohol consumption causes female breast cancer. Although the relationship may be relatively modest and the causal mechanism as yet unclear, given that breast cancer is a major cause of female death (particularly among Western nations) the implications for public health are considerable.

In sum, there is a currently consensus that alcohol is a contributory cause for oral cancer, oesophageal cancer, breast cancer and liver cancer (although further evidence regarding liver cancer may show otherwise). There is limited evidence that it may also contribute to lip cancer, stomach cancer and cancer of the larynx. There is insufficient evidence to conclude that alcohol is causally linked to other forms of cancer.

Measurement issues

Chikritzhs *et al* (1999) estimated that, collectively, cancers contributed to 7.8% of all alcohol-caused deaths in Australia during 1997, compared to 20.7% caused by alcoholic liver cirrhosis. However, the Aetiologic Fraction applied to breast cancer is likely to have been an underestimate given the recent research reviewed above and thus total actual numbers of alcohol-caused cancer deaths may have been higher. While individual types of cancer account for only a small number of alcohol-caused deaths, collectively their estimated contribution is significant and is likely to become larger as new research comes to hand. Of course having a small proportion of cases as alcohol-related means that most of the variance in prevalence is caused by other factors e.g. smoking. This raises the question of whether it is worthwhile to utilise such conditions for monitoring trends in alcohol-related harm across time. This issue will be considered further in relation to the use of composite measures of adverse health outcomes will be discussed later.

Cardiovascular disease

Prevalence

Cardiovascular disease is the leading cause of death in many countries. This includes high blood pressure (hypertension), stroke, arrhythmias, cardiomyopathy and coronary heart disease (including sudden coronary death). For example, each year more than 38% of all deaths in Canada are due to diseases of the circulatory system. Thus, even if alcohol is implicated as a contributory cause for only a small proportion of such deaths, alcohol-related cardiovascular disease would account for a substantial portion of total alcohol-related deaths.

Alcohol is by definition the prime cause of alcoholic cardiomyopathy. In 1992, about 1.1% of all alcohol-caused deaths in Canada were recorded as due to alcoholic cardiomyopathy. Alcohol is also considered a factor in cardiac dysrhythmias and heart failure, causing 1.5% and 0.18% of all alcohol-caused deaths, respectively, in

Canada in 1992. As noted above, there is also sufficient evidence to conclude that alcohol consumption is a causal factor in high blood pressure and haemmoraghic stroke. Thus, with regard to cardiovascular diseases, alcohol appears to be a causal factor in stroke, high blood pressure (hypertension), cardiomyopathy and heart failure.

The relationship between alcohol consumption and stroke is complex. On the one hand, alcohol consumption at high levels is associated with high blood pressure (hypertension), which is a strong risk factor for stroke. On the other hand, at low levels of consumption, alcohol may have a protective effect for stroke - particularly ischaemic stroke, due to its effect on HDL cholesterol, platelet stickiness and other thrombogenic factors.

It should also be noted that there are some studies which indicate no relationship between alcohol consumption and stroke, and others which resulted in divergent findings regarding different types of stroke. The comprehensive English *et al* (1995) review noted 21 studies which found a relationship between alcohol consumption and stroke, but there were also 8 studies which found no relationship. Their conclusion was that while there was "limited evidence" that drinking at a hazardous level (Medium Risk) caused stroke, there was "sufficient" evidence to conclude that harmful levels of consumption (High Risk) increased the risk of stroke. Their pooled estimate of Relative Risk showed a biphasic relationship, with a protective effect at low levels of consumption and an increased risk of stroke at high levels of consumption In another extensive review by Camargo and Rimm (1996), it was concluded that the evidence for a protective effect on ischaemic stroke at moderate levels of drinking is mixed.

With regard to any likely protective effect due to moderate drinking, evidence arising from more recent studies of the relationship between alcohol and stroke continue to produce mixed results (Knuiman and Vu, 1966). Conversely, recent studies have continued to produce evidence supporting the relationship between heavy consumption and increased risk of stroke (Wannamethee and Shaper, 1996). In a very large study of 18,000 middle-aged men in Shanghai, there was no evidence of a protective effect of low to moderate consumption on stroke, while heavy drinking was associated with an increase in the number of stroke deaths (Yuan *et al* 1997). In a very recent 21 year follow-up study, Hart *et al* (1999) showed that increasing alcohol consumption steadily increases the risk of stroke.

In summary, the majority of studies have implicated heavy alcohol use as a causal factor in stroke, particularly hemorraghic stroke and although inconsistent, the weight of evidence would appear to suggest that a low level of consumption offers some protective effect against ischaemic stroke. English *et al* (1995) concluded that for an Australian population, 17% of male and 19% of female strokes were caused by Medium and High Risk drinking. The U.S. Centre for Disease Controland Prevention concluded that alcohol consumption accounts for 7% of all stroke deaths in the U.S. (Shultz *et al*, 1991). In Canada it is estimated that alcohol accounted for 153 deaths and 943 hospitalisations in 1992, but at the same time, alcohol also prevented even greater numbers of stroke deaths and hospitalisations. Single *et al*, 1999)

Alcohol consumption is positively related to hypertension (high blood pressure). All of the major reviews concluded that there was a significant dose-response association between drinking alcohol and hypertension (high blood pressure) (e.g. English *et al* (1995), Shultz *et al* (1991), Camargo 1996). In particular, one very recently conducted review (Campbell *et al* 1999) concluded that observational studies have almost uniformly found a relationship between heavy alcohol consumption and increased blood pressure. While the biological mechanism remains uncertain, this conclusion is corroborated by experiments in which the blood pressure of heavy drinkers decreases following a decrease in alcohol intake.

Varying estimates are available regarding the proportion of hypertensive cases and deaths which may be attributed to alcohol. The English *et al* (1995) review concluded that 11% of male hypertension and 6% of female hypertension can be attributed to alcohol. The U.S. Centers for Disease Control and Prevention review (Shultz *et al*, 1991) indicated 8% of hypertension cases are attributable to alcohol. While hypertension (high blood pressure) is infrequently a direct cause of death, it is a major risk factor for stroke and heart disease. An analysis of risk factors for cardiovascular disease in a prevalence survey of more than 7000 Canadians age 35 or older concluded that approximately one fifth (21%) of cardiovascular disease is accounted for by hypertension (Single *et al*, 1999).

The relationship between alcohol consumption and coronary heart disease (CHD) is complex. On one hand, there is sufficient evidence to conclude that alcohol consumption is positively related to hypertension (high blood pressure) which is a significant causal factor in CHD. On the other hand, there is also growing epidemiological evidence that moderate drinking is associated with reduced risk of CHD among older adults, especially when consumed in small daily quantities.

In summary, there is a consensus that alcohol consumption at low to moderate levels has a protective effect against heart disease (English *et al* 1995, Klatsky 1996, Svardsudd 1998), but despite the relationship of alcohol use to hypertension, conclusive evidence is still lacking regarding the relationship of alcohol consumption at high levels to coronary heart disease.

Measurement issues

There has been debate about whether to include estimates of the protective effects of alcohol on some kinds of coronary heart disease in overall estimates of alcohol's contribution to preventable death and illness. Coronary heart disease is so common that the lives estimated to be saved among the large population of persons usually considered to be 'moderate drinkers' in population surveys usually outnumber the total number of lives lost from excessive alcohol use. Given that the protective effect no longer applies at consumption levels associated with a significantly increased risk of premature death, the approach of English *et al* (1995) is recommended whereby estimates of Low Risk alcohol consumption's beneficial impact on health are calculated and reported separately from the negative effects of excessive use. It is also worth noting that the implications of new research on drinking patterns may be that the protective effects of moderate alcohol consumption against premature death are under-estimated simply because the number of people deemed to be 'moderate' drinkers in most epidemiological studies is likely to be an overestimate. Most studies have only examined mean daily alcohol consumption and have neglected measures of a 'binge' drinking pattern which is more prevalent than often supposed (e.g. Stockwell *et al*, 1996). The beneficial effects of a low mean level of daily consumption are greatly lessened if in fact the alcohol is consumed in one or two heavy occasions per week (e.g. Puddey 1999). Thus the observed benefits to date in prospective studies will in fact have been diluted by being attributed to a group of drinkers not all of whom drink in a fashion that will protect against coronary heart disease. Of course, at the population rather than the individual level this may not matter for the development of alcohol harm indicators.

Other diseases related to chronic alcohol use

Prevalence

Alcohol is the direct cause of a small number of deaths and hospitalisations each year from gastritis. Alcoholic gastritis comprised 0.34% of alcohol-caused deaths in Canada in 1992 (Single *et al*, 1999) and 1.06% of alcohol-caused deaths for Finland between 1987 and 1993 (Mäkelä *et al*, 1997). The English *et al* (1995) review estimates that 24% of acute pancreatitis and 84% of chronic pancreatitis cases are due to alcohol; the U.S. Centers for Disease Control and Prevention (Shultz *et al*,1991) estimated that 42% of acute pancreatitis and 60% of chronic pancreatitis is due to alcohol.

Other causes of disease and death which may be linked to alcohol use include respiratory tuberculosis, diabetes, pneumonia and influenza, peptic ulcer and epilepsy. The evidence regarding the role of alcohol in these other causes of death and hospitalisation is mixed. For several disorders, the major reviews differ as to whether there is sufficient evidence for a causal link with alcohol. Thus, while the U.S. Centre for Disease Control and Prevention (Shultz *et al*, 1991) considers 25% of respiratory tuberculosis, 5% of diabetes, 5% of pneumonia and influenza, and 10% of peptic ulcers to be attributable to alcohol use, the English *et al* (1995) review and the Canadian cost study (Single *et al* 1996) did not consider there to be sufficient evidence to attribute alcohol to these disorders. On the other hand, while the 1991 US review did not include epilepsy, the English *et al* (1995) review estimates the Aetiologic Fraction of epilepsy attributable to alcohol to be 15%.

Measurement issues

Clearly these additional categories contribute in only a limited way to overall morbidity and mortality compared with the other conditions listed above. The English *et al* (1995) review estimated that only 0.8% of all alcohol-caused deaths in Australia in 1992 were for these ‘other’ conditions. There may, nonetheless, be a case for a composite indicator of morbidity and mortality as is discussed below. In particular the monitoring of morbidity due to pancreatitis is promising given a) the larger number of non-fatal cases and b) the relatively high component that appear to be alcohol-related.

Composite alcohol problem indicators

Excessive alcohol consumption has consequences for nearly every part of the human body. A composite indicator of all alcohol-related health events or deaths can be developed using ICD codes.

One approach that has been applied is to include all conditions which are 100% attributable to alcohol i.e. mainly alcohol dependence, alcohol abuse and alcoholic liver cirrhosis. As alcoholic liver cirrhosis constitutes only a part of all alcohol-related health problems, one can consider a broader category of alcohol-related health problems or mortality. Many long-standing heavy consumers die from somatic complications or have another diagnosis than alcohol dependence on the death certificate. The stating of the diagnoses of alcoholism, alcohol psychosis, or liver cirrhosis on death certificates may vary due to cultural or national habits in the putting of these diagnoses on the death certificate, which makes cross-country comparisons unreliable. As there probably is considerably less variation in practice in diagnostic labelling within a country, analyses of national trends for these diagnoses are more justified. An example of the application of this approach to develop national trend data is provided in Table 3.2.2 for Australia (Chikritzhs *et al*, 1999).

Another approach to have been employed is to use a composite of all conditions with a positive Aetiologic Fraction for alcohol. It has been found that such composite measures used for all chronic, all acute and both types of case combined when used to generate local population rates demonstrate significant association with local per capita levels of alcohol consumption (Stockwell *et al*, 1997).

In general terms, it can be recommended that it is advisable to report separately on major categories of adverse health outcomes to the extent that the volume of data permits this. Given that under-reporting is especially likely in relation to alcohol specific conditions, it is advisable to report separately on these conditions from other categories such as cancers. Further research on the use of alcohol problem indicators is required and this may indicate advantages in further stratifications of conditions by size of Aetiologic Fraction e.g. 1-25%, 26-50%, 51-75%. 76-100%. Given the different underlying mechanisms and underlying patterns of drinking, it is also recommended that composite measures are developed separately for conditions with acute and chronic causes.

In summary, there appear to different advantages and disadvantages to tracking alcohol problems using the alcohol specific conditions and those which are common but which have only a small proportion attributable to alcohol (e.g. breast cancer and heart disease). The specific conditions are under-reported but at least are confidently attributable to alcohol as the cause while the more general conditions with low fractions are influenced by many other factors. Weighting by aetiologic fraction partly compensates for this problem and it can be argued than the use of multiple conditions in a composite measure should also dampen any influences of external causes e.g. changes in the prevalence of smoking behaviour over time to the success of programs for the early detection of cancers. Again, it is recommended that the use of composite measures for national indicators is explored further through careful study and that caution is utilised when interpreting trends in indicators. The use of triangulation is also recommended i.e. comparing trends observed for different conditions and major categories of condition. The greater the consistency in the trends then the greater the confidence that may be placed in them.

Provided the information required as outlined in Chapter 3.1 is available, composite problem rates might be usefully calculated on an annual or even quarterly basis if volumes of data are sufficiently large.

Table 3.2.2: Estimated total number of alcohol-caused deaths in Australia attributable to long-term High Risk (NHMRC, 1992, hazardous/harmful) alcohol use, by year and condition

ICD-9 Codes	Cause of death	1990	1991	1992	1993	1994	1995	1996	1997
141, 143-146, 148, 149	Oropharyngeal cancer	66	64	60	62	57	54	61	55
150	Oesophageal cancer	48	49	49	47	52	50	50	54
155	Liver cancer	48	49	52	53	55	59	59	65
161	Laryngeal cancer	37	35	35	32	27	28	28	31
174	Female breast cancer	53	52	48	51	52	50	50	51
303	Alcohol dependence	196	185	185	198	181	232	193	257
345	Epilepsy	27	29	24	28	30	26	32	31
357.5	Alc. Poly neuropathy	0	0	0	0	0	0	0	0
401-405	Hypertension	40	39	38	39	38	37	37	38
425.5	Alc. Cardiomyopathy	147	155	148	120	134	116	109	109
430-438	Stroke	849	795	756	745	774	763	755	726
456.0-456.2	Oesophageal varices	3	3	1	3	2	2	3	2
571.0-571.3	Alc. Liver cirrhosis	707	683	720	617	687	670	695	683
574	Cholelithiasis	-1	-1	-1	-1	-1	-1	-1	-1
577.1	Chronic pancreatitis	15	10	12	14	12	17	19	13
696.1	Psoriasis	0	0	0	0	0	0	0	0
All chronic alcohol codes		1386	1352	1370	1263	1325	1340	1335	1388

Source: Chikritzhs *et al*, 1999

Recommendations

This chapter has reviewed indicators of alcohol-related problems that countries can use for monitoring the nature and extent of harm. It is recognized that countries have different levels of resources to commit for such monitoring. As a result, we identify four levels of detail for alcohol-related indicators.

1. LOW level indicators

For countries where the 4th digit of ICD-9 is not used (most developing and some developed) and for which no national survey data on alcohol use exist, the only unambiguously alcohol specific conditions available will be alcohol dependence and alcoholic psychosis. For countries where ICD-10 is used to at least the third digit then alcoholic liver diseases will also be recordable. Alcohol dependence and alcoholic liver diseases are major causes of alcohol-related mortality and are each worth monitoring where data are available. In addition a composite measure of alcohol specific conditions should be calculated including deaths from alcoholic psychosis as well. It should always be recalled that these types of condition are susceptible to biases such as those caused by changes in levels of training to the diagnosing physicians, to levels of health care provided and to the level of social stigma attached to alcohol caused illnesses.

For some countries with ICD-9 mortality data only recorded using the first 3 digits of diagnostic codes, it would be possible to use all cases of liver cirrhosis i.e. all the 571 coded conditions. However, the utility of this as an indicator is constrained in countries like China where there is a high level of cirrhosis caused by hepatitis.

A possible supplementary indicator would be a composite of certain cancers which are categorised in Table 3.2.1 as of 'Medium' alcohol causation. In ICD-9 these comprise the following 3-digit codes 140, 141, 143-146, 148, 149, 150, 155 and 161 (excluding female breast cancer). In English *et al* (1995) these are all estimated to have similar AFs and a straightforward approach is simply to add all cases together. Unfortunately, most of these cancers are more closely associated with tobacco use than alcohol and reliable national data on smoking prevalence would be required if these data were to be used to monitor trends in alcohol-related harm over time. This is not likely to be available in a country with low levels of resources for monitoring. However, in the event that national sales or survey data are available then such an indicator could be used alongside those identified above.

2. Medium level indicators

For countries where adequate data sets are also available for morbidity to the first three digits of ICD codes, the same methods described above should be applied to these as for mortality data. Some such countries (e.g. Germany) will have good national survey estimates of the prevalence of Medium and High Risk drinking for different age groups. These provide more accurate estimates and permit monitoring of within-country trends over time as well as crude international comparisons with other countries meeting the same criteria. Methods of adjusting AFs for estimated changes in Medium and High Risk drinking on the basis of survey and per capita consumption data are described in Chapter 3.1

3. High level indicators

At this level it is necessary to have national survey data permitting an estimation of the prevalence of Medium and High Risk consumption levels plus mortality and morbidity data recorded to 4 digits ie. allowing identification of all 38 alcohol-caused conditions identified by English *et al* (1995). In combination with the Relative Risk data provided in Chapter 3.1, this can be used to calculate the Aetiologic Fractions for all conditions caused by long-term heavy use of alcohol. The population rates of these should be reported for each condition separately and also jointly as a composite indicator of both alcohol-related mortality and morbidity. They should also be reported and examined in categories corresponding to the sizes of the estimated aetiologic fractions so that low, medium, high and complete alcohol causation conditions are separately categorised.

4. Optimal level indicators

The High level data above would be used in a more sophisticated manner to yield annual estimates of alcohol-related hospital bed-days and/or Person Years of Life Lost (PYLL) and Disability Adjusted Life Years (DALYs). These should ideally, include breakdowns for major administrative regions of the country.

In addition, national surveys should include scales like the AUDIT or the Severity of Alcohol Dependence Questionnaire, Form C (SADQ-C) to estimated prevalence of self-reported signs of alcohol dependence. It is usually only realistic to conduct such surveys every 3 to 5 years. It is also recommended that optimally the total economic cost of health and social problems caused by alcohol be estimated every 3 to 5 years using the international methodology described by Single *et al* (1996).

All countries can benefit from more accurate and reliable measures of alcohol-related problems within their national borders. Thus a most important recommendation for the future is to improve the measurement of alcohol's involvement in social and health problems. To this end it is recommended that where possible the full 4 digits of ICD-10 diagnostic categories are required to be routinely recorded for morbidity and mortality data alike. It is also recommended that national capacity is developed for calculating country-specific prevalence of High Risk alcohol use, Relative Risks and alcohol Aetiologic Fractions for conditions partly caused by alcohol.

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Chapter 3.3

Indicators of harm attributable mainly to the short-term effects of drinking alcohol

Summary

Death and injury caused by the acute effects of alcohol are widely documented in both the developed and developing worlds. This chapter summarises evidence from international literature reviews on the relationship between alcohol consumption and short-term or 'acute' consequences: in particular road crashes, violent incidents, suicide and other causes of injury. The potential for the creation of harm indicators is discussed in relation to each main area.

For countries with low levels of resources for national monitoring it is recommended that both separate and composite measures of a few defined acute causes of death are employed identified in international reviews as having a moderate degree of alcohol causation. Fuller reporting of mortality and morbidity data including use of all 4 digits of ICD diagnostic codes permit a wider range of conditions to be used. Adjustment of rates by estimated aetiologic fractions is recommended to be performed on the basis of local case series studies whenever available.

Countries with higher levels of available resources will also often have access to reliable data on road crashes which can be used to complement and confirm hospital mortality and morbidity data. Surrogate measures of alcohol-related harm are also recommended, in particular night-time occurrences of road crashes, assaults and injury presentation to emergency rooms.

In this Chapter indicators will be considered of problems which are mostly a more immediate or 'acute' consequence of alcohol consumption, ie mostly associated intoxication as opposed to long-term exposure to alcohol. Acute problems which are discussed here are: (1) alcohol-related traffic crashes, (2) alcohol-related unintentional injuries and death, (3) suicide, and (4) interpersonal violence. As was noted in the previous chapter, it should be remembered that in the case of suicide it is highly likely that long-term heavy drinking as well as acute intoxication contribute to this cause of death.

The collective contribution of these events to national morbidity and mortality estimates has been underestimated in the past. Recent and reliable estimates (Single *et al*, 1999; English *et al*, 1995, Chikritzhs *et al* 1999) suggest that in developed countries about 50% of alcohol-related deaths and two-thirds of Person-Years of Life Lost are from acute or mixed acute-chronic causes. Haworth and Acuda (1998) summarise a number of mostly case series studies from Sub-Saharan Africa finding a strong association between alcohol consumption, violent death and injury, road crashes and other causes of injury. Annex 10 reviews evidence for a similar conclusion in relation to Mexico. In Russia, alcohol is heavily implicated in road crashes, accidental poisonings, suicide and homicide (Vroublevsky and Harwin, 1998).

Acute alcohol-related problems are prevalent, costly and relate to issues of immediate public concern e.g. road crashes and violence. As a consequence the development of indicators of acute alcohol-related problems is of great value for any country that wishes to minimise alcohol-related harm and to evaluate the success of its prevention policies.

With the exception of injury and death from alcohol-caused road crashes in some countries, the involvement of alcohol is greatly under-estimated by police and health personnel and cannot usually be relied on to estimate the prevalence of alcohol-related harm. Instead, two other approaches may be employed:

(i) Estimate the Aetiological Fraction for alcohol using best available local data, ideally case-control studies (e.g. McLeod *et al*, 1999) but more usually case series where presence of alcohol had been estimated (see Chapter 3.1);

(ii) Employ 'surrogate' or proxy measures of alcohol involvement by reporting on the prevalence of problems with a known high alcohol involvement e.g. night-time crashes, assaults and injuries of all kinds.

This chapter will briefly review the evidence for the association between alcohol use and a range of problems with acute causes, outline the prevalence of alcohol-related cases and discuss measurement issues for each major category. It should be noted that the use of ICD codes is discussed mainly in relation to ICD-9 simply because most of the research reviewed used that version of ICD. See Chapter 3.1 for discussions of equivalences and conversions between ICD-9 and ICD-10.

Impaired driving injuries and fatalities

Prevalence

Automobile crashes cause substantial death and injury to motor vehicle occupants and to pedestrians. They also result in property damage. These outcomes involve pain and suffering, added costs of medical care, police enforcement, insurance, and lost work. Alcohol consumption impairs a variety of motor and perceptual skills necessary for driving. There is an enormous literature on the relationship between alcohol consumption and traffic injuries and fatalities. The English *et al* (1995) review of alcohol-related health disorders examined 44 studies on Blood Alcohol Concentration among fatally injured drivers and concluded that alcohol is causally related to road fatalities. The countries contributing these studies are listed in Table 3.3.2. The proportion of Australian road fatalities which could be attributed to alcohol was placed at 37% for males and 18% for females. Higher estimates have been made for the US (Shulz *et al*, 1991) and for Canada (Health and Welfare Canada, 1984). High estimates have also been made in a number of developing countries including Zambia, Zimbabwe and South Africa (Haworth and Acuda, 1998). In India it has been estimated that 25% of road accidents were alcohol-related (Chengappa, 1986). Alcohol-related road crashes represent a major cause of death in many countries. In 1996 17,196 people were killed in alcohol-related crashes in the U.S. which was 40.9% of all road crash deaths. In addition, there were 321,000 persons injured which accounted for 9% of all non-fatal crash injuries in the USA (National Highway Traffic Safety Administration, 1997). In 1992, it was estimated that 1,477 Canadians were killed due to impaired driving. According to a 1993 report of the Traffic Injury Research Foundation (1993), in 1991 48% of fatally injured drivers had some alcohol in their blood, 40% were over the legal limit in Canada of 0.08% Blood Alcohol Concentration (BAC) and 30% were over 0.15% BAC. Indeed, impaired driving is the single leading cause of death for young adults in most developed countries. Impairment from alcohol is particularly high among fatally injured drivers between the ages of 20 and 35, and the proportion of fatally injured drivers with a BAC in excess of the legal limit is generally greatest among drivers aged 20-25.

Considerable numbers of persons in both developed and developing countries place themselves at risk of being involved in an impaired driving accident. For example, approximately one in five Canadians age 15 or older report driving after drinking in the past month (Single *et al*, 1995). Self-reported driving after drinking is particularly high among males aged between 25 and 45 years of age. It is also strongly related to higher consumption levels. Drinking and driving has been a major problem in some developing countries too. In South Africa, Pieterse (1985) reported that 60.8% of 1,253 road deaths in one year had BACs in excess of 0.08%. It is noteworthy, however, that the official statistics from the South African Statistical Service for the same period were less than 3% (Rocha-Silva, 1987). This underlines the need for the use of proxy measures of alcohol-related crashes (see later) as on-the-spot estimates are not reliably available in most countries.

There is clear evidence that motor vehicle crash risk increases with alcohol consumption. Use of alcohol has been found to alter driving performance even at low dosage levels and to effect response times in dangerous road situations. One of the most influential case-control studies was the Grand Rapids study which showed that compared to a BAC of zero, all positive levels of BAC are associated with an increased risk of road crash (Hurst *et al*, 1994). Zador (1991) found that driver risk of being in a fatal crash doubles with each 0.02 % increase in BAC. Two Australian studies found that, compared to driver BAC of less than 0.05%, the risk of injury was about 3.5 times as great with driver BAC of between 0.05 and 0.099 and about 9.5 times as great with driver BAC of 0.10 % or above (English *et al*, 1995).

Measurement issues

Road crash data can usually be used to estimate numbers of alcohol-related crashes. The records of road crashes track the numbers of crashes, injuries, and deaths in fatal crashes. A large research literature already exists discussing the measurement issues for alcohol-related road crashes. Ideally, the blood alcohol concentration (BAC) of all drivers in each road crash should be determined. However, both practical issues (costs) and legal issues of protecting individual rights and legal liability prevent these measures from being routinely collected by law enforcement officers in some jurisdictions.

Road crash reports may be based on Blood Alcohol Concentration (BAC), breathalyser, motor skills tests, or just observation. When such data are compiled into machine-readable form, with time, date, and day of crash, location, number of vehicles involved, and numbers of fatalities and injuries, it is usually possible to estimate the extent of alcohol involvement. A number of different measures are possible as outlined below.

Fatal crashes with positive Blood Alcohol Concentration (BAC)

In some countries, the police are required to determine the BAC level of drivers in fatal road crashes. Fatal crash reports in some countries do include the BAC of the driver. Reliable BAC testing of drivers in fatal crashes (where victims died at the scene) can be available in many countries. Reports based on BAC tests for *non-fatal* crashes are generally prone to selective testing and greater variations in testing procedures.

Alcohol-related crashes based on police reports

In many countries police are required to report whether, in their judgement, alcohol was involved in road crashes. Alcohol-related crashes are those in which one or more of the drivers had been drinking in the judgment of the reporting police officer. Although police reports of alcohol involvement are becoming more widely available in many countries, they depend on an officer's discretion in determining whether to test, the choice of tests, and on the officers' interpretation of test results. There is a general under-reporting of crashes, especially for less severe crashes, and a more prominent under-reporting of alcohol involvement because of lack of testing, uncertainty from test results, and failure to report low levels of alcohol use. Police-reported alcohol-related road accidents are dependent upon the reporting practices of law enforcement officers who are investigating a road crash. Anderson and Burns (1997) found that well trained officers could determine whether or not French drivers involved in road crashes had been drinking. Under-reporting certainly exists in many countries which lack a tradition of careful analyses of drinking and driving crashes and there are significant differences between countries in police reporting practices. There may, however, be some use for such data as a means of tracking patterns over time in one country but not for international comparative purposes.

Night-time crashes

It has been found that up to 80% of night-time road crashes (both fatal and non-fatal) involving a single, private vehicle involve prior alcohol consumption by the driver. Although definitions of “night-time vary” (8 p.m. to 4 a.m; 8 p.m. to 8 a.m; 12 midnight. to 3 a.m have all been reported), alcohol involvement in single-vehicle crashes appears to peak between the hours of 12 midnight. and 4 a.m. (Gruenewald & Ponicki, 1995). Variations in local crash-handling procedures are likely to be small, unless the threshold for reporting crashes changes. Like single-vehicle fatal crashes, they include some crashes that do not involve alcohol and also exclude some crashes that do involve alcohol. Consequently, they are useful for tracking trends, but not for measuring the magnitude of the drinking and driving problem. It is important to note that their use has been established in modern industrialised countries in which heavy recreational drinking tends to be concentrated in the evening. The rhythms and routines of drinking and driving may be different in other countries and also in some remote rural communities within developed countries e.g. indigenous communities in Australia. It is recommended that where possible a locally appropriate time-frame is adopted based on empirical data regarding alcohol involvement in crashes at different times of day.

Single-vehicle night-time crashes

Single-vehicle night-time crashes are generally defined as crashes in which a single, non-commercial vehicle strikes a non-moving object in its environment between the hours of 8 p.m. and 4 a.m. Certain types of crashes may be excluded, such as bicycle- and motorcycle-related crashes. Single-vehicle night-time crashes are more common and thus provide more stable indices of drunken driving than single vehicle fatal crashes. When single-vehicle crashes are fully reported they are not subject to problems of officer discretion in reporting alcohol-involvement based on subjective judgement (Fell & Nash, 1989). Because some alcohol-related crashes are included and others that are alcohol-related are excluded (e.g., those where a drinking driver causes a crash with other vehicles), this measure does not provide an accurate measure of problem magnitude, but it is useful in gauging trends over time. Because of the small number of occurrences, the index is suitable only for areas with at least the population of large cities.

Fatal crashes

Drinking drivers are frequently involved in serious or fatal accidents. Fatal crashes have a high percentage of alcohol-related driving and are also preferred by some as a "surrogate" measure of alcohol involved crashes. However, fatal crashes may be too infrequent in many countries to provide sufficient observations and thus can be often unstable over time.

Roadside surveys

One potential indicator of drinking and driving can be derived from roadside surveys in which driver blood alcohol concentrations (BAC) are consistently measured. Such surveys if carried out for research rather than enforcement purposes, can be valuable sources of time series data concerning amount of drinking and driving and, more importantly, the level of potential driver impairment and thus the potential risk for incurring a road crash. Such roadside surveys have been conducted in Finland, Norway, Australia, New Zealand, the United States, Canada, and Sweden, though not always on a consistent annual basis. Finland has conducted consistent annual roadside surveys since 1979 in conjunction with the Central Organization for Traffic Safety in Finland. In this way, it is possible to examine changes over time in the percentage of drivers who are over the legal BAC limit (BAC=0.05) (Mäki, 1997).

Arrests for driving under the influence (DUI)

Arrests for drunken driving are often used to measure the level of drinking and driving. However, these data are largely a function of the responses by law enforcement and not a valid indicator of the actual extent of drinking and driving in any country. DUI data vary in the reliability of presentation both within and across countries and are considerably influenced by the level of emphasis on drunk driving enforcement in a particular location at a particular time. If such data are to be used in a national monitoring system then it would be necessary to also include information more directly indicative of policing enforcement activity such as officer hours devoted to drink-driving enforcement or, better still, numbers of breath-tests conducted.

Alcohol-related unintentional injuries and deaths

Unintentional falls, drownings, near drownings, and burns are important causes of death and injury. They lead to medical costs, lost work, and pain and suffering. The involvement of alcohol in fatal falls, drownings and burns, has been well described but less is known about its involvement in hospitalizations or the percentage of cases that may be attributed to alcohol. Accidental alcoholic poisoning is also a major cause of death in many countries.

Prevalence

Falls, drownings, and burns are the second, third, and fourth leading causes of unintentional death in the United States. The US Center for Disease Control (1996) reported death rates per 100,000 in 1994 of 5.48 for falls, 1.78 for drownings, and 1.75 for burns. Together these causes accounted for 9.01 deaths per 100,000 in that year. Non-fatal injuries occur at much higher rates. For 1985, Rice and MacKenzie (1989) report 783,357 hospitalized cases of falls or 334 per 100,000, and an additional 11.5 million minor injuries not requiring hospitalisation, 54,397 hospitalised cases of burns or 23.5 per 100,000, and an additional 1.4 million non-hospitalised cases, and 5,564 cases of near drowning or 2.34 per 100,000 and an additional 31,564 non-hospitalised cases.

Non-road transportation injuries: With the exception of road injuries and fatalities, there are few national data on other types of accidents such as those from boating or flying. The Australian review did not include water transport accidents, or air transport accidents, (English *et al*, 1995) but the U.S. Center for Disease Control (Shultz *et al*, 1991) apportioned 20% of such accidents to alcohol use. It is widely suspected that alcohol is a contributory cause to boating and other transportation accidents, in the same way that alcohol contributes to road crashes, but data are limited regarding the extent to which alcohol use is related to these events.

Drownings: The proportion of drownings attributed to alcohol is 34% in the Australian review and 38% in the U.S. Center for Disease Control review. A recent summary of the literature on drownings by Smith and Brenner (1995), estimates that 25 to 50 % of all drownings involve alcohol, although the causal role of alcohol remains uncertain. There is substantial variation in the studies on which this fraction is based, and most do not distinguish attribution from involvement.

Alcohol-related falls: There is substantial evidence that alcohol consumption is associated with a higher Relative Risk of being injured or killed in a fall. The Australian review included seven studies in which the Blood Alcohol Levels (BACs) of fall victims were recorded. Using a criteria of a BAC of 0.10% or higher, the pooled estimated proportion of falls attributable to alcohol was 34%. The U.S. Center for Disease Control (Shultz *et al*, 1991) concluded that 35% of unintentional falls are attributable to alcohol. Single *et al* (1998) estimated that in 1992, unintentional falls accounted for 408 deaths, 16,901 hospitalizations and more than 300,000 hospitalisation days in Canada. However, it should be noted that estimates of the AF for falls vary greatly with age which is a significant given that falls are very prevalent in the elderly. Mäkelä *et al* (1998) found that for Finnish people aged 70 to 89 years, only 8% of male and 0.8% of female deaths from falls were alcohol-caused. By comparison, respective figures for 15 to 34 year old Finns were 54% and 47%.

Alcohol-related fire injuries and deaths: A number of US studies have estimated the proportion of fatal victims of fire with BAC levels of 0.10% or higher. The estimated proportion of fatalities attributed to alcohol ranged from 39% to 49%. English *et al* (1995) pooled these estimates to arrive at an Aetiological Fraction of 44% of fire deaths being due to alcohol use. The U.S. Center for Disease Control similarly concluded that 45% of fire deaths are attributable to alcohol. It should be noted, however, that these estimates do not take smoking into account. As many heavy drinkers are also smokers, some of the association between drinking and an elevated risk of being injured or dying in a fire is due to the combined impact of drinking and smoking. In two studies information was obtained on the proportion of fires where the victim was both smoking and had a BAC of 0.10% or higher. In the absence of precise case-control studies on this type of injury, one (admittedly crude) device employed in the Single *et al* (1996) study was for cases to be divided evenly between smoking and alcohol, the estimated proportion of fire victims attributable to alcohol decreases from 44% to 37.5%. Even if one made the extreme assumption that all such cases were attributed to smoking and none were attributed to alcohol, there would still be an estimated 30% of fire injuries and deaths that could be attributed to alcohol. As an indicator of trends in alcohol-related harm over time, however, it is important to realise that changes in smoking behaviour will also greatly influence fluctuations in this indicator. As discussed later, this can be used as an argument in favour of using multiple indicators and also combining these into composite measures e.g. of all acute alcohol-related conditions.

Accidental poisoning

The major published reviews from Canada and Australia have not identified alcohol as a major contributor to accidental poisonings in most developed countries. However, this may require further investigation as in Finland (Mäkelä *et al*, 1997) and the former USSR (Vroublevsky and Harwin, 1998) at least substantial alcohol-involvement has been recorded. Mäkelä *et al* (1997) estimated that 16.4% of all alcohol-related deaths in Finland between 1987 and 1993 were from accidental poisonings.

Measurement issues

The systematic and consistent measure of the level of alcohol involvement in injuries has been a particular challenge for epidemiology and prevention research in alcohol. Due to the research of Cherpitel (1995, 1989a/b) and others, there is now a solid foundation for estimating the true nature of alcohol's contribution to increased risk of injury.

Mortality rates from all sources are compiled from death certificate information, which may include the date and time of death, a primary classification of cause of death, and place of death. Deaths caused by falls, drownings, and burns are easily identifiable and unlikely to be attributed to the wrong cause. They are classified in medical data sources by ICD event codes. The codes for these events are ICD-9 E880–E888 for falls, ICD-9 E890–E899 for fire injuries, and ICD-9 E910 for drownings. Burns and drownings can also be detected using diagnostic codes. Burns are also classified by diagnostic codes ICD-9 940–949, and drownings are classified by ICD-9 994.1.

Injuries and illnesses serious enough to require hospital care provide data about morbidity due to various causes. Hospital discharge data are available in some countries coded with ICD diagnosis and event codes. As with deaths, injuries caused by burns and near drownings are easily identifiable from diagnostic codes, and the rate of reported injuries is sufficiently high to provide observable rates at the community level. Where cause-coded data exist, injuries from falls and burns by cause (fire scald) are also readily identified. These types of injury are, therefore, useful contributors to a national set of alcohol harm indicators either on their own or in combination with other acute conditions.

Alcohol-related Injury Surrogate Using Hospital Data: The Prevention Research Center, Berkeley, California, in the United States, has developed a surrogate for alcohol-related injury and determined that patterns of alcohol involvement among hospitalized injury patients could be used for the development of a surrogate for alcohol-related injury (Treno and Holder, 1997). The injury surrogate involved the weighting of cases based upon analyses of trauma center data such that injuries likely to have involved persons with positive BACs (e.g., injuries sustained on weekends by young males who are victims of violence) are weighted more heavily than those not likely to be alcohol involved (e.g., injuries sustained during the week by elderly females through falls).

The surrogate has been developed based upon trauma center data in which blood alcohol was carefully measured as a part of clinical protocol. The measurement of blood alcohol concentration is based upon blood drawn and subsequently laboratory analysed. Application of these trauma data to hospital discharges provided one means to estimate the extent to which any one hospital treatment for an acute condition had a high (or low) likelihood of being alcohol involved.

The surrogate has its own set of limitations. First, as a surrogate it is not a direct measurement of the actual involvement of alcohol in each hospital event. The surrogate is a composite measure of the assigned likelihood that drinking is a risk factor. Second, as a surrogate, there is measurement error associated with each hospital event as well as with the overall mean or aggregate measurement of alcohol-related injuries over time. Such an error, however, is associated with any measuring technique. Third, there is a considerable delay in obtaining hospital discharge data which produces an even longer delay in developing a surrogate and conducting post intervention analyses.

Injury Deaths with Alcohol Involvement from Autopsy Reports: Autopsy records from many countries are often compiled by coroners or medical examiners offices and often contain the results of toxicology testing, including BAC at death. These records, however, are seldom maintained in easily accessible form. Problems with autopsy reports are considerable. These include (1) selecting to autopsy some, but not all, deaths; (2) selective testing for BAC of some, but not all, deaths; and (3) confounding of estimated BAC because of time lags since death. Autopsy reports are generally a specialised and unrepresentative subset of deaths in a country and are not recommended when other data are available. Such reports identify the cause of death using ICD codes. Death records cover all deaths in a community and are an important indicator of problem magnitude. They generally do not identify alcohol involvement. External cause codes only specify alcohol involvement in deaths that are directly due to the acute effects of alcohol (e.g., drowning in one's own vomit). In some cases, death records may provide information on contributing factors through the use of additional (i.e., non-primary) ICD-9 codes, but these codes still under-report alcohol involvement in most countries (Finland may be an exception – see Mäkelä, 1998).

Injuries with Alcohol Involvement from Emergency Room or Trauma Center Records: Data collected on individuals brought to emergency room (ERs) or Trauma Centers for treatment may include demographic information, time of day of admission, day of admission, type of admission, BAC, ICD-9 diagnosis codes denoting the nature of the injury or condition, and ICD-9 E-codes (external codes identifying the cause of the injury or condition). A few countries do aggregate ER records across facilities. Considerable variability exists across communities and facilities in the type of information routinely collected in ERs. The use of E-codes is relatively rare, and many facilities do not use ICD codes. In estimating problem magnitude, ER records represent only part of the burn, drowning, and fall cases. Testing for BACs among those treated for injuries is conducted erratically and depends on perceptions of medical necessity and staffing levels. This testing is not done routinely and consistently even in severe trauma cases. In addition, in many countries records are hospital property and are not made available, and the population of injured individuals appearing at ERs is systematically different from the general population of injured persons.

Night-time Injuries: Night-time injuries are those with high alcohol involvement and may be used as a surrogate for alcohol-related injuries in like manner to night-time road crashes (Cherpitel, 1994). These measures can be obtained from emergency room records and do not require that the medical staff do any special testing or coding. Australian data indicate that about 65% of injured persons presenting to Emergency Rooms between 10pm and 6am have consumed alcohol in the previous 6 hours (McLeod *et al*, 1999).

Injuries with Alcohol Involvement from Emergency Room Survey Data: This is a survey approach which interviews injury patients at emergency rooms (usually in local hospitals serving the target area or population) in which self-reports of alcohol-involvement in the injury obtained (usually via a breath sample, but blood samples could also be used). Perhaps because emergency room surveys allow for the direct measurement of the BAC of injury patients and are thus characterized by high face validity, they have been the traditional technique used for the study of alcohol involvement in injury. Additionally, these surveys may include questions on the type and cause of injury and personal drinking pattern information. They are also characterised by a high degree of design control. Specifically, instruments may be designed to reflect the specifics of the intervention being evaluated along with the substantive interests and theoretical orientations of the researcher. Additionally, such surveys do yield the types of injuries likely to be alcohol involved (i.e., those characterised by high levels of severity). This methodology is not without limitations as a means to provide data on the pre- and post-intervention effects of a prevention trial. First, emergency room surveys are extremely expensive. Of course, since per-respondent emergency room survey costs are a function largely of the “traffic flow” of respondents through local hospitals, it is difficult to determine an exact cost.

Injuries with Alcohol Involvement from Self Report Population Surveys: These are counts of injuries associated with drinking resulting from a survey of the general population, e.g., telephone or household survey. Telephone surveys with injury items have been recently developed as an alternative to the emergency room survey alternative (Cherpitel, 1995; Mäkelä and Simpura, 1985; Treno, Gruenewald, and Ponicki, 1996). This methodology allows for more survey items than are possible with an emergency room survey, is not subject to the vicissitudes of hospital administrators and probably provides a more representative sample of total injuries in the population. The majority of these injuries were less serious and thus less likely to involve alcohol. Moreover, very few of self-reported injuries are attributed to alcohol by the injured respondents. Such self-reports are also subject to the vagaries of respondent memories. A self report survey (household or by telephone) does, however, provide a means for systematic and consistent measurement, but the incidence of self-reported injury is low in frequency and relatively large samples are required for stable estimates.

Later in this manual it will be recommended that a number of survey questions and topics are combined in regular national surveys in those countries which can afford these.

Suicide

Prevalence

Alcohol has been implicated as a contributory cause to suicide in studies , Russia and Sweden (see Edwards *et al* for review). The U.S. Center for Disease Control concluded that 28% of U.S. suicides were attributable to alcohol. The Australian review of alcohol-related disorders examined a large set of Relative Risk studies, clinical case studies and blood alcohol case series studies and came to a more conservative conclusion that alcohol is implicated in 12% of male suicides and 8% of female suicides. A study of coroner reports in three Canadian provinces concludes that the estimated proportion of suicides attributed to alcohol may be considerably greater than that indicated by the Australian review (Rehm *et al*, 1996). A major analysis of all former USSR countries concluded that alcohol was implicated in more than 50% of suicides (Wasserman *et al*, 1994). In addition the latter study were able to link changes in the national availability of alcohol with changes in suicide rates – greater availability being positively correlated with suicide rate.

Measurement issues

Annual data on per capita suicide rates are compiled from death certificates and made available in many countries. Problems of failing to identify alcohol involvement have been discussed above. Mortality data generally includes date and time of death, a primary classification of cause of death, and place of death. Suicide coding is subject to problems in distinguishing intentional from unintentional acts that result in death (i.e., unintentional overdose versus intentional overdose) and inaccurate reporting of intentional death to protect the individual or family. Physicians may also fail to report suicide to avoid police questioning or spending time in court. Consequently, suicide mortality rates probably understate the prevalence of self-inflicted death. Some may be included under deaths of unknown intent.

The association between suicide and excessive alcohol use is complex because (1) alcohol may act as self-medication for the relief of depression or as an associated marker of psychopathology leading to suicide (2) alcohol use disinhibits impulses to suicide and directly supports aggression (3) excessive alcohol use impairs cognitive processes that otherwise assist with alternatives to impulsive or violent behaviour (4) alcohol abuse may be an indicator of social disintegration associated with suicide.

Alcohol involvement in suicide is substantially under-reported. When information on alcohol as an indirect cause is not ascertained or is known but not indicated through the use of multiple diagnosis codes, death records do not report suicides involving alcohol.

Autopsy records on suicides (as well as all violent deaths) are often compiled by medical examiners or coroners offices and may be made available to the public. These records are seldom maintained in easily accessible form. Problems include under-reporting of suicides, as well as determining alcohol involvement (see above). Specifically, reports of suicides may be unreliable because of (1) selective autopsies for some deaths and not others, (2) difficulties establishing intent, (3) biases in classifying intentional deaths as suicide, (4) selective BAC testing of some, but not all, deaths, and (5) confounding of estimated BACs because of time lags since death.

For some of the above reasons there are difficulties with suicide data as an indicator of alcohol-related harm. The major difficulty is the strong likelihood of there being different Relative Risks of suicide due to excessive alcohol use in different countries as a consequence of the many cultural factors which will influence this relationship. This is less of a problem for tracking changes over time in the same country, assuming that the socio-cultural sources of under-reporting remain relatively constant. We recommend that Relative Risk estimates be based upon well-conducted studies from, ideally, the country to which they are to be applied, or at least from culturally and economically similar countries. Even though suicide and alcohol involvement in suicide are both under-reported to varying degrees across different countries, official suicide rates still contribute significantly to premature deaths in many countries. Alcohol is a contributing cause in many suicides and this should be included in continuing estimates of alcohol's contribution to preventable death even if comparisons of rates between culturally dissimilar countries may be problematic.

Interpersonal violence

Violence is an intentional action by an individual or individuals that directly results in physical injury to another individual or individuals (Parker, 1993). This definition does not necessarily imply that the person committing a violent act intends to injure or kill the victim but that the harm-producing action was intentional. Besides injury and possible death, there may be property damage and emotional distress. Violence occurs along a continuum that ranges from minor assault among peers, in which no one is injured, to multiple homicide. Violence occurs across all kinds of interpersonal relationships including those of relatives, friends, acquaintances, and strangers. The definition may be expanded to include child abuse and minor assault without physical injury. Violence between individuals occurs in many forms and contexts. For purposes of reporting crime statistics, violent crime is defined as homicide, robbery, assault, and rape.

Alcohol-related assaults: Alcohol is implicated as a causal factor in assault in two ways: high alcohol intake represents a risk factor in becoming a victim of assault and alcohol is also a potential causal factor in committing an assault. The role of alcohol as a causal factor in perpetrating assault is highly complex and the evident association between alcohol consumption and violence may be partly explained by other factors. Nonetheless, the Australian meta-analysis examined 5 clinical case series that assessed for the presence of intoxication in assault perpetrators and concluded that 47% of assaults are attributable to alcohol. The U.S. ARDI software includes an alcohol Aetiological Fraction of 46% for assaults. In the Canadian cost study it was estimated that 160 deaths and 3,175 hospitalisations occurred in Canada in 1992 as the result of alcohol attributable assault. Studies in Zambia have estimated that alcohol is involved in between a half and two thirds of all violent deaths (Haworth and Acuda, 1998).

Alcohol-related child abuse: The Australian review examined eight studies on the role of alcohol in child abuse and concluded that there was sufficient evidence to claim that alcohol was a causal factor in 16% of cases. Applied to Canadian incidence data, it is estimated that 1 death and 76 hospitalisations was the result of alcohol-related child battering in 1992. It is generally believed that cases of child abuse tend to be highly under-reported in most countries.

Measurement issues

Use of Police Assault Record— Many countries report crime statistics on violent crimes. The data only include police-reported violent crime. There is substantial under-reporting that varies across crimes.

The BAC of some homicide victims may be obtained if an autopsy is performed. For most violent crimes, information regarding alcohol use is only available through observations of police or witnesses to the crime or the self-reports of participants. Self-reports of offenders and victims may be biased, however, and reflect other motives in the reporting of alcohol use, such as attempts to deny responsibility for the event or efforts to seek reduced criminal charges.

The most detailed and reliable data are available on homicide. Cases of robbery and assault are reported less reliably than homicide, with sexual assault probably least often and reliably reported because of the traumatic nature of the crime itself coupled with the stigma and blame sometimes attributed to victims. Where the degree of severity of an assault is indicated in records e.g. whether medical treatment was required then more confidence can be had in these data as an indicator. Serious cases of assault, best exemplified by homicide, are less subject to biases in policing levels and enforcement strategies as they are almost invariably reported to the police in any case.

Night-time Assaults from Police Records—Night-time assaults have high alcohol involvement in like manner to night-time road crashes and unintentional injuries. This indicator can be derived from police records and does not require that the law enforcement agency infer alcohol’s potential involvement (Stockwell *et al*, 1998). An Australian study estimated that 91% of assaults occurring in public places in Sydney between 10pm and 2am involved prior consumption of alcohol (Ireland and Thomenny, 1993). However, level of police enforcement greatly influences reported rates and these data need to be interpreted cautiously.

Assaults from Emergency Room Survey— Just as emergency room surveys are a potential source of epidemiological data about unintentional alcohol-related injuries, in like fashion intentional (non-fatal) assaults can be derived from such surveys. There is a great potential to expand the use of these data as an alcohol harm indicator. Providing there is reasonable access to Emergency Room facilities in a population of interest, presentations of persons with assault injuries will be determined more by severity of injury than the recording biases identified above for police data. The use of night-time cases as a surrogate for alcohol-related assaults also warrants investigation

Assaults from General Population Surveys—General surveys in some countries are used to develop estimates of crime. In the United States, the National Crime and Violence Survey has been administered nationally by the Bureau of the Census since 1972. The survey focuses on rape, robbery, assault, burglary, larceny, and motor vehicle theft, and includes information on the frequency and impact of crimes, characteristics of victims and offenders, circumstances surrounding the crimes, patterns of reporting to the police, and on whether the victim thought that the perpetrator used alcohol or illicit substances. People are sometimes unaware that they have been victims of a criminal act, especially domestic violence; even when aware, they may be reluctant to report an incident. However, since population surveys can gather information about crimes not reported to police and in a relatively safe context in which there are no consequences for respondents (e.g. having to identify the offender, having to testify in court) population surveys can be less subject to under-reporting than police records.

Comparisons between different countries regarding self-reported experiences of various crimes must pay special heed to the wording of questions used e.g. the time frame used for the question which may vary considerably. It is generally recommended that where possible multiple sources be used for estimating the extent of alcohol-related violence: if a trend is similar across police, health and survey data then this can be relied on.

Composite measures of acute alcohol-related problems

A new approach to monitoring the problems discussed above is to use a composite measure that combines health system information from all major categories of acute alcohol-related harm. Estimates of the rate of all acute alcohol-related hospital admissions in a year for a local population have been found to be highly associated with local rates of alcohol consumption (Stockwell *et al*, 1998), especially when these estimates were adjusted by appropriate alcohol Aetiological Fractions. Table 3.3.1 shows summary alcohol Aetiologic Fractions estimated for Canada by Single *et al* (1999) for both morbidity and mortality and provide the relevant ICD-9 codes for each category. These were updated estimates from the English *et al* (1995) review. ‘Accidental excessive cold’ for example, was not a feature of the Australian study!

Table 3.3.1: Aetiologic Fractions for conditions mainly caused by short-term effects of alcohol as estimated for Canada for 1992 by Single *et al* (1999)

Cause of disease or death:			**Aetiologic Fraction estimated for Canada**				
			Mortality		**Morbidity**		**Age**
Alcohol-related Conditions:	**ICD-10**	**ICD-9**	**M**	**F**	**M**	**F**	**Range**
<u>Alcohol specific causation:</u>							
Alcohol Toxicity		[980.0, 980.1] or [E860.0-E860.2]	1.000	1.000	1.000	1.000	0+ or 15+
<u>Medium alcohol causation:</u>							
Motor Vehicle Accidents		E810-E819, E820-E825	0.430	0.430	0.301	0.301	0+
Accidents by Fire & Flames		E890-E899	0.375	0.375	0.075	0.075	15+
Accidental Excessive Cold		E901	0.250	0.250	0.250	0.250	15+
Accidental Drowning		E910	0.299	0.227	0.128	0.094	15+
Accidents with Firearm Missile		E922	0.250	0.250	0.175	0.175	15+
Suicide, self-inflicted Injury		E950-959	0.272	0.168	0.277	0.172	15+
Victim, Assault		E960-E966, E968-E969	0.270	0.270	0.270	0.270	0+
Aspiration Vomitus		E911	0.250	0.250	0.250	0.250	15+
<u>Low alcohol causation:</u>							
Other Road Vehicle Accidents		E826, E829	0.200	0.200	0.140	0.140	0+
Water Transport Accid		E830-E839	0.200	0.200	0.140	0.140	0+
Air-Space Transport Accidents		E840-E845	0.160	0.160	0.112	0.112	0+
Accidental Falls		E880-E888	0.238	0.152	0.233	0.130	15+
Accidents with Objects/Machines		E917, E918, E919-E920	0.070	0.070	0.049	0.049	15+
Victim, Child Battering		E967	0.160	0.160	0.160	0.160	0-19

Notes:

1. "n.a." appears for one of the following reasons:
   (a) the Aetiologic fraction has been directly determined and the Relative Risk is thus not required
   (b) the condition only applies to the other gender (e.g. breast cancer for men)
   (c) no cases of mortality were observed (e.g. psoriasis). Where the Relative Risk is shown, the Aetiologic fraction has been calculated by dividing the total attributable incidents estimated for Canada (from age, gender and province specific prevalence data and the Relative Risk estimates) by the total incidents reported in Canada in 1992.
2. Estimated Relative Risks for suicide are 1.40 for Low Risk drinking, 2.32 for medium and 2.52 for High Risk drinking for both men and women. These were calculated by Robson et al (1998) using the indirect method utilising survey-based prevalence estimates for each level of drinking for men and women in Canada.

It must be stressed again that estimates of Aetiological Fractions are country specific in that they must take account of local estimates of prevalence of excessive drinking. In relation to acute alcohol-related harm, it is also necessary to take account of likely differences in the probability of harm occurring from excessive drinking given the multiple determinants of problem events and their interaction with drinking as a risk factor. For example, at a BAC of 0.05, the risk of a crash will depend on a whole range of road conditions such as traffic flow, road traffic policing and condition of the surface of the road. These will be very different in India, for example, compared with Sweden. Alcohol-related violence is more likely to occur in some settings such as crowded late night bars than at private parties i.e. it is much safer to be intoxicated in some settings than in others. Local drinking practices and preferences will greatly determine the risk of the various problem events occurring when a person is intoxicated.

In the absence of region specific, large scale and reliable cohort or case-control studies which incorporate measures of exposure to high risk drinking occasions (from which robust estimates of Relative Risk might be derived), it is recommended that local case series data are used to estimate the proportion of cases considered to be alcohol-caused by use of the direct method. Failing that, estimates based on pooled results from similar countries might be applied. Table 3.3.2 summarises the countries in which studies used by English *et al* (1995) were conducted and used to make pooled estimates of proportions with BACs in excess of 0.05%. Caution would need to be used when considering applying these estimates to countries not so included, especially if they have different patterns and levels of alcohol consumption.

As a consequence, the absolute levels of the various problem indicators that may be used to monitor acute alcohol harm should only be compared between countries with similar reporting systems and important similarities in culture and sociodemographic make-up. Tracking of acute problem indicators is more valuable within a country as a means of monitoring trends and relationships between trends in different variables over the years. It is recommended that multiple, best available acute harm indicators be used from different reporting domains especially hospital admission data, survey and police data. Likely sources of confounding should always be acknowledged for each data source and, where possible, also estimated. An example of national trend data is given in Table 3.3.3 for acute types of alcohol-related harm in Australia (from Chikritzhs *et al*, (1999).

Table 3.3.2: Pooled estimates from case series drawn from different countries for proportion of cases with BAC over 0.05mg/ml[7]

Diagnostic cattegory	ICD-9 code	Case series N =	Countries from which case series data reviewed in English *et al* (1995) meta-analysis	Pooled estimates of proportion of cases with BAC>0.05		
				Males	Females	Total
Medium alcohol causation:						
Motor Vehicle Accidents	E810-E819, E820-E825	14	New Zealand, USA, France, Scotland, Norway,,Australia, Denmark, Sweden, Switzerland, UK	0.37	0.18	0.26
Accidents by Fire & Flames	E890-E899	7	USA, France	0.44	0.44	0.44
Accidental Drowning	E910	8	USA, NZ, Denmark, France, Australia	0.34	0.34	0.34
Suicide, self-inflicted Injury	E950-959	12	USA, Australia, South Africa, Germany	0.25	0.25	0.25
Accidental Falls	E880-E888	3	USA, France	0.34	0.34	0.34
Victim, Assault	E960-E966, E968-E969	19	USA, France, South Africa, Denmark, Sweden, UK	0.43	0.43	0.43
Low alcohol causation:						
Accidents with Objects/Machines	E917, E918, E919-E920	10	Canada, USA, France, Denmark, Australia	0.07	0.07	0.07
Victim, Child Battering	E967	8	USA	0.16	0.16	0.16

Source: English *et al* (1995)

[7] Information from English D, Holman D, Milne E, Winter M, *et al.* The Quantification of Drug Caused Morbidity and Mortality in Australia, 1992. Canberra: Commonwealth Department of Human Services and Health, 1995.

Table 3.3.3: Estimated total number of alcohol-caused deaths in Australia attributable to short-term High Risk (NHMRC, 1992, hazardous/harmful) alcohol use, by year and condition

ICD-9 Codes	**Cause of death**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
291	Alcoholic psychosis	38	38	41	41	73	71	57	51
305.0	Alcohol abuse	24	10	15	13	10	16	18	13
427.0, 427.2, 427.3	SV cardiac dysrhythmia.	8	9	10	11	13	13	16	14
530.7	Gastro-oesoph .haemorrhage	3	1	1	2	4	3	1	1
535.3	Alcoholic gastritis	3	3	3	1	2	1	3	4
577.0	Acute pancreatitis	35	29	33	30	35	35	30	38
634	Spontaneous abortion	0	0	0	0	0	0	0	0
656.5, 764, 765	Low birth weight	0	0	0	0	0	0	0	0
980.0	Ethanol toxicity	45	33	48	24	25	48	63	37
980.1	Methanol toxicity	1	1	3	0	0	0	1	0
E810-819	Road injuries	632	552	483	467	453	468	452	417
E860.0	Alc. beverage poisoning	11	4	7	0	0	1	3	0
E860.1, E860.2,	Other eth/meth poisoning	1	1	0	2	5	0	2	2
E880-E888	Fall injuries	56	54	49	47	49	107	56	41
E890-E899	Fire injuries	41	51	46	38	45	37	45	34
E910	Drowning	71	70	70	75	69	64	62	73
E911	Aspiration	118	93	82	57	67	54	58	57
E919, E920	Occupational mach injury	5	6	5	4	5	3	4	5
E950-E959	Suicide	230	238	223	202	221	229	230	263
E960, E965, E966, E968, E969	Assault	157	141	130	123	132	37	130	124
E967	Child abuse	1	1	1	2	1	1	1	1
All acute alcohol codes		1481	1335	1252	1139	1208	1188	1231	1176

Source: Chikritzhs *et al,* 1999b

Recommendations

This chapter has reviewed indicators of acute alcohol-related harm. It is recognized that countries have different levels of resources to commit for such monitoring. As in the previous Chapter, we identify four levels of detail for alcohol-related indicators to reflect this reality. It is intended that the higher levels also include use of those indicators identified at the lower levels i.e. they show additional measures not alternatives.

Low level indicators

Countries with reliable mortality data coded to only 3 digits but including E codes for causes of intentional or unintentional injuries can report on annual rates of causes with a medium level of alcohol causation as identified by Single *et al* (1999), see Table 3.3.1. The only specific alcohol-caused acute condition identified there is that of alcohol toxicity, however 4 digit codes are required for its identification.

It is recommended that where there are sufficient data (e.g. at least 50 per year) all ‘medium alcohol causation’ cases for the country of interest (e.g. those listed in Table 3.3.1 for Canada) are used and reported on separately as well as in combination. It is likely that annual deaths from road crashes, suicide and assault will be sufficiently numerous in many countries to be reported individually. Of course local case series studies may identify other accidental causes of death which are at least moderately alcohol-related e.g. occupational injuries. Given that the estimated AFs vary within a fairly narrow band (for Canada between 0.25 and 0.43) and that applications of such estimates to other countries will not be precise in the absence of local studies, a composite measure comprising the sum of all these causes of death without adjustment for AF could be used. Alternatively, weighting by estimated country-specific AF could be used to present alcohol caused deaths over the time period of interest. Chapter 3.1 outlines methods for estimating country-specific AFs. It is recommended that cases of accidental falls involving persons over 65 years of age are not considered as related to alcohol consumption since most falls occurring in this age group are attributable to causes other than alcohol with previous estimates of AFs for elderly fall known to be severely overestimated (see Jonas *et al*, 1999).

When monitoring such indicators over time it is advisable to attempt crude adjustments of AFs in terms of proportional changes in prevalence of drinking over time on the basis of local per capita consumption data (see Chapter 3.1).

An important limitation on the use of such indicators would be in countries with relatively low levels of alcohol consumption – unless local case series studies confirm a significant proportion of cases of one the identified causes of death above are related to alcohol use. As a rule of thumb, if national per capita consumption is below 5 litres per person per year these indicators may not be useful. However, in relation to road deaths it is the alcohol consumption of persons driving motor vehicles which is important and per capita consumption may not be a good indication of what, in developing countries, will be a relatively affluent segment of the population. Certainly the higher the level of per capita consumption then the greater confidence can be had in these crude indicators.

Medium level indicators

These can be used for countries in which reliable morbidity and mortality data sets are available with ICD-9/10 E-codes recorded to only 3 digits. In addition such countries are likely to have separate data from road safety authorities identifying road crashes in which drivers, passengers or pedestrians are injured seriously or fatally. These will be especially useful as alcohol harm indicators if time of day data are also available so that a sub-set of night-time cases can be identified.

As described for mortality data above, it is recommended that all E-code conditions with estimated AFs of at least 0.25 are used. They should be reported separately for high volume cases and also in combination. Crude adjustments for changes in per capita consumption should once more be made for reporting trend data over several years (see chapter 3.1). Between-country comparisons should only be made where (i) local case series estimates of alcohol-related cases are available or internationally published studies are deemed to be applicable (see Table 3.3.2) and (ii) per capita consumption data are not thought to be significantly affected by an illicit trade in alcohol (iii) the mortality data are age-standardised (see Chapter 3.1).

Another valuable indicator will be rates of serious or fatal road crashes occurring between 8pm and 4am. Local data on the 'routine activities' of drinkers and drivers may suggest different time periods will capture the highest proportion of alcohol-affected drivers. In addition there may be certain days of the week which are known to be high drinking days such as paydays, social security days, weekends, festivals and public holidays – although the later two are not suitable for measuring trends in alcohol-related harm. Where available, BAC data of drivers involved in crashes can be used to establish the optimal time profile to be used in developing such an effective indicator.

High level indicators

These are achievable in countries where ICD E-codes are routinely recorded to 4 digits, where applicable case series data estimating AFs are available for ALL low, medium and high alcohol causation conditions listed in Table 3.3.1 and national survey data are available on prevalence of Medium/High Risk drinking.

Collectively these refinements will each result in various improvements to the Medium level indicators above. The 4th digit permits the use of the only alcohol specific acute conditions, namely alcoholic poisoning and toxicity. In some countries these are low in number (see Table 3.3.3) but in Finland, for example, four to five hundred are recorded annually (Mäkelä *et al,* 1997). The availability of local case series data or estimates from similar countries for each condition, will enable estimates of alcohol AFs for all low, medium and high alcohol-cause conditions to be estimated with more confidence. In turn this means that both morbidity and mortality data can be weighted to develop composite indicators and overall estimates of acute alcohol caused deaths and hospital separations. These composite indicators should be created separately for each level of alcohol causation and also reported in total. Triangulation can be used to examine trends having adjusted for estimated changes in drinking prevalence using the best available consumption data. In this regard, the availability of national survey estimates of drinking prevalence for different age groups of drinking at Medium and High Risk levels will enable a reliable local estimate of the age-specific AFs for suicide which tends to be a major cause of mortality. The AF for suicide is conventionally calculated using the 'indirect method' (thereby producing a Relative Risk).

For countries which have developed such local capacity to estimate their own country-specific AFs and ability to adjust these for changing levels of alcohol consumption, it is reasonable to make between country comparisons on the above indicators.

There are three additional indicators for acute problems suggested at this level:

Single Vehicle Night-time Road Crashes—This is the number of road crashes involving only one vehicle which occur between the hours of 8 p.m. to 4 a.m.

If data are available crashes by Blood Alcohol Concentration (BAC) of drivers, e.g., crashes with BAC > 0.05, or > 0.10, or > 0.15, at least in fatal crashes where one or more persons was killed should be used. In addition, fatal crashes versus serious injury crashes by BAC of drivers can be monitored.

Serious Night-time Assaults—These are all physical assaults occurring between 8 p.m. and 4 a.m. and presenting to emergency rooms between 10 p.m. and 6 a.m. Both police and hospital data can be used, though time of presentation is more usually available from police than hospital records.

Injuries from Emergency Room Records—This is an indicator with a substantial amount of alcohol involvement. If available, night-time injuries are a more valid indicator of alcohol-related trauma, especially for young males with either unintentional or intentional injuries (McLeod *et al*, 2000).

Optimal level indicators

Composite measures of acute harm

The High level indicators would be used in a more sophisticated manner to yield annual estimates of alcohol-related hospital bed-days, Person-Years of Life Lost (PYLLs) and less frequent estimates of the economic costs of these conditions (every 3 to 5 years). The first two categories (in addition to number of deaths and hospital admissions) should ideally be calculated with breakdowns for major administrative regions of the country.

National survey items on acute problems

In national surveys of drinking behaviour, items regarding self-reported events of acute alcohol-related problems should be included. There is no internationally recognised set of questions for achieving this as yet.

All countries can benefit from more accurate and reliable measures of alcohol-related problems within their national borders. Thus an important recommendation for the future is to improve the measurement of alcohol's involvement in social and health problems. This can be accomplished by purposeful measurement and coding of alcohol's presence in specific events of local concern resulting from acute exposure to alcohol. This can include a national policy of monitoring the time and place of problem event occurrence and determining the BAC of persons with acute problems that occur with high frequencies, e.g., injured persons who present at emergency departments.

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Section 4:

Summary and Recommendations

Chapter 4.1

Summary of key points and recommendations

Summary

A number of broad conclusions arising from the previous chapters are drawn and then the recommendations for developing national monitoring systems are summarised according to four levels of available resources.

A major conclusion is the need for individual countries to develop their own capacity and empirical base for national alcohol monitoring. Comparable and internationally standardised approaches for estimating per capita alcohol consumption, measuring drinking patterns via surveys and estimating alcohol-caused mortality and morbidity need to be further developed. However, the local inputs and assumptions required in each case will often need to be country-specific. Examples are with estimates of typical beverage strengths, serve sizes, Relative Risks for conditions partly caused by alcohol (especially those of acute causation) and the collection of accurate national alcohol sales, production and/or taxation data to estimate per capita consumption.

Another main conclusion is that monitoring systems can be developed which rely on 'indicators' of risky consumption and harm even where these do not give comprehensive estimates of prevalence. It must be possible to defend the assumption that external sources of bias are reasonably constant over time. In addition control non-alcohol problem indicators can be developed to partially control for bias and also multiple sets of indicators can be used to confirm observed trends using the principle of triangulation.

The minimum level of national capacity for monitoring is suggested to be access to reliable mortality data using the first 3 digits of ICD diagnostic categories to allow recording of a small number of alcohol-contributed causes of death. Higher levels require two or three questions included in national health surveys, ICD coding to four digits and reliable data on the number and timing of road crashes. An optimal level of monitoring would include the capacity to (i) convert mortality and morbidity data into annual estimates of Person Years of Life Lost (PYLLs) and Disability Adjusted Life Years Lost (DALYs) (ii) conduct detailed national alcohol as well as estimates of the full economic impact of alcohol on the nation's economy.

This guide has presented discussions of indicators of alcohol consumption and harm that are often considered in isolation from each other. It has been argued that data from industry, self-report surveys, health, census, police and traffic sources can be used in mutually consistent and supportive ways to create a valuable national resource for monitoring patterns of harm across time and place.

The potential to develop a comprehensive set of national indicators will depend upon the availability of some key sources of data. This in turn will depend on availability of funds and governmental commitment to expend these.

Before summarising the various recommendations, a number of conclusions and qualifications are worth noting regarding the ambitious task of monitoring both national and international trends in alcohol use and harm.

International comparability sometimes requires local development of the key variables

A recurring theme has been that the goal of international comparability is sometimes best achieved through the use of *locally* valid measures designed to assess a specific dimension of harm or consumption. In relation to survey data this means that the questions used, the beverages referred to and the drink sizes assumed will need to be adapted to each country to arrive at truly comparable estimates of, for example, the frequency of drinking more than 'five drinks' per day. In relation to comparing health statistics after applying alcohol aetiological fractions, it means that local estimates of the prevalence of high risk drinking need to be applied for chronic conditions and that local data are best used for estimating Relative Risks for chronic conditions and Aetiologic Fractions by the direct method for acute conditions.

A simple illustration was provided in Chapter 2.3 regarding the use of international conversion factors for typical alcoholic beverage strength and serve size which can lead to unnecessary errors since these factors vary quite considerably across countries. Similarly, the idea of using the concept of a 'standard drink' as a unit of measurement in consumption surveys is not recommended both because of international variation in what this is and the fact that individual drinkers frequently do not drink standard sized serves. In Annex 10 it was noted that in rural Mexico the use of the Last 7 Day method of asking about recent drinking would be complicated by the usual pattern among drinkers of drinking heavily only occasionally at fiestas which occurred every two or three weeks. In addition, the straight translation of a standard alcohol use assessment instrument resulted in items which were understood very differently in Mexico than in other countries.

Another example of an unhelpful international uniformity is in relation to the cut-offs used in drinking questionnaires to define particularly high risk drinking levels in terms of numbers of 'drinks' e.g frequency of "5+ drinks". As shown in Chapter 2.2, this item will reflect different amounts of alcohol consumed in different countries. It is strongly recommended that each country develop its own empirically based estimates of both typical serve sizes and alcoholic beverage strength for all major beverages and in both licensed and private settings. Providing the categories employed for different surveys are roughly comparable in terms of actual grams of alcohol, international comparability on frequency of, say, 60g + days can be readily achieved.

Section 3 espouses the concept of estimating the proportion of reported cases of a particular health problem that can be attributed to alcohol (the Aetiological Fraction). However, such fractions are not internationally applicable and must be calculated on the basis of (i) case series which identify systematically the proportion which are or (ii) the application of Relative Risk data to local prevalence data for particular risk levels of consumption. Even the Relative Risk data summarised in Tables 3.2.1 and 3.3.1 from one of the latest national quantification exercises must be applied with some caution to different countries. Local factors such as nutrition or condition of roads may modify risk levels across different countries.

Limitations of current data

Attention has been drawn in this volume to a number of often ignored limitations in national data used in relation to alcohol consumption. In particular, estimates of per capita alcohol consumption are made for many countries based on standard assumptions about the typical strengths of the major beverage types. As discussed in Chapter 2.3, the alcoholic strength of major classes of beverage (wines, beers, spirits) varies considerably both within categories and across time. Conversion factors for typical strengths are rarely based systematically on empirical data. Comparisons between countries are often made without reference to different age and sex profiles of their populations, which can in some cases partly explain different observed unadjusted levels.

A source of problems for survey data is in relation to comparisons between countries in the way in which units of alcohol consumption are reported and recorded. It is frequently asserted that 'standard drinks' in the USA contain approx 14g of alcohol, in Canada 13.6g, in the UK 8g and in Australia and New Zealand 10g for example. Several studies have shown, however, that in practice actual serve sizes of drinks vary substantially from these purported norms.

It is recommended that these issues are addressed so that more accurate national estimates can be made for these crucial conversion factors both across place and time. This would improve the validity of national level data and, hence, also increase the possibility of international comparisons.

Advances in alcohol epidemiology have resulted in new ways of estimating the extent of harm

The ideas discussed in this volume, particularly in Section 3, draw heavily from recent large-scale reviews which have quantified alcohol-related morbidity and mortality – in particular one conducted in Australia by English *et al* (1995) and an extension and replication of this work by Single *et al* (1996) for Canada. In many respects theses estimates of alcohol-related deaths and hospital bed-days are conservative and, as further scientific evidence accumulates, higher estimates will emerge. These quantification exercises are based on a rigorous evaluation of all available scientific evidence regarding the relationship between drinking alcohol at Low, Medium and High Risk volumes of alcohol consumed and the 61 health conditions in which alcohol has been implicated. It is recommended that other countries adopt this methodology and apply it to develop their own estimates. The summary of estimated Relative Risks from these studies shown in Section 3 can be a starting point for such an exercise. It is also necessary to have data from national surveys which provide estimates of the prevalence of low, medium and High Risk drinking levels in the general population. A different approach is required for estimates for acute problems where greater reliance must be place on local case series data on alcohol involvement and, ideally, blood alcohol level data from both cases and appropriate comparison groups. It is apparent that more case-control studies are required to estimate Relative Risk factors for acute problems. In addition consideration needs to be given to the possibility of estimating the prevalence of High Risk drinking for acute problems on the basis reported frequency of 5+ drinks per day. This would mean that the prevalence of such a drinking pattern could be applied to make more local and time specific estimates of alcohol caused acute problems.

Knowledge of numbers of alcohol-related deaths, illnesses and injuries, as well as to cost these, is of more than academic value. It is also highly salient information for policy makers and the many people who have input into the formation of national policies on alcohol. In Australia, the estimated 3,700 deaths per year (English *et al* , 1995) and $4.5 billion in costs (Collins and Lapsley, 1996) in 1992 are still quoted more than any other alcohol statistic and help keep national attention on alcohol-related harm to the extent that is warranted. The estimates for alcohol-caused deaths have been updated recently by Chikritzhs *et al* (1999a) and the same group have also adapted the method to generate quarterly data at the State level for the evaluation of a major alcohol policy initiative (Chikritzhs *et al,* 1999b). The methodology has also been applied at the local and regional levels (e.g. Midford *et al*, 1998).

One of the strengths of this approach is that it results in bottom-line statistics which most people understand. There is, however, another use to which data can be put and that is for monitoring changes in the levels of problems. It is recommended that time series of estimated cases be developed for monitoring changes in rates across time and place for policy purposes. This objective can also be pursued employing a range of other indicators which do not in themselves need to be estimates of the prevalence of a particular kind of harm but are, nonetheless, excellent indicators of harm e.g. night-time assaults, road crashes and emergency room presentations.

National and international comparability of trend data does not require comprehensive estimates of prevalence

A number of factors render comparisons between absolute levels or rates of harm across different countries problematic and unreliable. Alcohol specific diagnoses (cirrhosis, dependence, abuse etc) are prone to under-reporting to protect family reputations among other reasons. In relation to acute causes of harm, health and police personnel almost invariably under-report cases in which alcohol was consumed before the problem incident occurred and their subjective estimates must be treated with caution. In some instances, it may be reasonable to assume that these sources of under-reporting remain relatively constant over time so that fluctuations in levels over time reflect genuine changes in problem rates. Another recourse is to rely on proxy or surrogate measures for a particular type of harm. It has been recommended here that these are often viable for acute conditions when time of occurrence data are available. Thus night-time occurrences of violence in public places, single vehicle crashes and injury presentations to Emergency Rooms are all known to be highly associated with prior alcohol consumption in several countries and so fluctuations in levels of these are useful indicators of genuine changes in actual cases. Again it is necessary to assume that there has not been a major change in some other risk factor e.g. some kinds of other drug use.

The important point here is that while many of the data sources recommended are inadequate as reliable estimates of total prevalence of cases, they can, nonetheless, be employed (with some care) as indicators of trends in harm levels across both time and place. Steps need to be taken to ensure that there have not been major changes in other risk factors or in the methods employed for defining or otherwise recording cases. Changes in the availability of health services or in the overall presence of police in such places as near late night licensed premises or for conducting roadside breath-testing also need to be taken account of. The use of more than one method and data source is recommended whenever possible to determine how genuine is an observed trend while bearing in mind that some data sets, such as police arrest rates, are more prone to confounding than others.

Measures of both volume and pattern of drinking over time are recommended

The distinction between alcohol-related harm that is of acute as opposed to chronic origin is fundamental to this guide. It is now known that each kind of harm contributes about equally to the total number of alcohol-related deaths per year in Canada and Australia. While alcohol policy can be marginalised if seen to be mostly about preventing harm to a small minority of the population ('problem drinkers' or 'alcoholics') acute harm is a risk at one time or another, directly or indirectly, to almost everyone. The underlying patterns of drinking which expose an individual to risk of harm can be distinguished both from each other and from a pattern which is Low Risk or even beneficial in terms of apparently reducing the risk of death from coronary heart disease. Different though complementary approaches are required for the assessment of drinking which is High Risk for acute as opposed to chronic harm. In fact, the frequency of heavy drinking occasions contributes to the risk of chronic as well as acute problems (Puddey *et al*, 1999). On the other hand, regularity of drinking will determine degree of tolerance and hence the likely degree of intoxication and risk which will result from drinking a particular amount of alcohol on one occasion. It is recommended, therefore, that for all research and epidemiological purposes both measures of drinking volume and temporal pattern always be employed.

The issue of combining both volume and pattern measures has been explored here also in relation to per capita estimates of consumption for the whole population. It is recommended that the proportion of drinking that can be classified has 'Medium' or 'High' Risk be calculated for entire populations by extrapolation from community-wide surveys. It is acknowledged that survey generated estimates of per capita consumption tend to underestimate that derived from sales data. It is recommended, however, that a) the extent of this underestimation be minimised by use of the Graduated Quantity-Frequency method for each main type of beverage, and b) only the proportion or percentage of total consumption that is estimated to be High Risk (whether for acute or chronic adverse outcomes) be reported while noting that this will be an underestimate since surveys tend to miss some of the heaviest drinkers.

The need for consistent and complementary approaches to conducting surveys, analysing sales data and estimating rates of harm

It is important to note that there are several opportunities for adding value to national data systems by ensuring mutual consistency and complementarity across domains of information that are normally reported on separately. It is hoped that this guide may provide a reference point to facilitate such consistency and complementarity. For example, national surveys can enable estimates of per capita alcohol consumption to be more accurate be providing estimates of the amount of alcohol which is imported or home made. Prevalence rates for different risk levels of drinking are required for applying the epidemiological estimation methods to a particular population described here. National surveys can also be used to estimate directly from self-report signs of dependence and acute harm in the general community - though these require further development for wider application. Field work is recommended in each country and, ideally, regionally, in order to generate more accurate empirically based estimates of the alcohol content of different alcoholic beverages and typical serve sizes. The resulting information can be applied to develop more precise estimates of drinking pattern and drinking levels from both sales and survey data.

The use of multiple and complementary data sources also facilitates the use of 'triangulation' in the analysis and interpretation of trends. That is to say that if the great majority of alcohol harm indicators from different domains (e.g. health and police) and changing in the same direction, it is possible to have much greater confidence in the observed trend. Each indicator in isolation has its own strengths, weaknesses and biases. It is vital that these are not overlooked and that overall trends are examined from multiple vantage points. The same principle also applies to the interpretation of alcohol consumption data: trends supported both by sales and survey data are more reliable than if only one data source is available. Again, local variations in sources of bias should always be considered e.g. changes in recording systems when making an overall appraisal.

National monitoring of adverse consequences only is recommended

Awareness of the widely accepted evidence that moderate alcohol consumption prevents or significantly delays coronary heart disease, has led some to suggest that rather than just reporting numbers of deaths caused by drinking, it should be the net number of lives lost (or gained). It is strongly recommended that here that the separate issues of lives saved and lost are not confused by combining them as a net figure. Instead, the position on this adopted by English *et al* (1995) is recommended whereby estimation is made for public health purposes only of lives lost as a consequence of medium or High Risk drinking (defined as in excess of 40g per day for men and 20g for women – see Chapter 2.2) rather than for all drinking. A similar position was adopted by Single *et al* (1996) in their estimation of the economic and health costs of excessive alcohol use: only the economic costs were calculated as the benefits are almost invariably caused by drinking at Low Risk levels. The only disadvantage of this approach is that it overlooks the fact that at consumption levels below 40g for men and 20g for women there is some evidence of increased risk for some cancers. The level of this increased risk, however, appears to be small and the strength of the evidence is variable. There is also a small risk of acute harm e.g. from driving a vehicle after consuming amounts at or even below these levels. These facts, however, support the classification of such drinking as being "Low Risk" as opposed to entirely safe.

The policy implications of the beneficial effects of alcohol consumption have been reviewed by Casswell (1997) for the European Regional Office of WHO. It was concluded that there was no case for weakening controls on alcohol availability for fear of limiting the beneficial effects that alcohol has on heart disease for people over 45 years of age.

It is recommended that national monitoring systems focus on the level of harm from medium and High Risk drinking, for both acute and chronic harms, in order to serve as a guide for national efforts to reduce this harm.

Summary of recommendations

The key recommendations of the foregoing chapters are presented here in four summary tables (see Tables 4.1.1, 4.1.2, 4.1.3 and 4.1.4), one for each of a presumed level of the availability of resources for the purpose of national monitoring of alcohol consumption and harm. A 'low' level of available resources may be a consequence of generally low levels of funding for health-related issues or a lower commitment to tackling harm. In each case the later tables assume the use of measures listed in earlier tables unless an alternative is specifically recommended.

Table 4.1.1: Summary of recommendations for national monitoring systems with a LOW level of allocated resources

CHRONIC HARMS: Problems caused by long term heavy use	**ACUTE HARMS: Problems caused by occasions of intoxication**	**VOLUME OF ALCOHOL CONSUMPTION**	**HIGH RISK ALCOHOL CONSUMPTION**
1. Rates of death from liver disease, if rates of hepatitis B and C low. 2. Rates of death from alcoholic liver disease, alcohol dependence and alcoholic psychosis. 3. Optional extra indicator if national data on smoking prevalence known: composite measure of deaths from cancer of medium alcohol causation.	1. Rates of fatal road crashes (including pedestrians and cyclists), suicide, alcoholic poisoning and assault. 2. Composite measure of above plus other less frequent medium level conditions listed in Table 3.3.1.	1. Per capita adult alcohol consumption from international sources e.g. FAO.	

Table 4.1.2: Summary of additional recommendations for national monitoring systems with a MEDIUM level of allocated resources

CHRONIC HARMS: Problems caused by long term heavy use	**ACUTE HARMS: Problems caused by occasions of intoxication**	**VOLUME OF ALCOHOL CONSUMPTION**	**HIGH RISK ALCOHOL CONSUMPTION**
1. Rates of all alcohol-specific hospital episodes listed in 8.1.	2. Rates of hospital episodes for road crashes, alcoholic poisoning and assault. 3. Composite measure of above plus other less frequent medium level conditions listed in Table 3.3.1 (i.e. AF>0.25). 4. Trend data to be adjusted by annual per capita consumption level. 5. Rates of serious and fatal night-time crashes.	1. Per capita alcohol consumption estimated from national sources (production, sales and/or taxation). 2. QuantityXFrequency (QF) from survey to derive population rates of consumption at Medium and High Risk volume levels.	1. Per capita alcohol consumption of higher risk drinks e.g. very cheap and/or high strength categories, proportion of beer sold >3.5% alcohol/volume, or other local High Risk drink. 2. QuantityXFrequency (QF) from survey to derive population rates of consumption at Medium and High Risk levels on a *typical drinking day*. 3. Frequencies and %'s of all alcohol drunk on >40g days (men) and >20g days (women) - by QF; frequencies and %'s of all alcohol drunk on >40g days (men) and >20g days (women) - by QF.

Table 4.1.3: Summary of additional recommendations for national monitoring systems with a HIGH level of allocated resources

CHRONIC HARMS: Problems caused by long term heavy use	**ACUTE HARMS: Problems caused by occasions of intoxication**	**VOLUME OF ALCOHOL CONSUMPTION**	**HIGH RISK ALCOHOL CONSUMPTION**
1. Rates of all conditions adjusted by Aetiological Fraction, reported separately and combined for both morbidity and mortality – Relative Risk to be locally derived for liver disease and cancers relating to smoking. Drinking prevalence derived from national survey data. .	1. Rates of all conditions adjusted by Aetiological Fraction, reported separately and combined for both morbidity and mortality – and for which applicable case series data are available for nationally specific estimates of AFs. 2. Night-time rates of single-vehicle crashes, serious assaults and other emergency room injuries.	1. Per capita alcohol consumption also adjusted for imports, visitor consumption and home production applying the Graduated Quantity-Frequency method to estimate latter. Typical alcohol % alcohol content of drinks formally derived. 2. Graduated QuantityXFrequency estimate with alcohol content of drinks derived informally from local data. To derive population rates for men and women drinking at Medium and High Risk volume levels.	1. Proportion of total alcohol consumed in the form of High Risk drinks of any kind e.g. cheap fortified wine, cask wine, strong cider etc. 2. Frequencies and %'s of all alcohol drunk on each of >40g, 60g and 100g days (men) and >20g/40g/60g days (women) - by Graduated QF. 3. %'s of all alcohol drunk *above* each of the daily thresholds of 40g, 60g and 100g for men and 20g/40g/60g days for women - by Graduated QF. 4. Graduated QuantityXFrequency estimate with alcohol content of drinks derived informally from local data. To derive population rates for men and women drinking at Medium and High daily risk levels on a weekly basis.

Table 4.1.4: Summary of additional recommendations for national monitoring systems with an OPTIMAL level of allocated resources

CHRONIC HARMS: Problems caused by long term heavy use	**ACUTE HARMS: Problems caused by occasions of intoxication**	**VOLUME OF ALCOHOL CONSUMPTION**	**HIGH RISK ALCOHOL CONSUMPTION**
1. Annual rates of above conditions expressed as deaths, PYLLs, DALYs, hospital bed-days and economic costs. 2. 3 yearly estimates of total economic costs of harm 3. Rates of alcohol dependence using SADQ-C or CIDI-C and of alcohol problems by WHO problem scale, as part of 3 yearly national survey.	1. Rates of above conditions expressed as deaths, PYLLs, DALYs, admissions, hospital bed-days and economic costs. 2. Rates of fatal and serious road crashes with BACs >0.05/0.10% 3. Self-reported rates of personal and social problems from 3 yearly national survey	1. Per capita alcohol consumption also adjusted for imports, visitor consumption and home production applying the Graduated Quantity-Frequency method to estimate. 2. Graduated QuantityXFrequency estimate with alcohol content of drinks derived informally from local data.	As above.

Recommendations for international data collection initiatives

It is clear that the ability of both developed and developing countries to accurately quantify harm would be greatly assisted by some coordinated international research projects.

Updating estimates of Relative Risk data based on international research on alcohol and health

The work of English *et al* (1995) and Single *et al* (1996) can serve as a resource for many countries wishing to emulate their quantification exercises for domestic purposes. Relative Risk estimates for many conditions may, with some care, be 'transportable' from one country to another provided that useable prevalence data are available on drinking patterns and levels. Since the time of the preparation of these reviews many further studies have been published which can be used, in some cases, to refine further estimates of risk and, in others, to confirm a significant causal relationship with alcohol use. It is strongly recommended that an update of these international reviews be conducted on a regular basis, perhaps every three years. In addition, it would be worth exploring the limits on the generalisability of Relative Risk estimates both for acute and chronic conditions and, in particular, across and within different regions of the world.

Development and validation of a low cost national alcohol survey

Some of the above recommendations are essentially for the development of a common approach to conducting national surveys that permit estimates of both level and pattern of drinking and also assist with estimates of per capita consumption on the basis of sales data. It is recommended that a national survey instrument that achieves these objectives be developed and tested in a range of developed and developing countries incorporating the major language groups. The development of such an instrument would need to first review systematically instruments that have already been applied cross-culturally and cover at least some of these related topics. It would also need to provide a framework which, for some inquiries, would allow substantial local variation in the manner in which the information sought is collected.

Access to information on brand sales

A useful international collaborative research exercise would be to negotiate access to information on market share data, brand by brand and country by country in a times series. This could form part of an international project aimed at (i) examining the degree of error in current estimates of national per capita alcohol consumption and (ii) providing information to assist with the calculation of more accurate and comparable data.

Definitions of standard drinks used in different countries

The case for the promotion of an international "standard unit of alcohol" should be considered. The exact standard would have to be determined through research and negotiation. This may have utility both for the communication of research results and of quantities of alcohol in different beverage containers via labelling. In the meantime, it is strongly recommended that all reports of quantities of alcohol consumed are expressed in terms of grams of alcohol so that international comparability is facilitated. The conversion factor, if employed, from millilitres or other volumetric measures should also be stated clearly.

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Annex 1

Standard errors in prevalence estimates for different sample sizes: some worked examples

It is important to select a sample size that will enable prevalence estimates to be calculated within acceptable confidence intervals for a particular purpose. It is also important that there is sufficient power to determine whether differences in prevalence between sub-groups of interest (e.g. men and women) are significant. Some worked examples are shown below.

Suppose that 50% of men and 45% of women reported drinking in the past year. In a sample of 1,000 with 500 men and 500 women, the 50% prevalence estimate for men would have a standard error of _(0.50)(0.50)/500 = 0.0224 or 2.24%, and the 45% prevalence estimate for women would have a standard error of _(0.45)(0.55)/500= 0.0222 or 2.22%. The test statistic for the significance of the two prevalence estimates would be z = (0.50 - 0.45)/(_0.0224^2 + 0.0222^2) = 1.59. This is smaller than the value of z = 1.96 required for statistical significance at the p<.05 level, assuming a two-tailed test. Alternatively, if the sample size was 4,000 (2000 men and 2,000 women), the 50% prevalence estimate for men would have a standard error of _(0.50)(0.50)/2,000 = .0112 (1.12%), the 45% prevalence estimate for women would have a standard error of _(0.45)(0.55)/2,000 = 0.0111 (1.11%), and the difference between the two would yield a test statistic of z = (0.50 - 0.40)/(_0.0112^2 + 0.0111^2) = 3.17 -- significant at the p<.05 level. Thus, the desired level of precision and types of comparisons to be made should be taken into account when determining sample size.

Annex 2

Alcohol conversion formulae for different international units of weight and volume

I. To convert alcohol by weight to alcohol by volume or alcohol by volume to alcohol by weight. These conversions are used in Canada where alcohol by volume is commonly the means of expressing alcohol.

Formulas

$$\%\ \text{Alcohol by Volume} = (\%\ \text{by Weight}) \times \frac{(\text{Specific Gravity Beer})}{(\text{Specific Gravity Alcohol})}$$

$$\%\ \text{Alcohol by Weight} = (\%\ \text{by Volume}) \times \frac{(\text{Specific Gravity Alcohol})}{(\text{Specific Gravity Beer})}$$

Specific Gravity Alcohol = 0.79 (Note: Alcohol by volume is defined by different governments and associations at temperatures ranging from 60°F to 20°C, leading to values from 0.789 to 0.791 for this factor. For ordinary use, 0.79 will give sufficient accuracy.)

Examples

1. A Canadian product analyses 3.93% Alcohol by weight. Sample specific gravity is 1.00868. What is the alcohol by volume?

Solution:

$$\%\ \text{Alcohol by volume} = (3.93)\ \frac{(1.00868)}{(0.79)}$$

% Alcohol by Volume = 5.02%

2. Canada reports a beer at 4.18% alcohol by volume. How does this product compare with normal U.S. beer targeted at 3.30% alcohol by weight? Specific gravity was 1.00525.

Solution:

$$\% \text{ Alcohol by Weight} = (4.18) \times \frac{(0.79)}{(1.00525)} = 3.28\%$$

Note:

As the specific gravity of alcohol is approximately equal to 0.8 and the specific gravity of beer is close to 1.00, a rough estimate for converting is to use a factor of 0.8.

$$\text{Alcohol by Volume} = \frac{\text{Alcohol by Weight}}{0.8}$$

or

Alcohol by Weight = Alcohol by volume x 0.8

II. Alcohol proof is used as a measure of alcohol concentration in some industries but not the beer industry where % by weight or % by volume is the normal units. Proof is simply alcohol by volume x 2.

Formula

% Alcohol by Volume x 2 = Proof

1/2 Proof = % Alcohol by volume

III. Proof gallon is used for taxing alcohol in other than the beer industry, i.e., taxes are assessed on the basis of how many proof gallons you have. This method of taxing is designed to simplify the problem of dealing with both volume and alcohol concentration.

A proof gallon is defined as one gallon at an alcohol concentration of 100 proof (or 50% by volume).

Formula

To determine proof gallons, determine the volume you would have if the alcohol were diluted or concentrated to 100 proof (50% volume) using the formula:

Actual Concentration x Actual Volume = (50% Volume) x Unknown Volume
(Proof or % by Vol) (or 100 Proof)

Example

You have a tank of wine at 12.5% volume alcohol, there are 130,000 gallons in the tank, how many proof gallons will you be taxed on?

Solution:

130,000 x 12.5% = Proof Gallons x 50%

Proof Gallons = 32,500

Source: Siebel Institute of Technology, Chigago, Illinois.

Annex 3

Illustration of the Last 7 Day approach to estimating recent drinking behaviour for different beverage types

The format of the questions may follow the following:

How many beers did you have on Sunday?

What was the size of the glasses or bottles of beer that you drank? (MAY PROVIDE RESPONSE CATEGORIES REFLECTING TYPICAL CONTAINER OR DRINK SIZES OR RECORD EXACT SIZE, E.G., EXACT NUMBER OF CENTILITERS)

(REPEAT QUESTIONS FOR EACH TYPE OF BEVERAGE, FOR EACH DAY OF THE WEEK)

The following example shows how volume of ethanol intake is calculated if beverage type and drink size are obtained. It assumes that each ml of beer contains .033 g ethanol, that each ml of wine contains .10 g ethanol and that each ml of spirits contains .30 g ethanol:

Day of the week	Number of drinks	Ethanol content of drinks	
Monday	No drinks of any kind	0	
Tuesday	1 20-cl glass of wine	1 x 200 ml x .10 =	20 g
Wednesday	2 20-cl glasses of wine	2 x 200 ml x .10 =	40 g
Thursday	2 20-cl glasses of wine	2 x 200 ml x .10 =	40 g
Friday	3 6-cl shots of spirits &	3 x 60 ml x .30 =	54 g
	1 20-cl. glass of wine	1 x 200 ml x .10 =	20 g
Saturday	4 20-cl glasses of wine	4 x 200 ml x .10 =	80 g
Sunday	2 33-cl bottles of beer	2 x 330 ml x .033 =	22 g
Total week			276 g

Based on these responses, the weekly volume of intake is 276 g, the annualized volume is 52 x 276 = 14,352 g, the average daily ethanol intake is 276/7 = 39.4 g, and the average ethanol intake per drinking day is 276/6 = 46 g. This respondent would be classified as a medium risk drinker if male and a high risk drinker if female according to the categories described in Chapter 4.

Annex 4

Calculation of annual volumes of ethanol from beverage specific Quantity-Frequency survey questions: a worked example

The beverage specific Quantity-Frequency questions might be as follows:

In the past year, did you drink any beer?

How often during the past 12 months did you consume any beer? (SHOW RESPONDENT CARD CONTAINING CATEGORICAL RESPONSE OPTIONS, e.g.: every day, nearly every day, 3 to 4 days a week, 1 to 2 days a week, 2 to 3 days a month, once a month, 7 to 11 days in the past year, 4 to 6 days in the past year, 2 or 3 days in the past year, once in the past year)

On days when you drank beer during the past 12 months, how many beers did you USUALLY drink? (RECORD EXACT NUMBER OF DRINKS)

What was the size of beer that you USUALLY drank on days when you drank beer? (OPTIONALLY, MAY PROVIDE RESPONSE CATEGORIES REFLECTING TYPICAL CONTAINER OR DRINK SIZES)

What was the largest number of beers that you drank on any day during the past 12 months? (RECORD EXACT NUMBER OF DRINKS)

How often did you drink (largest number) beers during the past 12 months? (SHOW RESPONDENT CARD CONTAINING CATEGORICAL RESPONSE OPTIONS AS INDICATED IN EXAMPLES ABOVE)
(REPEAT ALL QUESTIONS FOR WINE AND SPIRITS)

Let us assume that a respondent answers the above questions by reporting that his overall frequency of drinking beer was 3 to 4 days a week, that he usually drank 2 beers, that the usual size of beer consumed was 33 cl., that the largest number of beers consumed was 12, and that he drank 12 beers on 7 to 11 days in the past year.

First the two frequencies are converted to days per year: 3 to 4 days a week = 3.5 x 52 = 182 and 7 to 11 days in the past year = 9 days, again based on the midpoints of the categories. Under the simplifying assumption that the respondent drank his usual quantity of 2 33-cl beers on all of his 182 drinking days except the 9 days when he drank 12 beers, the volume of beer consumed during the past year is then equal to the sum of his usual and heaviest consumption:

Usual consumption = (182 minus 9 days) x 2 drinks x 330 ml x .033 g/ml
= 3,767.9g

Heaviest consumption = 9 days x 12 drinks x 330 ml x .033 g/ml
= 1,176.1g
Total consumption = 4,944.0 g

Assuming that the respondent did not consume any wine or spirits in the year preceding interview, then his total annual ethanol intake is 4,944.0 g, his average daily ethanol intake is 4,944.0/365 = 13.5 g, his average ethanol intake per drinking day is 4,944.0/182 = 27.2 g, and he would be classified as a low risk drinker for long term problems. It is noteworthy that he also engages in some drinking which is high risk for acute types of harm. If the respondent had consumed other types of alcoholic beverages in addition to beer, then the volumes of ethanol consumed in the form of those other beverages would be added to the volume of ethanol intake from beer to yield the total ethanol intake from all beverages.

Annex 5

The Graduated Quantity-Frequency (GQF) method of recording alcohol consumption by survey: A worked example

The following question illustrates the kind of questions needed for this recommended survey approach:

During the last 12 months, how often did you have twelve or more drinks of any kind of alcoholic beverage in a single day, that is, any combination of cans of beer, glasses of wine, or drinks containing liquor of any kind? (SHOW RESPONDENT CARD CONTAINING CATEGORICAL RESPONSE OPTIONS AS IN PREVIOUS EXAMPLES)

(REPEAT QUESTIONS FOR THE FOLLOWING CATEGORIES: 8 but not more than 11 drinks, 5 but not more than 7 drinks, 3 but not more than 4 drinks, and 1 but not more than 2 drinks)

Commonly, a lead-in question is used to establish the maximum number of drinks consumed during the reference period. This may be used to determine the uppermost quantity category that should be asked. For example, if a respondent reports that his or her heaviest quantity consumed was six drinks, the questions on frequencies of consuming 8-11 and 12+ drinks could be omitted. This information also can be used in determining the midpoint of the uppermost quantity category for volume estimation. For example, if a respondent reports that the largest number of drinks consumed is 9, then the midpoint for the category of 8-11 drinks can be set at 8.5 (the midpoint between 8 and 9) instead of 9.5 (the midpoint between 8 and 11).

Let us assume that a respondent provides the following answers to a set of GF questions: Her largest number of drinks was 9 (thus, she is assumed to never have consumed 12+ drinks), she drank 8-11 drinks 2 days in the past year, she drank 5-7 drinks once a month, she drank 3-4 drinks 2 to 3 days a month, and she drank 1-2 drinks 3-4 days a week.

First, the midpoints of the frequency categories are converted to days per year, e.g., once a month = 12, 2 to 3 days a month = 2.5 x 12 = 30, 3-4 days per week = 3.5 x 52 = 182. Then the midpoints of the quantity categories are estimated: 8.5 for the category of 8-11 drinks (the midpoint of 8 and 9, her largest reported number of drinks), 6 for the category of 5-7 drinks, 3.5 for the category of 3-4 drinks and 1.5 for the category of 1-2 drinks. Assuming a standard drink size of 12 g, her annual volume is then calculated as follows:

8.5 drinks x 2 days x 12 g	=	204 g
6.0 drinks x 12 days x 12 g	=	864 g
3.5 drinks x 30 days x 12 g	=	1,260 g
1.5 drinks x 182 days x 12 g	=	3,276 g
Total	**=**	**5,604 g**

This respondent's annual volume of ethanol intake is 5,604 g, her average daily ethanol intake is 5,604/365 = 15.4 g, her average ethanol intake per drinking day is 5,604/226 = 24.8 g, and she would be classified as a low risk drinker by the criteria outlined in Chapter 4. However, it should be noted that for acute alcohol-related problems this would be a mis-classification as her consumption is not 'moderate' on every occasion. This illustrates the advantage of the GQF over the QF method and allows a better specification of different high risk drinking patterns.

Annex 6

Readers are alerted to the fact that further work is underway in determining optimal conversion methods and an update can be obtained from the National Alcohol Indicators Project team based at the National Drug Research Institute, Curtin University, Western Australia, 6845, Australia. Fax: +61 8 9486 9477; email tim@ndri.curtin.edu.au.

Preliminary conversion table for ICD-9 to ICD-10 for alcohol-related conditions identified in English et al (1995)

ICD-9 Codes	ICD-10 codes	Cause of death
141, 143-146, 148, 149	C02, C03-C10, C12-C14, C06.9	Oropharyngeal cancer
150	C15, C26.8	Oesophageal cancer
155	C22	Liver cancer
161	C32	Laryngeal cancer
174	C50	Female breast cancer
291, 303, 305.0	F10.0, F10.4, F10.5, F10.6, F10.7	Alcoholic psychosis [1]
303	F10.0, F10.2	Alcohol dependence[1]
305.0	F10.0	Alcohol abuse[1]
345	G40-G41	Epilepsy
357.5	G62.1	Alcoholic Poly neuropathy
401-405	I10-I13, I15.0, I15.1, I15.8	Hypertension
425.5	I42.6	Alcoholic Cardiomyopathy
427.0, 427.2, 427.3	I47.1, I47.9, I48	SV cardiac dysrhythmia
430-438	I160-I169, G45.0, G45.4, G45.8, G45.9	Stroke
456.0-456.2	I185, I198.2	Oesophageal varices
530.7	K22.6	Gastro-oesophageal .haemorrhage
535.3	K292.2, K290	Alcoholic gastritis
571.0-571.3	K70 (includes some fibrosis and hepatic failure conditions)	Alcoholic. liver cirrhosis
571.5-571.9	K74 (includes fibrosis), K76.0, K76.9	Unspecified liver cirrhosis
571.0-571.9	K70, K74, K76.0, K76.9	All liver Cirrhosis
574	K80	Cholelithiasis
577	K85	Acute pancreatitis
577.1	K86.1	Chronic pancreatitis
NA	K86.0	Alcohol-induced chronic pancreatitis [3]

634	O03	Spontaneous abortion
656.5, 764, 765	P05-P07	Low birth weight
696.1	L40.8, L40.2	Psoriasis
980.0	T51.0	Ethanol toxicity
980.1	T51.1	Methanol toxicity
E814	V02-V05, V09.2-V09.9	Pedestrian road injuries (motor vehicle traffic accidents)
E810-819[7]	V02-V05, V09, V12-V15, V17-V19, V20-V79, V80.3-V80.6	Road injuries (accidents involving motor vehicle)
E826, E829[2]	V01, V10-V11, V80.2, V82.8, V88.9, V87.9	Other road vehicle injuries (not involving motor vehicle)
E860.0- E860.2	X45	Alcohol toxicity (Alcoholic beverage poisoning, Other eth/meth poisoning)
E880-E888	W00-W19	Fall injuries
E890-E899	X00-X09	Fire injuries
E910	W65-W74	Drowning
E911[5]	W78	Aspiration
E919, E920	W24, W29-W31, W49	Occupational machine injuries
E917, E918, E919-E20 [2]	W21, W22-W24, W29-W31, W49, W52	Accidents with Objects/machines
E950-E959	X60-X84	Suicide
E960-E966, E968, E969[4]	X85-X99, Y00-Y02, Y04-Y05,Y08-Y09	Assault
E967[6]	Y07,	Child abuse

[1] ICD-10 combines Alcoholic psychosis , Alcohol dependence and Alcohol abuse under the three digit code F10 “Mental and behavioural disorders due to alcohol use”, in order to determine each distinct condition it is necessarily to use a fourth digit. Due to some lack of clarity in coding rules, it is possible that all three ICD-9 codes may be classified as ICD-10 F10.0

[2] Conditions and Codes from, Single et al (1999)

[3]Alcohol-induced chronic pancreatitis is a new code implemented in ICD-10 and has no ICD-9 equivalent.

[4]The ICD-9 codes used to identify interpersonal violence in English et al (1995) did not include E960, E961, E963 or E964 but have been used by Single et al (1998) and Murray and Lopez (1996) and for that reason have been included here

[5]English et al (1995) denote the ICD-9 code E911 as Aspiration, which, while not specific to alcohol consumption was noted by English et al (1995) as almost entirely due to aspiration of vomitus in alcoholics in Australian coding systems. While the actual conversion code for ICD-9 E911 is in fact W79, this ICD-10 code excludes inhalation of vomitus and implies that cases coded as such will no longer be solely due to vomitus in alcoholics. However, ICD-10 now specifically identifies inhalation of gastric contents as W78.

[6]It is suggested that since code Y07 (Other maltreatment syndromes) is not specific to children and not entirely comparable to the ICD-9 E-code for “child battering” (E967) that Y07 is only equivalent to E967 where the patient/deceased is aged under 15 years.

[7]English et al (1995) provide aetiologic fractions for motor vehicle *traffic* accidents (occurred on a public highway) which are simply identified in ICD-9 as E10-E19, however ICD-10 delineates between traffic and non-traffic accidents (occurred entirely in any place other than a public highway) using a fourth digit coded as 1 (.0 = non-traffic, 0.1= traffic and 0.9 = unspecified). Without knowledge of the proportion of "transport accidents" (as termed in ICD-10) which are considered non-traffic is it difficult to determine with confidence to what degree three digit codes identified using ICD-10 and relating to transport accidents actually apply to motor vehicles in traffic and therefore to what degree the AF in English et al (1995) is applicable.

Annex 7

Calculating Person-Years of Life Lost (PYLL) using a life table method

The following formula is used to estimate Person Years of Life Lost while adjusting for residual mortality (see Chapter 3.1 for discussion).

$$S_{ik} = n_i \left\{ \sum_{x=0}^{i-1} d_{xk} \sqrt{p_{x.k}}\, P_{x+1,i.k} \left[a_i \left(1 - p_{i.k}\right) + p_{i.k} \right] + 1/2\, d_{ik} \left(1 - a_i\right)\left(1 + \sqrt{p_{i.k}}\right) \right\}$$

where

a_I = average proportion of time lived in the ith age group by people who die in the group.

n_i = the width of the ith age group (all five years)

d_{ik} = the number of deaths due to k in the ith age interval

$p_{i.k}$ = the conditional probability of survival in the ith age interval after elimination of *k* as a cause of death,

and

$$P_{x+1,i.k} = \begin{cases} \prod_{v=x+1}^{i-1} p_{v.k}, & x+1 < i \\ 1, & x+1 = i \end{cases}$$

The method of calculation of the $p_{i.k}$ is as follows (Chiang, 1968)

where

d_i = the total number of deaths in the ith age interval;

p_i = the conditional probability of survival from all causes of death in the ith age interval, calculated by the formula

$$p_i = \frac{1 - a_i n_i M_i}{1 + (1 - a_i) n_i M_i}$$

where M_i = the all-cause mortality rate in the ith age interval.

Sourced from English *et al* (1995)

Annex 8

Suggested questions for a 3 item and an 8 item set of questions about alcohol consumption

A. Module Containing Minimum Required Items (3 Questions)

1. *In the past year, how often did you drink any alcoholic beverage, for instance, beer, coolers, wine, spirits or fermented cider? (SHOW RESPONDENT CARD CONTAINING RESPONSE CATEGORIES OR READ CATEGORIES ALOUD.)*

   Every day

   Nearly every day

   3 to 4 times a week

   1 to 2 times a week

   2 to 3 times a month

   Once a month

   7 to 11 times in the past year

   4 to 6 times in the past year

   2 or 3 times in the past year

   Once in the past year

   Never drank any alcoholic beverage in past year •

   Never in my life

   (SKIP REMAINING ALCOHOL Q.)

2. *How many drinks did you USUALLY have on days when you drank alcoholic beverages in the past year? By drink, I mean the equivalent of a 33 cl glass, can or bottle of beer or cooler, a 20 cl glass of wine, or 4 cl of spirits, not counting any mixer, water or ice.*

   _______________ *Number of drinks*

3. *In the past year, how often did you drink five or more drinks of any alcoholic beverage or combination of beverages in a single day? (SHOW RESPONDENT CARD CONTAINING RESPONSE CATEGORIES OR READ CATEGORIES ALOUD.)*

Every day

Nearly every day

3 to 4 times a week

1 to 2 times a week

2 to 3 times a month

Once a month

7 to 11 times in the past year

4 to 6 times in the past year

2 or 3 times in the past year

Once in the past year

Never drank five or more drinks in past year

B. Module Containing Minimum Required Items with Some Additions (8 Questions)

1. *In your entire life, have you ever consumed 1 or more drinks of any type of alcoholic beverage?*
   Yes
   No • SKIP REMAINING ALCOHOL QUESTIONS

These next questions ask how often you drank various amounts of drinks. By drink, I mean the equivalent of a 33 cl glass, can or bottle of beer or cooler, a 20 cl glass of wine, or 4 cl of spirits, not counting any mixer, water or ice.

2. *In the past year, have you consumed 1 or more drinks of any type of alcoholic beverage, for example, beer, coolers, wine, spirits or fermented cider?*
   Yes • SKIP TO Q.3
   No

3. *Counting all types of beverages combined, what was the LARGEST number of drinks that you drank in a single day during the past year?*

_______________ *Number of drinks*

4. *In the past year, how often did you drink 12 or more drinks of any type of alcoholic beverage on a single day? (SHOW RESPONDENT CARD CONTAINING RESPONSE CATEGORIES OR READ CATEGORIES ALOUD.)*

Every day

Nearly every day

3 to 4 times a week

1 to 2 times a week

2 to 3 times a month

Once a month

7 to 11 times in the past year

4 to 6 times in the past year

2 or 3 times in the past year

Once in the past year

Never

5. *In the past year, how often did you drink 8 to 11 drinks of any type of alcoholic beverage on a single day? (SHOW RESPONDENT CARD CONTAINING RESPONSE CATEGORIES OR READ CATEGORIES ALOUD.)*

Every day

Nearly every day

3 to 4 times a week

1 to 2 times a week

2 to 3 times a month

Once a month

7 to 11 times in the past year

4 to 6 times in the past year

2 or 3 times in the past year

Once in the past year

Never

6. *In the past year, how often did you drink 5-7 drinks of any type of alcoholic beverage on a single day? (SHOW RESPONDENT CARD CONTAINING RESPONSE CATEGORIES OR READ CATEGORIES ALOUD.)*

Every day

Nearly every day

3 to 4 times a week

1 to 2 times a week

2 to 3 times a month

Once a month

7 to 11 times in the past year

4 to 6 times in the past year

2 or 3 times in the past year

Once in the past year

Never

7. *In the past year, how often did you drink 3 or 4 drinks of any type of alcoholic beverage in a single day? (SHOW RESPONDENT CARD CONTAINING RESPONSE CATEGORIES OR READ CATEGORIES ALOUD.)*

Every day

Nearly every day

3 to 4 times a week

1 to 2 times a week

2 to 3 times a month

Once a month

7 to 11 times in the past year

4 to 6 times in the past year

2 or 3 times in the past year

Once in the past year

Never

8. *In the past year, how often did you drink 1 or 2 drinks of any type of alcoholic beverage in a single day? (SHOW RESPONDENT CARD CONTAINING RESPONSE CATEGORIES OR READ CATEGORIES ALOUD.)*

Every day

Nearly every day

3 to 4 times a week

1 to 2 times a week

2 to 3 times a month

Once a month

7 to 11 times in the past year

4 to 6 times in the past year

2 or 3 times in the past year

Once in the past year

Never

Annex 9

Table 13: Zambia (Lusaka and Mwacisompola): percentages of respondents (aged 15 years and over) who experienced alcohol-related problems during the year preceding the interview

	Total Community Sample								"Drinkers"	
	Suburban		Peri-urban		Rural		Total			
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Personal consequences										
Felt that I should cut down on my drinking or stop altogether	36	9	19	10	34	9	30	9	58	39
Have awakened the next day not being able to remember some of the things I had done while drinking	17	5	11	4	16	9	15	6	28	26
Sometimes get drunk even when there is an important reason to stay sober	16	4	13	4	19	5	16	4	31	17
Have had hands shake a lot the morning after drinking	8	5	6	3	12	6	9	4	17	18
Have been told by a doctor or health worker that the amount I was drinking was having a bad effect on my health	6	2	3	3	5	3	5	2	9	10
Have taken a drink first thing when I got up in the morning	6	3	4	2	12	4	7	3	14	12
Stayed intoxicated for several days	6	5	3	1	6	3	5	2	9	10
Social Problems	18	6	12	8	21	8	17	7	33	33
Felt the effects of alcohol while on job										
Have been ashamed of something I did while drinking	13	5	7	4	12	3	11	4	21	18
Got into a fight because of my drinking	4	2	4	3	8	2	5	2	9	9
Have been told to leave a place because of my drinking	4	1	3	1	6	2	5	1	9	5
Have been involved in a road accident when I have been drinking	6	1	1	1	2	3	3	1	6	3
Have been involved in an accident at home when I have been drinking	2	1	1	3	6	2	3	2	6	7
Have been involved in an accident at work when I have been drinking	2	1	1	1	3	0	2	1	3	2
No. of respondents	165	205	151	223	155	196	471	624	251	152

Source: Ritson E.B. (1985) Community response to alcohol-related problems: review of an international study. Public Health Papers No. 81. WHO, Geneva.

Annex 10

The measurement of alcohol consumption and harm in Mexico: a case study

Introduction

In this Appendix, experiences of measuring and monitoring alcohol consumption and related harm in Mexico will be discussed as an example of a country where few resources have traditionally been available for this purpose. It begins with an overview of what has been learned about alcohol use and problems in Mexico from anthropological, sociological and public health perspectives. A number of methodological issues will then be summarized which need to be considered when applying monitoring systems to a country like Mexico.

Patterns of alcohol consumption in a society result from the type and amount of alcoholic beverages available and from local traditions and norms about who is permitted to drink as well as how much and under what circumstances. Drinking norms may vary for different subgroups of the population, generating also different behaviors and problems derived from violating the established norms.

At the same time it is also true that a trend toward globalization that has reduced diversity in drinking practices, and aggressive marketing strategies of the alcohol industry, have standardized patterns and beverages across many different societies. For instance, it is estimated that international beer and spirits products have spread more widely across the globe than has wine in the period since 1970, in many cases displacing consumption of traditional alcoholic beverages (WHO 1999). In, Mexico, it represents 70% of the market of alcohol (Rosovsky & Romero, 1996) 54% of the total per capita consumption of alcohol as compared to 11% of the most widely used traditional fermented beverage obtained from a Mexican agave and named “pulque”. This drink has been consumed in the Mexico since before the 15th Century (Medina-Mora, Cravioto, Villatoro et al., 1999).

As a result of unique local factors, in many societies patterns of drinking might be studied using international definitions but also, special adaptations to local contexts are required. The extent of unrecorded consumption, the range of beverage types, including fermented and distilled beverages, sizes of glasses and degrees of alcohol content of the main drinks as well as regional and ethnic variations within each country require special considerations. When international instruments are used, careful translation and cultural adaptation are necessary. This Appendix deals with the problems that these issues pose for monitoring alcohol consumption and harm. The first part describes drinking patterns and consequences. The second deals with problems of measurement derived from the specific way in which drinking behavior and outcomes express themselves in the Mexican culture, and discusses alternative solutions.

Drinking patterns

The Mexican drinking culture can be characterized by: i) a pattern of "fiesta drinking" where drinking usually means inebriation and light daily drinking is uncommon; ii) the fact that not all population groups have the same access to alcohol, for example females are usually excluded; iii) a lack of norms encouraging moderation, and iv) the presence of a high level of problems derived from episodes of acute intoxication such as accidents, and those from chronic use such as liver cirrhosis.

"Fiesta drinking", described since the Indian and Spanish cultures were mixed five centuries ago, prevails to the present day. During the pre-Colonial times drinking was an occasional practice limited to certain festivities controlled by effective regulations. The Spanish conquest modified the indigenous patterns of use, to one of indiscriminate use while previous cultural controls lost their efficacy for regulating drinking and local authorities lost their influence. Distilled beverages were introduced, and beverages then consumed included, in addition to "pulque", wine and brandy so that the proportion of the population that drank alcohol and got drunk increased. According to Taylor (1979) three main factors accounted for this increase in consumption: the inclusion of a higher proportion of macehuales (the lower social group formed by the poorer and simpler citizens, "those who could only travel by foot") in the group of drinkers; the incorporation of ritual inebriation into numerous festivities in the catholic calendar and the commercialization of "ptlque".

Non-taxed production of beverages is not a new phenomenon in Mexico. During colonial times, local production of distilled beverages "chinguirito" made from sugar cane, a precursor of rum, was prohibited and only spirits coming from Europe were allowed. This was defended by the colonial rulers as a means of reducing social disruption. As the local demand could not be satisfied by the amounts they were able to import from Spain, illegal production of distilled beverages became a common practice (Lozano, 1998).

Illegal distilleries were established near the sugar cane plantations from where the raw material was obtained. Sometimes they were placed in caves or other places located away of the scope of local authorities, but there is also evidence that this distilleries were placed in houses within the communities, which made it easier to sell their products. Documents related to criminal processes provide an idea of how these distilleries operated, they were usually small with only one still or several producers were organized to produce each small amounts and they were usually established on temporal premises and moved according to needs (Lozano, 1998).

Nowadays the non registered production of beverages maintains some of these former characteristics. By means of avoiding taxes and the fulfillment of the sanitary regulations for the production of alcoholic beverages, these producers compete for the markets with beverages at very low prices. For example, it is possible to buy three quarters of a litre of aguardiente for less than the cost of a litre of milk. The production of non-registered alcohol is encouraged by lack of regulations for denaturalizing industrial alcohol, or the control of transportation and selling of alcohol for human consumption in closed containers, or destruction of containers after being used, among other factors.

Among the urban population of legal drinking age (18 years) beer is by far the most frequently consumed beverage followed by spirits: beer accounts for *54%* of sales and spirits for *20%*. Pulque is the next most popular beverage in terms of numbers who drink it but with a far smaller market share of only *11%*, followed by wine at *2.3%*, coolers and other prepared beverages, *6.1%* and 96% alcohol or “aguardiente” at *6%,* a distilled beverage made from sugar cane or grapes. (The word “aguardiente” means “burning water”).

A proportion of the “aguardiente” consumed is made up of locally produced traditional beverages. From the 27 more widely consumed, 18 are aguardientes, 10 are made from sugar cane, 4 from grape, and the rest from mixed sources. These beverages are not regulated (Consultores Internacionales, 1999).

According to the 1998 National Household Survey of the urban population 18 to 65 years of age, only 12% drank alcohol weekly (Medina-Mora et al, 1991). When only males are considered, the proportion of weekly drinkers increases to 26% while 74% of male drinkers usually consume 5 or more drinks per occasion. At the other extreme, while as many as 42 % of the population reported not having ingested an alcoholic beverage in the last year, only 23% of the males were so categorized. In 1989 these rate was slightly higher, 27%. Among females rates of abstention decreased from 63.5% in 1989, to 55.3% in 1998. However, high rates of both abstention and heavy drinking are still observed simultaneously.

Analysis of the 1989 National Survey also showed important differences in the populations that report drinking different types of alcoholic beverages. For example, it was found that males were more likely to drink all types of alcohol other than wine; the likelihood of drinking increased with age for all beverages except for beer; consuming wine and aguardiente/96% proof alcohol was associated with being out of work while drinking beer and spirits was more likely if the person worked, though drinking pulque was not affected by this variable; pulque and aguardientes were significantly related to a low level of education, spirits and wine with high educational level while beer consumption was unrelated to education.

Social and personal problems were associated with being male, not working and having a low educational level; younger age was associated with the likelihood of reporting personal problems related to drinking; all beverages were positively associated with the risk consequences and use of aguardiente/96% proof alcohol was highly associated with problems of dependence (Medina-Mora *et al*, 1997).

Local surveys (Medina-Mora, 1993) have shown similar data. A survey conducted in parts of central Mexico showed that while 38% of the drinkers of “aguardiente”, 48% of beer drinkers, 52% of “pulque” and 53% of spirits drinkers limited their intake to 1 or 2 drinks per drinking occasion, as many as 72% of regular table wine drinkers drank in this pattern and also reported few related problems.

Cross country comparisons between patterns of adult drinking and problems in Mexico (Caetano & Medina-Mora, 1988), and Spain (Martines *et al*, 1988), in selected regions of both countries, have made evident the difference between the “fiesta drinking” pattern in Mexico and that found in typical Mediterranean cultures. Patterns of frequent use (once a week or more often) with low quantities (1 or 2 drinks per sitting) are almost non existent in Mexico (3% of drinkers as compared to 46% in Spain); while infrequent use (once a month/less than once a week) with high quantities (5+ per sitting at least once a year), the most frequent pattern in Mexico (24%) is practically not observed in Spain (1%). As expected, higher rates of problems derived from acute intoxication were observed in Mexico.

Per capita consumption in Mexico is low as compared to other countries at 5.12 litres of ethanol for the population 15 years of age and older (Rosovsky & Romero, 1996). This rate does not include unrecorded consumption which, as a result of changes in the legislation, is presumed to have increased considerably in recent years. Mexican alcohol industry sources have estimated that *for each 5 litres of alcohol consumed, 2 are unregistered, (Consultores Internacionales, 1999).*

Per capita estimates through household surveys result in similar figures, though the under-estimation that results from survey-based estimates of 40 to 60% needs to be borne in mind (see Chapter 2.2). The National Household Survey of 1989 estimated an annual per capita intake of 4.6 litres per person. This figure does not include consumption among the rural population (25% of the total population), nor that over 65 years of age. Actual per capita consumption is, therefore likely to be in the region of 8 to 12 litres per year, a comparable figure with many developed countries which keep more reliable records.

In spite of this low rate of apparent per capita consumption the rates of alcohol problems related to both acute intoxication and chronic intake are substantial. A cross cultural study undertaken by Cherpitel and colleagues (1993) in Mexico and the United States found a higher rate of alcohol involvement among emergency rooms attenders in Mexico (21% vs. 11%), but a higher proportion of heavy drinkers in the United States (21% vs. 6%).

According to the National Household Survey only 73% of the alcohol related problems that included family, job, accidents and police problems, were the responsibility of people that had not reached the dependence criteria. This high rate of problems derived from events of acute intoxication is expected to be due to the prevailing drinking pattern (Medina-Mora *et al.*, 1991).

The Mexican drinking patterns described above are supported by cultural norms. Well defined cultural norms establish, for instance, that drinking is a male behavior, and while occasional inebriation among males is considered an accepted behavior females should abstain. These double standards are supported by both males and females of the different age groups. In contrast norms toward moderation are not well supported by the population, and there does not seem to be a clear differentiation in people’s minds between drinking and excessive drinking (Medina-Mora, 1993).

Unfortunately, problems derived from chronic alcohol abuse are also high, the more prevalent being hepatic cirrhosis. In Mexico, liver cirrhosis (30.7 per 100,000 inhabitants) is one of the top ten causes of death among the country’s population and it is the most common cause of death among males between 35 and 54 years of age. The mortality rate due to alcohol has increased from 7.8 per 100,000 persons in 1970 to 12 in 1995 among the population 15 years of age and older (Rosovsky & Borges, 1996).

The lack of correspondence between per capita consumption and alcohol-related problems is derived from unrecorded consumption as well as from the uneven distribution of the available alcohol that is consumed by only a proportion of the population. There are great differences in the proportion of males and females of different age groups that consume alcohol.

Differences between urban and rural drinking practices

Rural populations have been studied through local surveys. Those studies that have compared rural and urban populations have documented higher levels of heavy drinking in rural populations but also higher rates of abstinence. For example, Medina-Mora (1993) found that for central Mexico, 6% of the urban population were classified as heavy drinkers, compared with 12% of the rural population. Rates of abstinence among rural populations were 33% and 26% for urban populations in central Mexico. Abstinence rates among were 61% and 45% respectively among females from rural and urban backgrounds interviewed in Mexico City while rates of reported problems were, respectively, 15% and 9% when controlling the amount drank (Calderón, *et al*, 1981).

Rural males in Mexico City drank higher amounts of alcohol, spent more time drinking, got drunk more frequently, more often drank to forget problems and to celebrate, had higher levels of social tolerance toward drinking and inebriation, and reported more problems than their urban counterparts (Calderón, *et al.*, 1981).

These studies have also documented that urban and rural females are more similar to one another than what has been observed for males. In central Mexico, both groups of females reported similar rates of abstention (66% and 67%) and low levels of heavy drinking (1%). In both cases females under 40 years of age reported higher levels of drinking than their older counterparts, these difference being higher among urban females.

These findings support the need to study drinking behavior and problems as independent dimensions.

Ethnic differences

Patterns of alcohol use among indigenous cultures show strong variations, an example being the complete integration of alcohol use in all aspects of life among the Chamulas of Chiapas, and the strict norms that limit alcohol use to certain occasions among the Tarahumaras of Chihuahua.

Alcohol use among the Tarahumaras has been well described by Kennedy (1963). The local beverage consumed is the "tesgüino", which is made from germinated corn left for fermentation along with the seed of a local plant "basi huari". As all fermented beverages, it must be consumed shortly after production. It is usually drunk in groups and almost always with an external justification such as a religious ceremony, a civil event or an activity of collective work. In order to undertake a "tesgüinada", the person involved must make the "tesgüino", and invite the neighbors to consume it while they, for example, work in the fields. When another of the neighbors requires support from other members of the community they repeat this same procedure.

There are strict rituals observed during the drinking of "tesgüino" with the first drink dedicated to the gods and the order of the rest determined by the drinker's position in the community's hierarchy - those with most authority and influence drinking first. The social space within which the individual interacts is determined by those with whom the "tesgüino" is consumed. This therefore shapes the production and distribution of the beverage. When an individual is left out from the "tesgüinada", it is considered a form of ostracisation and thus it is also a means of social control. It is also an occasion for procurement of justice and a way of releasing sexuality. While intoxicated, extramarital relations are performed, and no guilt is associated with them as responsibility is considered to be attenuated under the influence of alcohol.

Alcohol abuse in the region of Chiapas has been the subject of many anthropological studies. Bunzel (1940), found vestiges of pre-hispanic roots in the ritual patterns of drinking among the Chamulas, where to refuse to drink in a ceremonial way was considered rude. This pattern is opposite to the secular patterns of drinking of the western society. De la Fuente (1955) described this culture as an "alcoholic culture" due to the fact that, with the exception of the indians that have adopted the Christian religion, indians ".... consume great quantities of alcoholic beverages ... liquor is not only an indispensable part of social life but is the vehicle of contact".

Males drink in groups more than women, but drinking is common also among females. Binge drinking and intoxication during festivities may last a whole week (Bunzel, 1940). Initiation into alcohol consumption occurs early in life as parents even give small quantities to newborn babies, but social use starts in early adulthood, when civil or religious positions are occupied, and alcoholism is common among those that have occupied these positions. Among the Chamulas, alcohol use *per se* is not condemned if drinking and inebriation is linked to a group social function, but it is discouraged when it becomes a "vice" or bad habit, not linked to social activities.

According to Bunzel (1940), the patterns of alcohol use observed among the Chamulas, differ from the Quiché groups of Chichicastenango, Guatemala, in spite of the fact of sharing a common Mayan origin. Among this latter group, drinking only occurs during the market days and as part of the rituals during civil and religious festivities. During these occasions intoxication and sexual activity is common though, contrary to Kennedy’s (1963) observations of the Tarahumaras, guilt is often associated as it goes against their social norms. Bunzel (1940) reported that when drinking was not associated with these special occasions there was more tension and antisocial behavior was more common.

Madsen and Madsen (1969) studied two indian communities with different degrees of acculturation within Mexico City. In Tecospa, nahuatl was still spoken and pulque was the more widely consumed beverage. Alcohol was a means of social integration as indicated by its consumption in social and festive occasions. Drunkenness was accepted among males but was not tolerated among females. In Tepepan, drinking served as a means of obtaining personal security and also a place in society. It was intimately linked to "machismo" and the idea that aggressive behavior is part of being a male. A great ambivalence towards alcohol use and abuse was described by these researchers who observed that performing antisocial behaviors while intoxicated was not tolerated, that frequent use of alcohol and especially intoxication was considered a sign of weakness. At the same time the alcoholic was seen as a victim of destiny and as a person that was not responsible for his problems.

Problems of measurement and alternative solutions:

i) Capturing occasional heavy drinking patterns.

Aggregate measures of volume obtained through population surveys reflect total amount consumed by defined periods of time. In some contexts, this way of measuring alcohol can be misleading as the same rate would result from drinking one beverage per day and drinking 15 cups per sitting two times in the month, perhaps resulting in different types of risks and related problems. In fact surveys undertaken in Mexico have shown how aggregate measures of total alcohol intake per year explained only 11% of the variance of problems while 81% of consequences were reported by drinkers consuming high quantities per occasion (Medina-Mora et al, 1991). As discussed in Chapter 2.2, this underlines the value of employing the Graduated Quantity-Frequency method as a means assessing both average patterns and less frequent heavy occasions.

The data from the 1989 National Survey on alcohol and other drug use shown in Table 7.1 illustrate the value of measures of ‘binge’ drinking in the Mexican context. Though most problems are related to ingesting high quantities, independently of the amount drank per occasion, when the two dimensions are combined to form distinctive categories, then it becomes obvious that the variable that accounts for problems is the quantity taken per occasion rather than the frequency of drinking.

Table 7.1: Drinking level and pattern and risk of problems

Drinking Patterns	Drinkers Without Problems	Drinkers With Problems
Infrequent	35.31%	5.77%
Monthly / never 5 drinks per sitting	15.81%	6.08%
Monthly/ 5+ occasionally*	26.19%	**33.65%**
Weekly /never 5 drinks per sitting	7.32%	4.45%
Weekly /5+ occasionally*	8.74%	**21.82%**
5+ weekly	6.63%	**28.08%**

% of the total number of drinkers who either reported problems or reported not having experienced any personal or social problems.
*at least once a year

The differences in drinking patterns between Mexico and Spain discussed in the previous section of this Appendix are a good illustration of how measuring consumption by volume would have disguised the differences in patterns of drinking and could not have explained the different rate of related problems

Nonetheless, volume rates are also useful for measuring consequences. This is shown in the following curves that represent the relation between the total amount of alcohol used, the development of dependence (as measured by ICD10) and psychosocial problems (including binge drinking, blackouts, health consequences, problems with the family, at work or with the police, intentional and unintentional injuries).

ii) Collective drinking and inebriation.

The measurement of drinking needs to consider regional variations in drinking patterns. For example, those linked to special occasions or festivities. When alcohol use is not uniform throughout the year, but is determined by special occasions, time frames for investigating the patterns of alcohol intake should be considered carefully.

In some rural communities of Mexico, alcohol use is more a collective practice than an individual behavior. As mentioned above, intake is linked to special festivities where communal inebriation is prevalent. In these circumstances, the "usual" pattern might be of abstention or low levels of drinking, except during the festivities. These can be very frequent - some communities, up to 80 regular events involving public intoxication in a calendar year have been observed (Menendez, 1992). Thus it might be necessary, when studying these groups of the population, to include questions about drinking on special occasions. In these cases representative samples across the year are required to capture these special occasions. The procedure of asking consumption by recording the last 7 days would not capture these events and questions on usual amounts could also be misleading.

When research is conducted among groups with a high level of illiteracy or different conceptions of time frames as is the case in indian communities, to ask about usual patterns of drinking in 12 month periods is irrelevant and often an important source of bias. It is thus necessary to refer to local festivities and other significant events as time frames. Usually more accurate information is gathered if questioning starts with the last drinking event and then goes further back in time (Kershenobich et al., 1998).

iii) unrecorded alcohol

Several efforts have been made to try to estimate the amount of consumption of untaxed alcohol, through surveys. The national household survey included questions that inquired about ever use of 96° alcohol, use of alcohol obtained from open containers and alcohol packed in 40ml. envelopes. Questions on name and brand of beverages were also included. Very few drinkers responded affirmatively to these questions. From the names of beverages provided, only a few could be identified as faked beverages. It is estimated that people, in many occasions are unaware of what they are drinking.

In fact, the Consumer Federal Public Attorney (Procuraduría Federal del Consumidor), through a national program of surveillance of alcoholic beverages found that from 1,013,502 tequilas surveyed, 23,368 (2.3%) were non registered brands. In 21 visits to stores, for verification, 36 faked beverages were identified, as probed by laboratory testing, for example, some of the beverages were not derived from grape as stated in the label. Also 80,650 out of 300,995 (27%) beverages surveyed did not fulfill official regulations that included incorrect specification of alcohol per volume or required on labels.

In a more detailed study undertaken in a city of 600,000 inhabitants located near the Capital City, questions related to price and brand of the beverages were used in a representative household survey conducted by personal interview. In addition, interviewers visited all establishments that sold alcohol that were located in the block of houses in the sample, they asked for type of beverages available, brand type, size of the container and price. After inquiring for the regular types of beverages, respondents were asked whether there were less expensive beverages specifically, “aguardiente”. Of 28 establishments visited, 21 sold alcohol in closed containers and 7 were places where alcohol could be drunk on the premises, in 13 premises only beer was sold and in only 3 cases was low priced “aguardiente” or other local beverages available. No information was gathered on whether or not the beverages sold fulfilled official regulations, including registration with the Ministry of Health.

During the personal interview, people were asked if they had bought alcohol during the 7 days prior to the interview, and for those that answered yes, amount bought, size of container, type and brand, amount paid, and place where beverages were bought were asked for each day of the week. Data obtained showed the preponderance of beer over other beverages, and weekends of occasions for buying and drinking with Fridays and Saturdays accounting for 89% of the occasions, though little information was obtained related to untaxed alcohol. Two problems were faced, as daily or weekly alcohol intake is not a common practice, few respondents answered this section and those that had obtained alcohol during the previous week found it difficult to remember the prices they had paid.

In order to avoid relying on peoples recall, the National Household Survey on Budget and Expenses, leaves the questionnaire in each household, and daily information on expenses is annotated in the questionnaire for a week. More information is gathered through these procedure, though apart from reflecting the low economical level of the families that drink aguardiente (Medina-Mora, 1999), the only additional information is the low price paid per litre, suggesting, that at least a proportion of these beverages are untaxed.

Range of beverage types, typical serve sizes and alcohol content

In Mexico, the surveys conducted have traditionally inquired about drinking different types of beverages as well as questions about total numbers of alcoholic 'drinks' without distinguishing beverage type.

This way of asking about drinking allows the inclusion of all types of alcoholic beverages, and not only those considered to be such by some cultural groups e.g. 96% proof alcohol. It also provides further information on drinking practices and problems as the choice of beverage is often linked to the cultural background, age, gender, socio-economic situation, patterns of drinking and problems, thus providing useful information. Also, as discussed in Chapter 2.2, these more detailed questions result in higher estimates of consumption, though they more expensive and time consuming to conduct.

Drinkers usually drink more than one type of beverage but the proportion who reported consuming different drinks within their usual repertoire varied a great deal with only 13% for "pulque", a small proportion (3%) "aguardiente" or 96% proof alcohol. Just over half (51%) included wine in their repertoire, while beer (78%) and spirits (72%) were more widely used.

Regional variations in the incidence of liver cirrhosis have provided important clues to its relatively high incidence in spite of the relative low rate of per capita consumption calculate from official sales data (Rosovsky & Borges, 1996). About 50% of all cases of cirrhosis occur in states located in the central part of the country, where "pulque" is a common beverage, which represents cirrhosis rates of three times the national average. On the other hand, the average for communities with the same ethnic background that prefer "aguardiente" is also high, suggesting the concurrence of other risk factors perhaps related to infections. This underlines the need for considering other risk factors for cirrhosis in some countries and some regions within countries.

Equivalences in serve sizes and strength of beverages require careful consideration. Mexican researchers usually use pictures of the main beverage types, including a variety of presentation and sizes, along with the usual glasses or containers and make the equivalencies to number of drinks. It is believed that this procedure will reduce bias, but this issue deserves further consideration from research.

An additional factor deals with the difference between fermented and distilled beverages. The former have a short life, have lower alcohol content (for example "pulque" ±3%), but strength varies as it matures. The usual amount ingested per drinking occasion also varies. It is common practice to use additives to strength pulque, such as plants with psychotropic properties (Soberon 1992). Thus "pulque" is not a standard beverage.

The same can be said for other traditional beverages, some authors (Berruecos, 1994) have described up to 53 different traditional beverages consumed nowadays in different regions of the country. These beverages can be grouped into those that are produced from fermentation of different fruits or plants, those that are made with pulque or mezcal (distilled beverage made from Mexican agaves, similar to "tequila"), and those that combine "aguardientes" with fruits.

International and intra-national translation problems

The cultural adaptation of international instruments goes beyond the correct translation of the meaning of words and also requires special considerations as is illustrated by the following examples.

- Drinking and drunkenness in some groups are considered as synonymous, maybe because both behaviors are often linked. This fact is exemplified by surveys that show how males drink great quantities with 66% of male drinkers taking 5 or more drinks per occasion at least once a month (Medina-Mora *et al*., 1991).
- In spite of the fact that wine is so seldom consumed (5% of total alcohol reported by urban adult populations in terms of ethanol) the word 'wine' is considered by some as synonymous with 'alcohol' other than that in traditional fermented drinks such as pulque. This phenomenon is still observed among certain rural populations and migrants from rural settings. It has origins in the Spanish Conquest when distilled beverages were introduced to the country and the indigenous people gave the same name to all the newly introduced beverages.
- Pulque is often not considered to be an alcoholic beverage in rural Mexico, being more often considered as part of the regular diet, perhaps because of it's high protein value.
- It is common for some groups not to consider beer as an alcoholic beverage. A more recent example of the same phenomenon has been observed in relation to the new range of "coolers" which are marketed by trying to portray them as soft drinks, or beverages of moderation.
- A WHO project documented the absence of Mexican words to distinguish between 'hangover' and 'withdrawal'. The authors of the study found that some drinkers considered withdrawal as a more severe form of hangover. For a few respondents there was no difference. There were no colloquial words for withdrawal, and the regular term used in the medical and academic field is too technical, "abstinence syndrome". When asked about the meaning of the word respondents gave answers more related to the word abstinence, though they were able to relate symptoms to the act of stopping drinking such as anxiety and tremors (Campillo, 1992), thus suggesting the need to include symptoms or further explanations in questions about 'withdrawal'.
- Another example was observed with the use of the AUDIT screening instrument developed by the WHO (Babor *et al*., 1989) and widely used around the world. In spite of the fact that it was translated and back translated, and in general showed good reliability coefficients (De la Fuente & Kershenobich, 1992), when administered to rural workers one item generated a large number of inconsistent positive responses. Further study by these researchers of the meaning of the words as directly translated revealed that the word chosen first as the translation for "injured" could not only mean physical injury but also the sense of having hurt some one or that it could include a variety of other meanings such as: disappointment, to cause emotional or financial hardship. Thus the word was changed for one that could only be conceptualized as physical injury and thus increase the reliability of the instrument (Medina-Mora *et al*, in press)

WHO has developed guidelines for adequate translation and cultural adaptation of research instruments to local cultures (Trotter, 1997). They include translation to the local language by bilingual experts, discussion of meanings and adaptations made by experts in the field, and back translation to the original language. Cognitive exercises that assess the process between posing a question and obtaining an answer by asking the interviewee to think aloud while producing a response, are an invaluable tool (NIDA, 1992)

Per capita consumption estimates and unrecorded alcohol consumption.

Per capita estimates based on alcohol production data and total adult population estimates are an important tool for international comparisons (see chapter 2.2). They also allow for the evaluation of the growth of the market for different beverages. Though they share the same limitations as measures of volume, they tell us nothing about the way alcohol is distributed in the population. Even more, when unrecorded alcohol represents an important share of the market, such estimates will be misleading.

In Mexico unregistered alcohol has a long history but there has been increasing concern with a perceived increase in the availability of this untaxed alcohol. Though there are no estimates of the market share of these beverages, there are data that suggest it makes an important contribution to overall consumption, especially among disadvantaged groups.

Not only tax evasion but also spates of deaths caused by the use of non drinkable alcohol sold as "aguardiente" (e.g. 49 deaths in one small rural locality in 1996) have contributed to official concern. Reports of illegal production plants, and the detection of pipes transporting high quantities of alcohol used to aid production to retail stores that sell non canned alcohol are also indicative of the problem.

Population surveys have traditionally inquired about the consumption of high concentration alcoholic drinks such as 96% proof alcohol and "aguardientes" as a group which is differentiated from distilled registered beverages. From these data, however, it is not possible to determine how much of the consumption reported as distilled beverages or "aguardientes" correspond to registered beverages. An observational study conducted by Natera *et al* (1997) in downtown Mexico City, showed how 47% of the bottled alcohol sold in small outlets had no official register. The alcohol industry has provided evidence of the proliferation of alcohol sold in recycled bottles of known brands of alcohol where the name has been slightly changed. This is likely to be true given that there is no regulation for the destruction of bottles and thus reported consumption of distilled beverages in surveys probably includes both registered and unregistered alcohol.

Recent surveys have included questions on specific brands of beverages, using a diary of the last events where alcohol was purchased in small shops as a means of capturing part of the consumption of unrecorded beverages.

Problem indicators

In rural areas of different ethnic background, as previously mentioned, drinking and drunkenness are common during special festivities that can go on for various days. During these occasions, in certain ethnic groups, women are allowed to drink (Natera, 1987), binge drinking and intoxication can last one week, and alcohol is taken from morning to night.

Under these circumstances it is not uncommon for both groups, but specially for females that seldom drink in other times of the year, to experience a significant number of problems. It would not be unusual in a survey that uses a 12 month period for women to report that they had an episode of binge drinking, that they drank first thing in the morning, that they did not remember what they did while drinking and that they were ashamed or felt guilty of what happened while drinking.

Another important consideration is the fact that females are usually excluded from drinking occasions. The cross cultural study by Rootman and Moser (1985) documented how in Mexico, very little male drinking took place with the spouse, most being in the company of male friends and relatives. At the same time, almost half of the male drinking was reported to take place at home. Wives are thus excluded from drinking but not from the consequences, provoking a high degree of tension. According to these authors, the considerable degree of concern expressed by the families might be explained by this factor. The importance of the family as a means of social control was further confirmed by the fact that a large proportion of drinkers reported talking to their spouses and other relatives about their problems.

Thus it might be concluded that having a family problem related to alcohol intake might not have the same meaning in different cultural settings.

The use of cirrhosis mortality and, especially, that linked to alcohol as an indicator of alcohol related harm must also be seen through the lens of local context. Mexico illustrates how cirrhosis mortality as an indicator of alcohol related harm requires careful application and interpretation in different countries. Adjustment to the age structure of a Western European country gives a mortality rate of 49 per 100,000 (Edwards et al., 1994), a rate higher than might be expected from Mexico's apparent per capita consumption level. This suggests the concurrence of other risk factors probably linked to infections and malnutrition. It is also, once more, indicative of the extent of unrecorded alcohol consumption, especially in rural areas.

Mexico provides another example of how cirrhosis rate is affected by local factors. Chiapas, a state in Mexico with one of the highest levels of alcohol consumption (Navarrete, 1988), has a below average rate of cirrhosis. It may be that the unusually high death rate in this state, undoubtedly related to its poverty, limits the numbers of people living to an age where death from chronic liver disease might be an issue for them.

Problem indicators from health and road crash statistics can also be developed in Mexico for problems caused by the acute effects of alcohol. Medium and High Risk alcohol consumption is prevalent in Mexico and even though official per capita consumption only just hovers above 5 litres per person per year it will be apparent that actual consumption levels are far higher because of the extent of illicit production. As a consequence, it is suggested that the health indicators for Low and Medium resource countries apply even in the absence of reliable estimates for local Aetiologic Fractions. The problem indicators identified in Chapter 3.3, namely rates of death from suicide, homicide, road crash and poisoning are useful alcohol harm indicators in Mexico. In addition, road crash statistics can be used to identify the time of day so that the indicator of 'night-time' crashes is also viable.

Conclusions

In order to measure alcohol-drinking patterns it is possible to use internationally developed measures but special adaptations are required according to local uses and norms.

The indicators employed to measure drinking patterns should take into account the local ways in which alcohol is consumed, both in terms of volume and pattern. The Graduated Quantity-Frequency approach adequately measures both these aspects and is also cost-effective.

Time frames should be selected to take account of the occasions on which alcohol is consumed. When alcohol is restricted to special occasions or varies between special occasions and every day life, questions on drinking practices during special events at certain times must be included. The use of a 12 month reference period for the GQF will document the extent of such different patterns though extra questions are required if more information is needed about the context of this consumption.

It might be necessary to include different indicators of use and consequences for males and females.

When assessing problems it is important to take into account that these result not only from behaviors but from violation of norms, that vary from one setting to other. Thus the same item can have different meanings and implications when referred to in different contexts.

Cultural adaptation of international instruments must be conducted with great care. Exercises aimed at capturing the local meaning of key words are a good practice since it is sometimes the case that apparently interchangeable words have widely differing meanings.

Surveys can provide valuable information when patterns of intake are assessed for different type of beverages, thus making it possible to describe patterns and total volume ingested for each type included in the questionnaires. A general question of overall consumption may also be useful as the sum of individual beverages does not necessarily give an adequate estimation of the total frequency or quantity ingested. As described in Chapter 2.2, however, the use of individual beverages does result in higher estimates of consumption than do general estimates of numbers of ‘drinks’ consumed on an occasion and may be a more precise measurement. This manner of inquiring also allows the inclusion of all type of beverages and not only those considered as such by the population including the use of 96% proof alcohol as an alcoholic beverage. The choice of beverage is often linked to the cultural background, age, gender, socio-economic situation, among other factors, thus providing useful information. It is, however, expensive and time consuming to seek beverage specific information from surveys.

It also helps to make some indirect estimations of unrecorded alcohol. To date questions introduced in the Mexican surveys have been problematic thus there is a need to explore better ways of getting this information, perhaps by asking about specific brands of beverages bought in the recent past. This requires the use of recent recall methods such as the Last 7 Day approach described in Chapter 2.2 with modification for the fact that weekly drinking is relatively uncommon. An adaptation of the Finnish approach of inquiring about the last three occasions on which alcohol was consumed would be better with questions about specific beverages, how obtained and prices paid.

The same concerns about equivalence in serving sizes and strength of beverages as discussed in Chapter 2.3 are certainly applicable to Mexico. An additional consideration is with the difference between fermented and distilled beverages. Fermented beverages have a short life and lower alcohol content but their strength varies as they mature. The usual amount ingested by drinking occasion also varies. It is common practice to use additives to increase the alcohol content of some beverages making it hard to estimate alcohol content of such drinks when reported in surveys.

In developing countries, especially where few resources are available for research purposes, information about alcohol from surveys may be limited to small sample sizes with restricted geographic coverage. Official records from health and police authorities may sometimes not be reliable. As discussed in Chapters 3.2 and 3.3, mortality data from health records are usually the most reliable source of official information for alcohol harm indicators, especially for liver cirrhosis, homicide and road crashes.

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A recent international conferÂ ence focused on developing consensus on questionnaire items for measuring alcohol consumption and alcohol-related social harm in international comparisons. The recommendations from this conference (Dawson and Room 2000), as well as the recently published International Guide for Monitoring Alcohol Consumption and Related Harm (World Health OrganÂ ization [WHO] 2000), may help optimize comparability in internaÂ tional alcohol surveys. The following sections demonstrate the complexity of assessing alcohol conÂ sumption using two examplesâ€"drink size and strength, and Why monitor alcohol use and related problems? Introduction The global burden of alcohol-related problems The social and economic costs of excessive alcohol use The value of national data on alcohol use and harm Contents of the guide Who should monitor and how should the results be disseminated References. Section 2Â International guide for M onitoring alcohol consumption and harm. advice on the establishment of national monitoring systems in order to provide accurate information upon which to base and develop national policies. This guide needs to be seen as complementary to other WHO publications concerned with national and international monitoring. Recorded alcohol consumption refers to alcohol consumed according to the official statistics at country level based on production, import, export, and sales or taxation data. Unrecorded alcohol consumption refers to alcohol which is not taxed and is outside the usual system of governmental control, such as home or informally produced alcohol (legal or illegal), smuggled alcohol, surrogate alcohol (which is alcohol not intended for human consumption), or alcohol obtained through cross-border shopping (which is recorded in a different jurisdiction).Â International Guide for Monitoring Alcohol Consumption and Related Harm. WHO, 2000. Other references WHO.