Chapter 6: Alcohol and Europe

Alcohol places a significant burden on several aspects of human life in Europe, which can broadly be described as 'health harms' and 'social harms'. Seven million adults report being in fights when drinking over the past year and (based on a review of a small number of national costing studies) the economic cost of alcohol-attributable crime has been estimated to be €33bn in the EU for 2003. This cost is split between police, courts and prisons (€15bn), crime prevention expenditure and insurance administration (€12bn) and property damage (€6bn). Property damage due to drink-driving has also been estimated at €10bn, while the intangible cost of the physical and psychological effects of crime has been valued at €9bn-€37bn.

An estimated 23 million Europeans are dependent on alcohol in any one year, with the pain and suffering this causes for family members leading to an estimated intangible impact of €68bn. Estimates of the scale of harm in the workplace are more difficult, although nearly 5% of drinking men and 2% of drinking women in the EU15 report a negative impact of alcohol on their work or studies. Based on a review of national costing studies, lost productivity due to alcohol-attributable absenteeism and unemployment has been estimated to cost €9bn-€19bn and €6bn-€23bn respectively.

Looking from a health perspective, alcohol is responsible for about 195,000 deaths each year in the EU, although it is also estimated to delay 160,000 deaths in older people mainly through its cardioprotective effect for women who die after the age of 70 years (although due to methodological problems, this is likely to be an over-estimate of the number of deaths delayed). A more accurate estimate is likely to be the 115,000 net deaths caused in people up to the age of 70, which avoids most of the likely overestimate of alcohol's preventive effect in older age. These figures are also relative to a situation of no alcohol use, and the net effect would be much greater if we look at the lowest-risk level of drinking. Measuring the impact of alcohol through Disability-Adjusted Life Years (DALYs) lessens this problem, and shows that alcohol is responsible for 12% of male and 2% of female premature death and disability, after accounting for health benefits. This makes alcohol the third highest of twenty-six risk factors for ill-health in the EU, ahead of overweight/obesity and behind only tobacco and high blood pressure.

This health impact is seen across a wide range of conditions, including 17,000 deaths per year due to road traffic accidents (1 in 3 of all road traffic fatalities), 27,000 accidental deaths, 2,000 homicides (4 in 10 of all murders), 10,000 suicides (1 in 6 of all suicides), 45,000 deaths from liver cirrhosis, 50,000 cancer deaths, of which 11,000 are female breast cancer deaths, and 17,000 deaths due to neuropsychiatric conditions as well as 200,000 episodes of depression (which also account for 2.5 million DALYs). The cost of treating this ill-health is estimated to be €17bn, together with €5bn spent on treatment and prevention of harmful alcohol use and alcohol dependence. Lost life can either be valued as lost productive potential (€36bn excluding health benefits), or in terms of the intangible value of life itself (€145bn-€712bn after accounting for health benefits).

Young people shoulder a disproportionate amount of this burden, with over 10% of youth female mortality and around 25% of youth male mortality being due to alcohol. Little information exists on the extent of social harm in young people, although 6% of 15-16 year old students in the EU report fights and 4% report unprotected sex due to their own drinking.

Between countries, alcohol plays a considerable role in the lowered life expectancy in the EU10 compared to the EU15, with the alcohol-attributable gap *in crude death rates estimated at 90 (men) and 60 (women) per 100,000 population. Within countries, many of the conditions underlying health inequalities are associated with alcohol, although the exact condition may vary (e.g. cirrhosis in France, violent deaths in Finland). Worse health in deprived areas also appears to be linked to alcohol, with research suggesting that directly alcohol-attributable mortality is worse in deprived areas beyond that which can be explained by individual-level inequalities.*

Many of the harms caused by alcohol are borne by people other than the drinker responsible. This includes 60,000 underweight births, as well as 16% of child abuse / neglect and 5-9 million children living in families adversely affected by alcohol. Alcohol also affects other adults, including an estimated 10,000 deaths in drink-driving accidents for people other than the drink-driver, with a substantial share of alcohol-attributable crime also likely to occur to others. Parts of the economic cost are also paid by other people or institutions, including much of the estimated €33bn due to crime, €17bn for healthcare systems, and €9bn-€19bn of absenteeism.

Natural experiments and time-series analyses both show that the health burden from alcohol is related to changes in consumption. These changes show the behaviour of the heaviest drinkers more than lighter drinkers (given that e.g. the top 10% of drinkers account for one-third to one-half of total consumption in most countries), but also tap into the wider tendency for populations to change their levels of consumption collectively. Across the whole population, the impact of a one-litre change in consumption on levels of harm is highest in the low-consuming countries of the EU15 (northern Europe), but still significant for cirrhosis, homicide (men only), accidents, and overall mortality (men only) in southern Europe. While some have argued that the greater change in northern Europe reflects the 'explosive' drinking culture there, this may also reflect the greater proportional size of a one-litre change in the low-consuming northern European countries. Overall, it has been estimated that a one litre decrease in consumption would decrease total mortality in men by 1% in southern and central Europe, and 3% in northern Europe.

INTRODUCTION

The evidence for alcohol's causal relation to a number of consequences on the individual level has been summarized in Chapter 5. This chapter builds on this by showing what the evidence means for Europe as a whole, transforming changes in individual risk to levels of harm in European society. The chapter deals first with social harms (e.g. crime, the workplace), before discussing the scale of health consequences (both positive and negative) based on work undertaken by the WHO. Finally, the chapter describes how changes in a society's levels of consumption relate to changing levels of harm – which sometimes show different results from the changes in individuals' drinking presented in the previous chapter. Use is made throughout of the estimate of the social costs of alcohol in Europe, which was presented in Chapter 3. As stated previously, it is strongly advised that any reader who wishes to use these figures should consult Box 3.3 in Chapter 3 to ensure that the results are used accurately.

Social Harms

The myriad results of drinking outside of damage to health – usually referred to as the 'social consequences' of alcohol – form an important part of society's view of alcohol, yet research into this area is yet to fulfil its potential (Klingemann and Gmel 2001). To date there have been relatively few European comparative studies, and it is frequently impossible to make meaningful comparisons across countries. The lack of good records for many of the harms, combined with different ways of recording alcohol's involvement, makes the task doubly difficult. Further complications include the numerous possible biases in associational figures related to alcohol, such as the potentially different chances of being arrested when drunk (either higher, due to reduced ability to avoid arrest, or lower, due to the increased demands on police forces at times of peak alcohol consumption).

In response, a number of surveys have been conducted looking at people's reports of consequences of drinking, both with young people (e.g. ESPAD) and adults (e.g. ECAS). While these add valuable perspectives to an area otherwise lacking much data, they are hard to interpret – does a higher rate in one country compared to another mean that the problems are actually more widespread, or simply that more people believe in a link between drinking and outcomes? In America, for example, all objective measures of risky consumption and harm (average consumption, drinking 5+ drinks on one occasion, liver disease and alcohol-related fatal crashes) decreased between 1984 and 1990, but drinkers' reports of social consequences rose dramatically.

This raises the question of what exactly these surveys show (Room and Hradilova Selin 2004). For harms that are truly 'social' in that they depend on being noticed as harms by others, this question is relatively unproblematic and self-reports from the drinker (Room and Hradilova Selin 2004) or by others (Room 2000) can be used with a certain level of confidence. For example, many drinking-related marital problems depend on the spouse's view on whether drinking is a problem, and do not exist 'independently' of this. However, for the rarer but more severe categories of harm that can meaningfully be measured relatively 'objectively' – such as the frequency of workplace accidents or the risk of perpetrating a violent crime – there are substantial problems in interpreting a drinkers' attribution as reflecting the objectively-measured causal role (Gmel *et al.* 2000).[1]

This explains why changes in cultural views of the effects of drinking can result in drinkers' experience of alcohol-related problems increasing at a time when objectively-measured harms are decreasing. The limitations of *only* using drinkers' self-reported attributions of alcohol-related problems have been clearly identified (Dawson and Room 2000), but, unfortunately, few of the resulting recommendations have yet resulted in further research (research that does exist is only on the individual level, and is, therefore, covered in Chapter 5). Nevertheless, self-reports *are meaningful* in the sense that they show people's own views on the level of social problems related to alcohol, even if they do not fully capture all the harms that exist separately from people's attributions. Bearing these caveats in mind, then, the first half of this chapter summarises the existing research on social harms, looking in turn at crime, the family, the workplace, and nuisance and harassment.

[1] It should be further noted that even the 'objective' epidemiological studies are usually vulnerable to biases in memory and definition (e.g. the boundary between disorder and harmless fun); see Room (2000).

Crime

Alcohol use is associated with crime in all European countries, and is particularly involved with violent crimes (see Table 6.1). It should be borne in mind that this shows how far alcohol is *associated* with violence, which is likely to be greater than its *causal* role (Rossow, Pape, and Wichstrøm 1999; see also Chapter 5). The data presented for different countries are also not directly equivalent given large and often opaque methodological variations, and the issue of whether victims' drinking is included is generally unclear.

Nevertheless, both Table 6.1 and a review of studies conducted in North America and northern Europe (Rossow, Pernanen, and Rehm 2001) found that the proportion of *violent crimes* reported to be committed under the influence of alcohol is highest in the Nordic countries. Other surveys in the Nordic countries have also found 2%-3% of men and 1%-2% of women have been physically harmed by a drunk person in the past year (Mäkelä *et al.* 1999; Rossow and Hauge 2004). In contrast, a survey within the ECAS project found the highest rates of people who report being in a fight when drinking come from Germany, the UK (both >5% of drinking men) and Ireland (>10%), with the lowest rates of around 1% coming from Italy and Sweden (Ramstedt and Hope 2003). Interpretation of these results is, however, complicated by the unknown total number of fights in each country.

Even within violent crimes as a whole, the involvement of alcohol may vary. In Finland, Germany, Norway, Poland and the UK, assault associations seem higher than those for *robbery and sexual crimes*, although the range of results is also greater and more spread out between victim and offender drinking. *Vandalism* also shows a strong association with alcohol where data is available (Belgium, Estonia, Latvia and Norway), as does theft in a number of countries. The alcohol-crime link for all of these is stronger for drinking to intoxication (cf. Chapter 5) – in the UK, for example, 24% of all violent offences are committed by 18-24 year old binge-drinkers, compared to 16% for other regular drinkers and 5% by occasional- or non-drinkers of the same age (Matthews and Richardson 2005).

Crime and beliefs about alcohol

Differences in the relation of crime to alcohol across different countries – and, in particular, those that do not reflect volumes or patterns of drinking covered in Chapter 4 – suggest that 'drunken comportment' has important effects on levels of crime in a given society (cf. also Chapters 2 and 5). However, it is also possible to argue that these results mainly arise because some Europeans believe more in a link between alcohol and violence than other Europeans. Only the ECAS study has investigated this in any detail, by looking into views on responsibility and predictability of actions done when drunk (Room and Bullock 2002). This found that drinkers' responsibility for their actions when drunk was seen as highest in France but lowest in Germany and Italy, while over 50% more in Italy believed that "anyone might become violent after drinking too much" compared to Finland. These results suggest that there are significant variations between countries in understandings of drunken behaviour, but these may not follow a simple pattern across Europe.

Similarly ambiguous are the results of time-series analyses, which compare trends in recorded crime with changes in recorded levels of consumption. This method, therefore, implicitly includes all of the possible causal mechanisms between alcohol in crime, going beyond just the intoxication of the perpetrator to include intoxication in the victim and any tendency for drinking occasions to add to potential conflict situations. These can be presented as either the *percentage change per litre of* *consumption*, or combining this percentage change with the total level of consumption to find the implied *alcohol-attributable fraction of all crimes.* However, these results can point in opposite directions, as the % change per litre of consumption tends to be greater in countries where the level of consumption is lower, i.e. northern Europe.

Table 6.1 Selected crimes and their relation to alcohol

	Country	% linked to alcohol	Type of link[2]
All crimes	Belgium	20	Intoxication
	England & Wales	25	Under-the-influence
	Finland	47	Intoxication, prisoners
	Germany	7	Under-the-influence
	Hungary	35	Intoxication
	Latvia	34	Under-the-influence
	Lithuania	21	Under-the-influence
Violent crime	Belgium	40	Intoxication
	England & Wales	48	Under-the-influence
	Estonia	60-70	Alcohol-related
	Finland	66	Intoxication, prisoners (assault)
	France	25	1973 data; Alcohol-related (assault)
	Germany	24	Under-the-influence
	Norway	80	Intoxication
	Spain	42	Under-the-influence, victims in A&E
	Sweden	86	Intoxication
Robbery	England & Wales	19	Under-the-influence
	Finland	53	Intoxication, prisoners
	Norway	40	Intoxication
	Poland	40	Intoxication
Sex offences / Rape	England & Wales	58	Alcohol-related
	Finland	49	Intoxication, prisoners
	Germany	29	Under-the-influence
	Norway	60	Intoxication

As discussed in the text, the methodology underlying these data is not consistent – any comparisons of these values should, therefore, be done highly cautiously.

[1] Sources are: Belgium, Estonia, Hungary, Norway, Poland and Sweden (Rehn, Room, and Edwards 2001); Finland (Murdoch, Pihl, and Ross 1990; Salomaa 1995); France (Murdoch, Pihl, and Ross 1990); Germany (Bühringer et al. 2002); Latvia and Lithuania (Alcohol Policy Network 2005); Spain (MacDonald et al. 2005); UK (Leontaridi 2003)

[2] As described by the source of data – Intoxication: either victim of offender's view on whether offender was intoxicated; BAC: Blood Alcohol Concentration from police test; Under-the-influence: described as such in the source; Attribution: either victim or offender attributes harm to drinking; Alcohol-related: either an unspecified link, a self-report of any alcohol use in the 4-6 hrs immediately prior to the event, or a positive but unspecified BAC level.

Looking at *assaults*, for example, the alcohol-attributable fraction was moderately larger in Sweden and Norway (50%) than France (33%), with no significant effect found in Denmark (Lenke 1990). In contrast, the effect of a one litre change in consumption was far weaker in France than elsewhere, but the much higher level of consumption in France gave a much more similar role of alcohol in assaults overall.[2] A similar result can be seen for *homicide*, where northern European countries show much stronger effects per litre – a result often explained as the result of 'explosive' drinking patterns there (Room and Rossow 2001; Rossow, Pernanen, and Rehm 2001). Yet once more, those countries showing smaller effects per litre are also those with higher levels of consumption, with a net result that the estimate of the number of alcohol-attributable homicides per capita is similar in northern and southern Europe (see under 'homicide' below, and also the discussion of time-series analyses more generally towards the end of this chapter). While this type of country-level analysis is valuable in order to escape from some of the biases inherent in most other individual-level methods, it also assumes that the relationship between changes in consumption and crime is constant at all levels of drinking, which may or may not be the case in practice.

The evidence presented here and in the preceding chapter shows that alcohol is associated with some types of crime to some degree across the whole of Europe – including southern Europe – and much of this seems to be due to alcohol's causal role. Yet, despite the importance of knowing how many crimes occur due to alcohol across different countries, we are, unfortunately, left with insufficient evidence to say anything more conclusive about patterns of alcohol and crime in Europe. This represents a major gap in the available data, given that the number of assaults reported to the police that are linked to alcohol is likely to be of an order of magnitude of 350,000 each year or more (although evidently not all the assaults linked to alcohol will be due to alcohol in a causal sense; see below).[3] An even higher potential indicator comes from ECAS survey data, which suggests that seven million adults have been in fights when drinking in the past year, although, once more, this says nothing about how many of these were *due* to drinking.[4] The lack of data for any other indicators is reflected in the recommendations for future research in Chapter 10.

Estimating the cost of alcohol-attributable crime

Despite the absence of robust comparable data on alcohol and crime, it is possible to make a tentative aggregate-level estimate to show the potential scale of alcohol-attributable crime costs across Europe, and also, hopefully to act as an incentive to conducting future research (cf. the recommendations in Chapter 10). This is based on the review of previous studies presented in Chapter 3, in which several studies attempted to estimate the crime cost due to alcohol. These national-level studies have often found it to be a substantial element of the final direct tangible cost, and have generally used one of two different approaches:

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[2] The data for France stop at 1958, which limits the ability to generalise from these results to more recent periods. Lenke also notes problems with the historical consumption data used for the calculation in France.

[3] This assumes that alcohol is linked to one-quarter of all assaults (25% was chosen as it is the level of the lowest associational figure found in Table 6.1 above). Offence rate data is taken from the European Sourcebook of Crime and Criminal Justice Statistics (Killias *et al.* 2003); it should be noted that there are substantial differences in the definition of an 'assault' between European countries.

[4] ECAS results for the aged 18-64 years drinking population in France, Finland, Germany, Ireland, Italy, Sweden and the UK (Ramstedt and Hope 2003) were extended to the EU15 according to the average for the 'ECAS region' (effectively northern Europe, central Europe and southern Europe). These were turned into numbers of people according to WHO HFA population data for 15-69 year olds and the abstinence figures covered in chapter 4.

1. First, studies have simply used the associations of alcohol and each type of crime as a maximum figure for the causal role, and presented the resulting costs as 'up to' a certain value, e.g. the UK study performed by the Prime Minister's Strategy Unit (Leontaridi 2003). While methodologically coherent, the figures in practice are often interpreted as estimates of the causal role; this means that the social cost is inflated relative to its likely value.

2. The second method has been to interview prisoners or arrestees, and ask them whether they believe they would have committed the crime if they were not drunk (Collins and Lapsley 2002; Pernanen *et al.* 2002). This then provides an estimate of the proportion of crimes that prisoners/arrestees themselves believe are due to alcohol. Although this method is far from ideal, the fact that *"the choice is between methods that are all lacking in some respects"* (Pernanen *et al.* 2000:56) has meant an increasing use of this method in sophisticated recent studies. In the Canadian study of federal inmates, 24% of crimes were committed by people who were drunk at the time, but only 17% of crimes (between one quarter and one third less) were described as due to alcohol (either dependence or drunkenness).

3. It is theoretically possible to create a third method to estimate the crime cost, although this has not been attempted by any of the reviewed studies. This would be based upon the alcohol-attributable fractions for each offence type from the time-series analyses discussed above. While this would avoid some of the biases inherent in people's perceptions of causality, time-series analyses tend to be more robust when countries are pooled together (to get a greater number of time points), which limits their accuracy for short time periods in individual countries.

BOX 6.1 – ALCOHOL AND CRIME

- Alcohol is associated with crime – and especially violent crime – across the EU.
- An estimated 7m adults report being in fights when drinking in the past year.
- The tangible cost of crime due to alcohol has been estimated at €33bn in the EU in 2003. This is split between police, courts & prisons (€15bn); crime prevention expenditure (burglar alarms) & insurance administration (€12bn); and property damage (€6bn).

Although these can be adapted to produce an estimate of crime costs in Europe,[5] the absence of comparable data on alcohol-attributable (or even alcohol-related) crime clearly precludes any attempt to adjust these estimates for the level of crime due to alcohol in each country.

This methodological problem is true for all of the cost components (as discussed under 'Methodological Issues' in Chapter 3), but may be particularly problematic for the crime estimate. This should be borne in mind while interpreting the results, and prevents any possible comparison of crime costs between individual countries.

[5] As with the other cost components, the crime costs estimates are based on scaling the crime costs in each study according to a common indicator, such as government public order expenditure (see chapter 3). To address the issue of causality, the results of alcohol-*related* crime costs are presented in Table 3.1, before the overall result is reduced as described in footnote 6.

Of the three methods outlined above, it is the second method using prisoner attributions – representing the current 'state of the art' – that forms the basis of the headline figure for the crime costs.[6] Our overall estimate for the total cost to Europe of crime *due* to alcohol is, therefore, €33bn in 2003.[7] The greatest cost within this is for spending on police, courts and prisons (€15bn), although this still accounts for less than half the costs. The remaining amount is made up of costs in anticipation of crime (crime prevention expenditure such as burglar alarms, together with the administration of insurance) that costs an estimated €12bn, and property damage from crime that accounts for a further €6bn.

Beyond these tangible costs, we can also place a value on the physical and psychological effect of violent crime on the victims. Depending on the value given to a quality adjusted life year (QALY) (a similar measure to a DALY but derived from people's responses rather than expert evaluations), these intangible costs of crime come to €9bn-€37bn per year (€52bn for the cost of alcohol-*related* crime).

The family

Table 6.2 Domestic violence and its relation to alcohol

The methodology underlying these data is not consistent – any comparisons should be done cautiously. *See Table 6.1 for sources.*

	Country	% linked to alcohol	Type of link (see Table 6.1 above)
Domestic violence	France	30	Alcohol-related
	England & Wales	53	Under-the-influence
	Iceland	71	Attribution
	Ireland	34	Attribution (trigger)
		71	Alcohol-related
	Netherlands	30	Intoxication
	Portugal	*16*	*Alcohol (or other drug) related*
	Spain	25	Alcohol-related
	Switzerland	26	Attribution
		40	Alcohol-related

While the harm done to families has been a factor in debates on alcohol for a significant amount of time (see Chapter 3), and a causal role of alcohol has been established for a number of harms (see Chapter 5), it is only recently that any research has been done to quantify the level of this harm within Europe. Domestic violence has been the subject of the most investigation, often within a similar framework to the crimes discussed above, and 16%-71% of domestic or intimate partner violence has been linked to alcohol across Europe (see Table 6.2). Most Europeans believe alcohol to be causally linked, with a European survey finding that "alcoholism" – cited by nearly 19 of every 20 citizens of *each* Member State – is regarded as the leading cause of domestic violence (Eurobarometer 1999).

Alcohol has similarly been linked to individuals' home lives or marriages, with 4% of men and 2% of women across seven countries saying this has been harmed by their drinking (Ramstedt and Hope 2003). Fewer problems were mentioned in southern Europe than elsewhere, although, once more, it is impossible to know if this is due to

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[6] Using the figures presented above, this suggests a reduction of 29% from the cost of crime *associated* with alcohol to the cost of crime *caused* by alcohol.

[7] The cost using the time-series analysis method was €27bn, and the cost of crime related to alcohol was €46bn. The time-series analysis method is based on results showing that 70%-80% of violent crime was associated with alcohol in Norway/Sweden while only 50% was causally due to alcohol according to time-series analyses. This suggests a reduction of 38% from the cost of crime *associated* with alcohol to the cost of crime *caused* by alcohol.

cultural biases or a real difference in the level of harm. A similar question has also been asked of 45-64 year-olds in Krakow (Poland) and Karvina-Havirov (Czech Republic), which found a very high level of reported home life problems among men (Bobak *et al.* 2004). In both studies and as found elsewhere, men report more family problems from their own drinking than women, a pattern that is likely to stem from the difference in male and female drinking covered in Chapter 4.
Less information is available on child abuse and neglect, but there has still been sufficient evidence from clinical case studies for one major review to ascribe 16% of child abuse to alcohol use (English *et al.* 1995), a finding accepted by two more recent reviews (Single *et al.* 1999; Ridolfo and Stevenson 2001). Reports from Denmark, Hungary, the Netherlands, Portugal, Spain and the UK support a figure of this magnitude, with alcohol related in various ways to 10%-50% of cases (McNeill 1998; Sundhedsministeriet [Ministry of Health] 1999; WHO 2004).

BOX 6.2 – HARMS TO THE FAMILY

- Alcohol is estimated to be a causal factor in 16% of child abuse and neglect.
- 4.7m-9.1m children (6%-12%) live in families adversely affected by alcohol.
- The intangible cost of alcohol dependence to family members has been estimated at €68bn in the EU

Besides the drinking of parents, young people's own drinking can also damage their home-life. More than 6% of 15-16 year old students report suffering problems with their parents due to their drinking, equivalent to over 700,000 young people.[8] In the EU15 this was as common for girls as boys (possibly reflecting the greater similarity in their drinking habits; see Chapter 4), but problems were twice as common in boys compared to girls in the EU10.

Alcohol dependency

The prevalence of alcohol dependence in the EU was estimated in Chapter 4 to be 23m people, with the risks of becoming dependent on alcohol covered in Chapter 5. This section attempts to look at the harms associated with alcohol dependence, although few data are available to make European-level estimates.

Only one study has attempted to quantify the intangible impact of a relative's alcohol dependence, based on people's willingness to pay for a hypothetical effective treatment for a family member (Jeanrenaud *et al.* 2003; Jeanrenaud and Pellegrini 2004). If this is extended across Europe using the estimates of alcohol dependence above, then we can estimate that the intangible impact of alcohol dependence on family members is €68bn per year.

Living with harmful drinking and alcohol dependent parents is a risk for a number of problems later in life, and affects a substantial number of children. A previous report for the European Commission on 'Alcohol and the Family' used Danish and Finnish research to estimate the number of children living in families adversely affected by alcohol (McNeill 1998). Updating this research for the present day in the enlarged EU, and adding new research from the UK National Association for the Children of Alcoholics as a lower bound (Callingham 2002), we can estimate that 4.7m-9.1m children (6%-12%) in the EU live in families adversely affected by alcohol.

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[8] Population-weighted EU averages presented – population data of 15-16 year olds taken from Eurostat; young people's reported harms from the ESPAD study (Hibell *et al.* 2004).

Work and alcohol

Despite employers' interest in reducing the burden of alcohol in the workplace, there is a lack of information on the exact scale of work-related harm due to difficulties in measurement. For example, very few studies have robustly quantified lowered productivity in the workplace due to the previous day's drinking, although one study by recruitment consultants in the UK estimated a 27% drop in productivity for each hungover day at a total cost of £1.8bn (reed.co.uk 2004). Outside Europe there is a similar lack of research, with one New Zealand study finding that 12% of employed drinkers had experienced reduced productivity at work due to their drinking, which rose to 30% of the 10% that drank the most (Jones, Casswell, and Zhang 1995).

Slightly better data are available for alcohol-related absenteeism in Europe. One study in Denmark, Finland, Norway and Sweden found that 3%-6% of all men and 1%-4% of all women have not gone to work at least once in the past year due to their drinking. Consequences of this type were also much more common for 19-34 year olds than older ages for both men and women (Mäkelä *et al.* 1999). Alcohol's role can also be estimated from the perceptions of employers, although evidently their views may not match the experiences of the drinkers themselves. Bearing this in mind, 12% of companies in Ireland mentioned alcohol as a cause of short-term absences for men (of which one-quarter saw it as the primary cause), while 3% believed the same to be true for women (with one-third seeing it as the primary cause; IBEC 2004). Alcohol was seen to be less implicated in long-term absences.

Box 6.3 – Alcohol and the Workplace

- Nearly 5% of drinking men and 2% of drinking women in the EU15 report a negative impact of alcohol on their work or studies
- 3%-6% of men and 1%-4% of women in the Nordic countries have not gone to work because of their drinking
- Lost productivity due to alcohol-attributable absenteeism and unemployment costs the EU €9bn-€19bn and €6bn-€23bn respectively each year

Alcohol has also been shown to relate to unemployment, with heavy drinking increasing the risk of being unemployed relative to lighter drinking at the same time as unemployment increases the risk of heavy drinking (see Chapters 3 and 4).

In total, nearly 5% of drinking men and 2% of drinking women across seven EU15 countries reported a negative impact of alcohol on their work or studies in the past year (Ramstedt and Hope 2003). This ranged from 3% or less for men in Sweden and France, to over 9% in the UK and Ireland (the same pattern also holding for women). In Ireland (data not reported for other countries), young people were much more likely to report problems with work than other age groups, particularly young women (10% at age 18-29 years compared to 1% for 30-49 year-olds).

As the paucity of information here suggests, further research is needed to compare the impact of alcohol on the workplace in different EU countries (in similar fashion to that for crime, described above). Nevertheless, using the review of national-level studies described in Chapter 3, we can estimate that alcohol use caused a potential €9bn-€19bn worth of productivity to be lost in the EU in 2003 due to absenteeism, and a further €6bn-€23bn of lost productivity due to unemployment. As stated throughout this chapter, these figures not only provide a tentative estimate of the scale of alcohol-attributable harm in Europe, but will also, hopefully, act as an incentive to action on the research recommendations outlined in Chapter 10.

Nuisance and harassment

Information on the scale of alcohol-related nuisance and harassment is only available from the Nordic countries, which are unlikely to be fully representative of the whole EU. Nevertheless, this research does suggest that nuisance and harassment may be one of the areas with the widest impact. Around 1 in every 5 people in the Nordic countries has been kept awake at night by 'drunken noises' (ranges are for national averages from four countries: 16%-22% men, 22%-24% of women). Nearly as many people have been harassed in a public place by drunk people (12%-26% men; 14%-25% women), while around 10% of men (8%-12%) and 20% of women (15%-25%) have been afraid of drunk people in the street (Mäkelä *et al.* 1999; Rossow and Hauge 2004). In parallel to most of the harms from people's own drinking (e.g. work-related harms), these problems from other people's drinking were more likely at younger than older ages for both sexes (Mäkelä *et al.* 1999; Rossow and Hauge 2004).

HEALTH HARMS

A global study of health risks conducted by the World Health Organization allows us to make an estimate of the overall effect of alcohol on health in Europe (see Box 6.4). All of the figures presented here are for the net effect of alcohol compared to no consumption of alcohol at all – in other words, taking into account the beneficial effects of some patterns of low-level alcohol consumption on some illnesses. This raises some problems, however, because (as discussed in Chapter 5) the lowest-risk level for alcohol consumption in much of Europe is above zero at older ages. In practice, this means that the results presented here are underestimates of the full-scale of alcohol-related harm, if by this we mean the harm compared to the lowest risk situation.

Methodological issues

The results are particularly sensitive to the risk estimate for heart disease One recent study has suggested that when changes in alcohol intake are taken into account, the J-shaped risk curve can still be found but the risk ratios for heart disease and overall mortality are substantially altered (Emberson *et al.* 2005; see Figure 5.8 in Chapter 5). Overall, the study showed a lower mortality rate in drinkers as a whole (compared to non-drinkers) using the conventional method, but a *greater* mortality rate using a single measure of average intake (conventional all-cause mortality risk for drinkers of 0.86 compared to abstainers, but 1.11 using revised method; present authors' calculations from published results).

The results are unlikely to be accurate at older ages The relative risk of alcohol for coronary heart disease declines with age (Abrams *et al.*, 1995), but in most estimations of alcohol-related harm, including this report, the same relative risks have been used for all age groups (see Chapter 5). This leads to an overestimation of deaths caused and prevented by alcohol in older age groups, which is especially relevant for coronary heart disease deaths prevented, where there is almost certainly an overestimate using the current methodology. It is likely that the majority of the beneficial effects of alcohol would be significantly reduced if age-specific relative risk estimates are used (Rehm *et al.* 2005). Further, there may be inaccuracy in death certificate recording in older age, whereby a higher proportion of deaths are recorded as ischaemic heart disease (see Chapter 5).

BOX 6.4 – THE WHO'S GLOBAL BURDEN OF DISEASE STUDY

The figures presented here are all adapted from the Global Burden of Disease (GBD) study on the relative impact of different health risks internationally: [9]

- *Adapting the figures*: the GBD figures were originally calculated for the three WHO sub-regions of Europe. These sub-regional figures have been turned into EU-wide figures on the basis of the size of the adult population in each country.[10]
- *Patterns of drinking*: due to evidence of an independent effect of ways of drinking (see chapter 5), the GBD study tried to look at the effect of both the volume of alcohol and the way that it is drunk:
    - A crude attempt was made to summarize drinking patterns (sometimes based on expert opinion alone), giving each country a score of 1 (least harmful) to 4 (most harmful).
    - These patterns combined information on abstinence, heavy drinking occasions, drinking with meals and drinking in public places.
    - A multilevel modelling technique was then used to look at the different impact of volume of drinking for each pattern, looking only where drinking patterns are thought to play a large part (heart disease and injury).
- *The EU10 and EU15*: Although scores of 1 and 3 are found in both regions, EU10 countries mainly had a score of 3, while most of the EU15 had a score of 1. The more harmful patterns in the EU10 were calculated as having a greater negative health impact, which explains the differences shown in Figures 6.3 and 6.4 below.[11]

A net beneficial effect only occurs for deaths at older age The net impact of alcohol on mortality is very different at different ages, due to the changing conditions

[9] For details, see (Rehm *et al.* 2003a; Rehm *et al.* 2003b; Rehm *et al.* 2004). ICD-10 codes are given for each health area below; to convert to ICD-9 codes, use the list available from http://www3.who.int/whosis/burden/estimates/GBD_cause_list.pdf.

[10] For two areas (intentional injury and unintentional injury), the figures gained using the method in Box 6.4 were disaggregated into two component parts (homicide and suicide for intentional injury, road traffic accidents and other accidents for unintentional injury). This was done by applying the reported age-scaled Alcohol Attributable Fractions (AAFs) from the GBD study to reported numbers of deaths taken from the WHO's Health For All database (figures were adjusted so that these came to the same total as that using the more general method). Parallel methods were also done within cancer (breast cancer) and gastrointestinal conditions (cirrhosis), with the reported AAF applied to the mortality and morbidity found elsewhere in the GBD project, and the figures for the remaining conditions (other cancers and type II diabetes) obtained from the residual figure.

[11] More precisely, the average pattern for the EURO-A sub-region was 1.34, while EURO-B was 2.93 and EURO-C 3.62. The different aggregate values for the EU10 and EU15 are because all of the EU15 countries are in sub-region EURO-A, while the EU10 countries are split between EURO-A (Cyprus, Malta, Slovenia), EURO-B (Poland and Slovakia) and EURO-C (Estonia, Hungary, Latvia, Lithuania). Calculated independently, the population-weighted pattern value for the EU15 is 1.27 and the EU10 is 2.80.

that people die from during the life-course (see Chapter 5) (Britton and McPherson 2001; McPherson 2004). Drinking has a damaging effect on health overall in youth and middle-age, but this can be obscured by the small beneficial impact at older ages given the greater overall rate of death with increasing age (White, Altmann, and Nanchahal 2004; Connor *et al.* 2005). This is illustrated in Figure 6.1, which shows the share of deaths attributable to alcohol in EU citizens who die younger than age 70 years. For those who die between the ages of 60 and 69 years, 5% of the 449,000 male deaths and 1% of the 247,000 female deaths are due to alcohol. This means that alcohol is responsible for a *net* 115,000 deaths up to the age of 70 in the EU.[12]

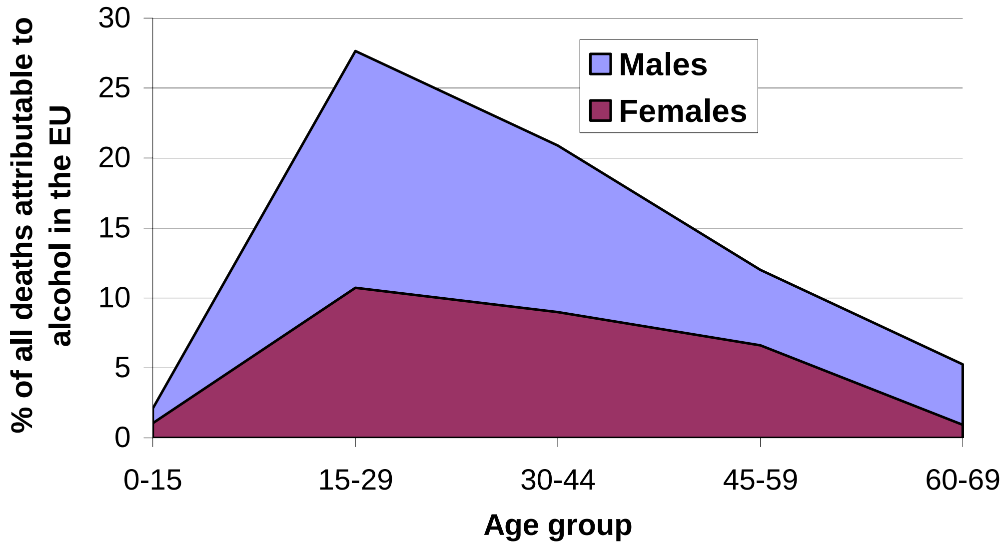

Figure 6.1 The share of deaths attributable to alcohol in EU citizens younger than age 70 years (year 2000). Source: GBD data (Rehm 2005).

Another way to view this is to consider potential years of life lost due to alcohol. Without accounting for the methodological problems described above, recent Canadian data shows that it is only in the age group 80+ years that alcohol leads to a benefit, Figure 6.2.

The number of deaths caused by drinking above the lowest-risk level is much higher than the 'overall' number of deaths Alcohol mortality figures are very sensitive to the situation they are being compared with – in other words, whether they are relative to no alcohol at all, or relative to level of drinking with the lowest risk of death (nadir). This can be seen in the detailed UK analysis (White, Altmann, and Nanchahal 2004), where the net effect of alcohol use in women was only 166 deaths, but drinking over the nadir (0-24g alcohol/day depending on age) caused over 3,500 deaths. This was over 85% of the total number of deaths before taking into account the cardioprotective effect, suggesting that the number of deaths above the nadir in the EU will be much closer to the gross figure (see below) than the net figure.

[12] This is based on the Rehm 2005 paper shown in Figure 6.1 and uses the same population-scaling method as described for the main results in Box 6.4.

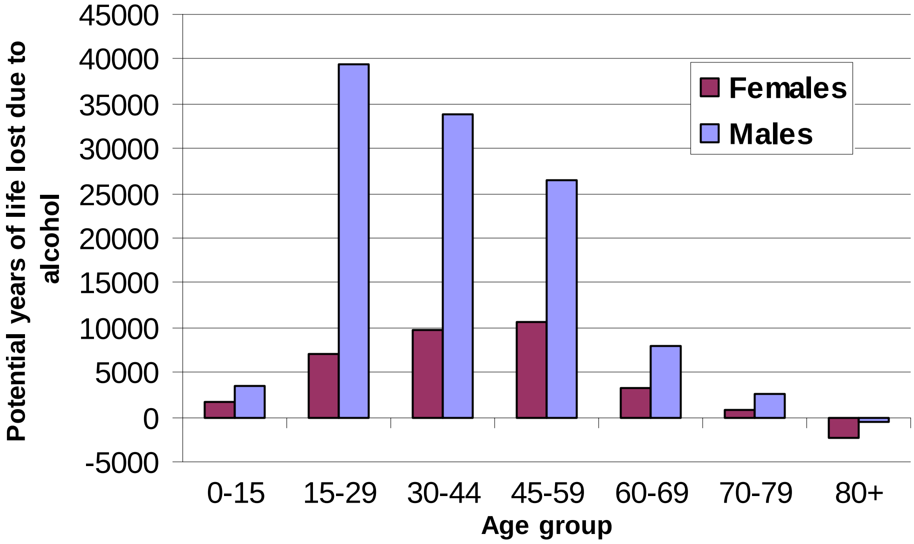

Figure 6.2 The potential years of life lost in Canada due to alcohol (year 2001). Source: Rehm *et al.* (2005).

Deaths due to alcohol in the EU

It can be estimated that within the 25 countries of the European Union, alcohol causes nearly 195,000 deaths each year (Figure 6.3); when the six other study countries are included this figure rises to 260,000. This is equivalent to 6% of all male deaths, together with 2.5% of all female mortality

At the same time, without taking all of the above methodological problems into account, it is estimated that around 160,000 deaths are delayed in Europe (particularly for women) relative to a situation of no drinking at all. As described above, caution should be taken in using these figures, since most of the deaths delayed are occurring at an age of death of more than 70 years, and particularly more than 80 years, where there is considerable uncertainty in the reliability of the estimates.

Looking at the full age-range – and bearing in mind the substantial methodological problems discussed above – the estimated net effect of 35,000 deaths in the EU breaks down into a large *negative* impact on men (nearly 5% of all mortality) and a *positive* but smaller effect for women (3%). Looking at the more limited age range – where the estimate is likely to be more accurate, but the impact on those over 70 is omitted – the net 115,000 deaths breaks down into a large negative impact on men (5% of all mortality) and a smaller but still negative impact on women (1%). The difference between men and women is due to both the fact that women die at older ages than men (thus accentuating the potential beneficial impact of alcohol) and due to women's less hazardous and harmful drinking, which also accentuates a reduced risk for coronary heart disease.

Burden of ill-health

The other way of assessing the scale of alcohol as a public health problem is to examine the whole burden of illness and disease, looking at years of healthy life. The

WHO uses a measure called Disability-Adjusted Life Years (DALYs) to estimate the number of healthy years of life lost due to each risk factor. For example, while a year of perfect health will count as 1 and a year of death will be 0, a year of damaged health that significantly affects Quality of Life will be somewhere in between. DALYs measure a gap in health between the current position and what could be achieved.[13] The results differ from the mortality estimates in two key ways:

- First, illnesses that kill people earlier in life will become more important;
- Second, non-fatal conditions such as depression, which significantly damage people's quality of life, will become more important.

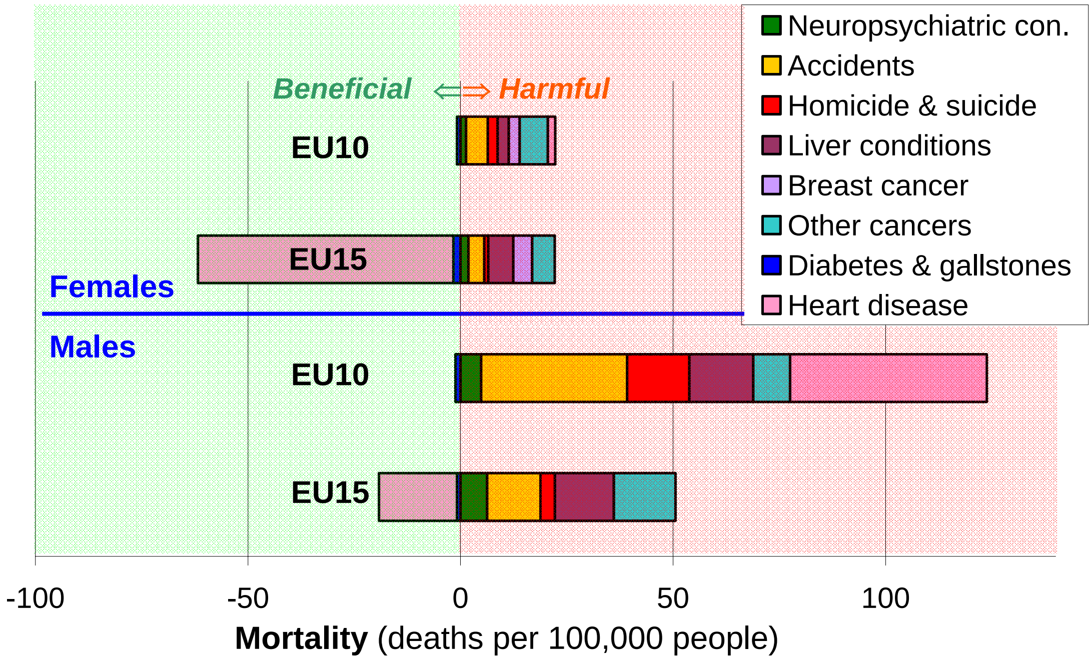

Figure 6.3 Alcohol-attributable mortality in the European Union

Adapted from WHO's Global Burden of Disease study (Rehm et al. 2004)

This has the added advantage of reducing the problem of whether to compare alcohol to no consumption at all, or to the lowest-risk drinking level. Looking at the previous UK example, any alcohol use is responsible for 23,000 years of life lost each year in women (6% of the total), but drinking above the nadir only changes this to 25,000 years of life lost (White, Altmann, and Nanchahal 2004). While this difference is still significant, it is clearly of a different order of magnitude from the same question in the context of mortality.

Using this method of assessing morbidity losses, alcohol is responsible for the loss of over 4.5 million DALYs every year in the EU (7.4% of all DALYs; see Figure 6.4). Again, this is principally for men, accounting for 12% of all male ill-health and

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[13] It should be noted that DALYs cannot be expressed in terms of the indicator of health expectancy that has been adopted within the European Community Health Indicators (ECHI) project. Although similar in many ways, Healthy Life Years were chosen due to their positive orientation (valuing health rather than disability) and greater ease of communication. See http://europa.eu.int/comm/health/ph_information/implement/wp/indicators/docs/ev_20050125_rd01_en.pdf .

premature death and a smaller but still sizeable 2% of all female ill-health and premature death. The larger proportion of the burden arises from alcohol-related neuropsychiatric conditions and accidents.

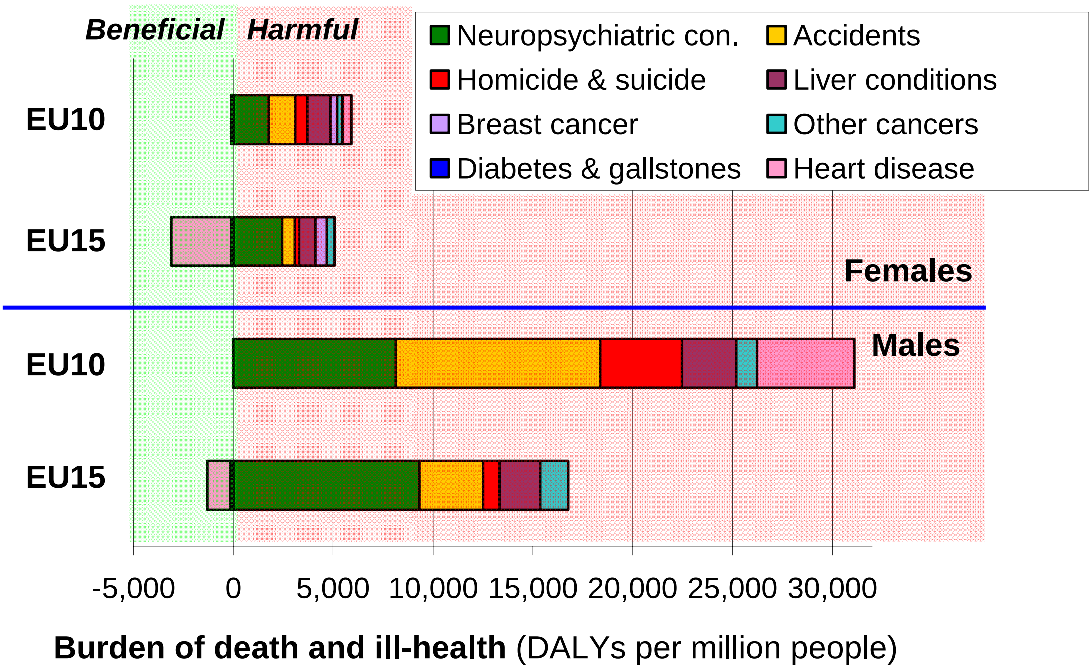

Figure 6.4 Alcohol-attributable burden of death and ill-health in the European Union

Adapted from WHO's Global Burden of Disease study (Rehm et al. 2004)

This makes alcohol the third-leading risk factor for death and disability in the European Union, ahead of obesity/overweight and nearly four times that of illicit drugs (see Figure 6.5). Only blood pressure and tobacco account for a greater morbidity toll.

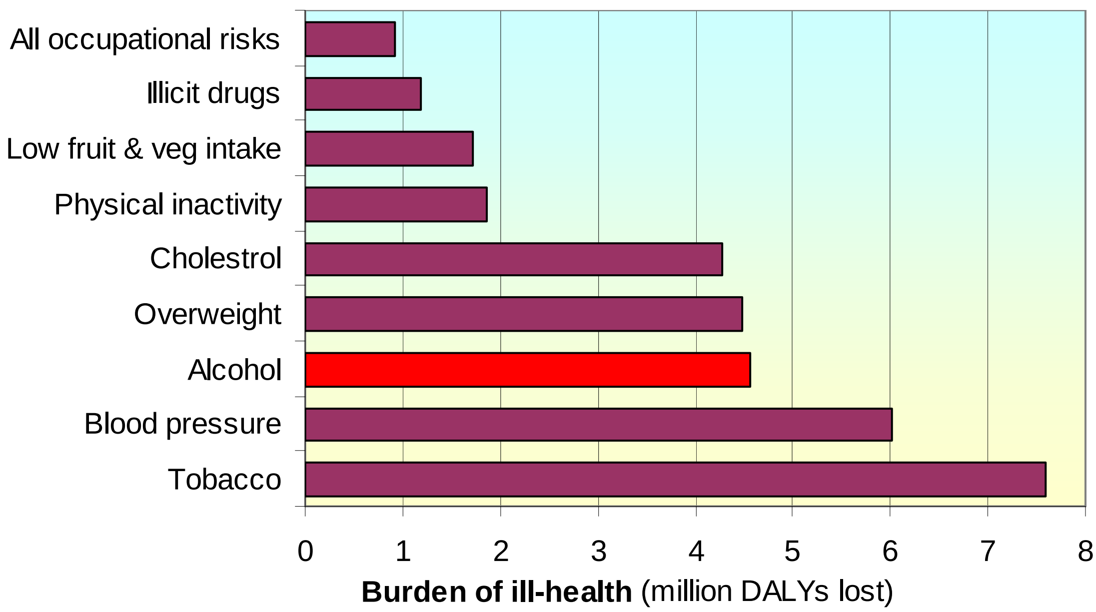

Figure 6.5 Top 9 risk factors for ill-health in the European Union. *Adapted from WHO's Global Burden of Disease study (Rehm et al. 2004)*

Intentional injury – homicide and suicide [14]

Over 2,000 **homicide** deaths per year are attributable to alcohol use – a small proportion of the total harm done by alcohol, but 4 of every 10 homicides that occur in the European Union. In the EU15 this reflects the burden of homicide more generally, but in the EU10 alcohol disproportionately affects homicide in men (accounting for half of all male murders). Beyond alcohol, the total homicide rates are generally much higher in the EU10 than the EU15 (most strongly of all in the Baltic countries), although it must be noted that there is considerable overlap between individual countries within the two groups. Taking the individual crime as the focus (as for other crimes above), studies from Finland, France (1973), Germany, Norway, Poland, Sweden and the UK suggest that 40%-70% of homicides are alcohol-related in some way (see footnote to Table 6.1 for sources). A more objective way to look at this is through the results of time-series analyses in 13 EU15 countries and Norway as part of the ECAS project (Rossow 2001; see below). Although the effect per litre was greater in northern Europe, the higher consumption levels in southern Europe mean that the overall estimated number of alcohol-attributable homicides is estimated to be similar in northern and southern Europe (see Figure 6.6). In actual fact, the estimated share of all homicides that are due to alcohol is slightly higher in southern (61% of all homicides) than northern Europe (50% of a higher homicide rate; see also the more detailed discussion under 'crime' above).

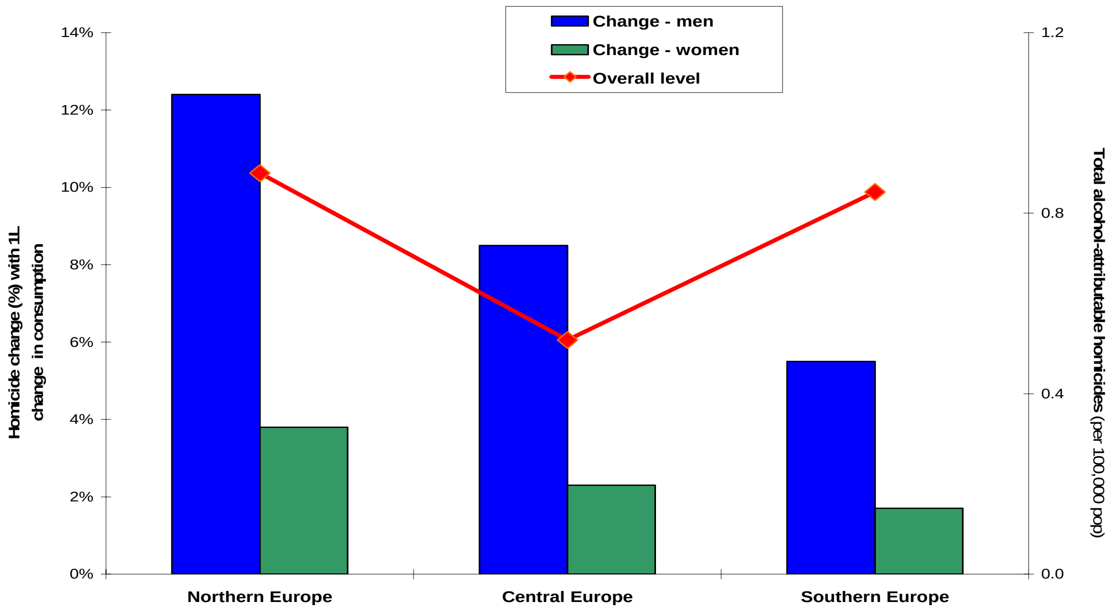

Figure 6.6 Homicides and alcohol in northern, central and southern Europe. Source: Rossow 2001

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[14] Unlike for the other health categories described in this chapter, two separate estimates are available for deaths due to homicide/suicide – (i) using the technique described in Box 6.5 (i.e. population-scaling the overall results), based on ICD-10 X60-Y09, Y35-Y36, Y87.0, Y87.1; or (ii) combining the deaths due to homicide (ICD-10 X85-Y09) and suicide (ICD-10 X60-X84) in each country with the alcohol-attributable fractions for each age and sex presented in the GBD study. The second method is likely to be more accurate as it is country-specific and more detailed, but it is not comparable with the other mortality figures reported in this chapter. For this reason, the numbers of deaths presented in this chapter in the 'Intentional Injury' section are slightly lower than those presented in the 'Mortality' section (including Figure 6.2).

Deaths by **suicide** account for 7%-8% of the total deaths due to alcohol, a toll that is greater for men. The 10,000 deaths represent more than 1 in every 6 suicides and nearly 1 in 4 of those in the EU10. Male suicide is also much more common in the EU10 in parallel fashion to most alcohol-related conditions (although the candidate countries of Bulgaria and Romania have relatively low levels). Southern Europe contains some of the lowest suicide levels in Europe, although the lowest, Greece, where suicide is one-fifteenth as common a cause of death as in Lithuania, has many more deaths of undetermined intent, suggesting that differing recording practices on death certificates may also be at work. However, this fits with previous research conducted on a national level that suggests stronger alcohol effects on suicide are found in the Nordic countries than in France, Portugal or Hungary (Rossow, Pernanen, and Rehm 2001) or more generally in southern and central Europe (Norström *et al.* 2001).

Morbidity figures are only available for intentional injuries as a whole, but confirm the substantial role of murder, assault, suicide and attempted suicide in the European burden of disease. Although less pronounced than for mortality, alcohol-attributed intentional injuries nevertheless reduce EU health by 350,000 DALYs, and are around twice as prominent in the EU10 as in the EU15.

Unintentional injury – drink-driving and other accidents [15]

The best estimate from the GBD suggests that more than 1 in 3 **road traffic fatalities** are due to alcohol. These drink-driving deaths are not equally split between genders, with 15,000 male deaths compared to 2,000 deaths for females. It has also been estimated that 2%-3% of all journeys in the EU15 have a drinking driver (European Transport Safety Council 2003), with research consistently showing that the share of alcohol involvement rises with the severity of the problem. For example, alcohol-related accidents were 11% of all traffic accidents in Latvia in 1999, but accounted for 32% of serious and 39% of fatal accidents (Baltic Data House 2001). Looking only at damage to property, the cost of traffic accidents in the EU has been estimated to be €10bn in 2003.

A large body of evidence suggests that the burden of alcohol-related traffic fatalities has a different weight in different regions of Europe. Overall traffic fatality rates are significantly worse in southern Europe

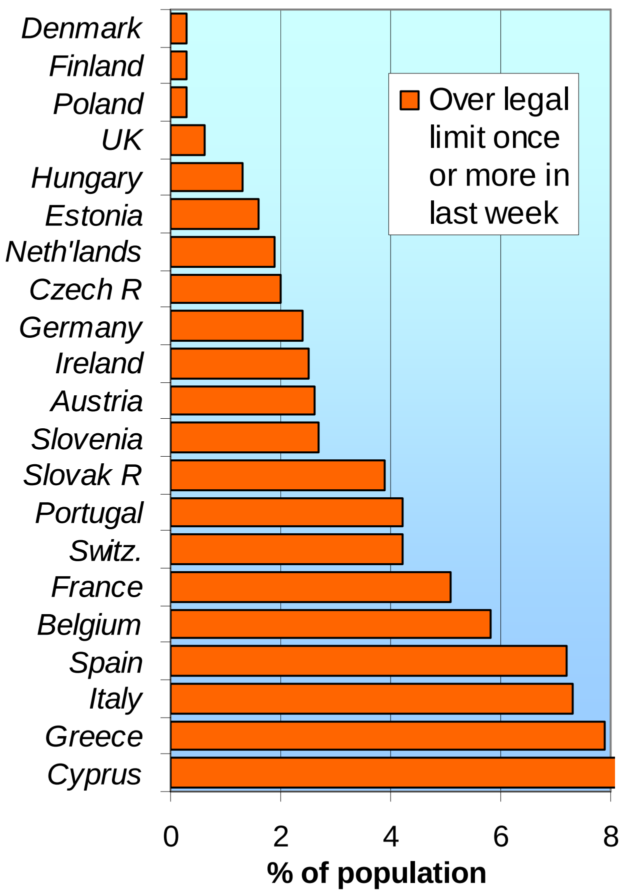

Figure 6.7 Drink-driving behaviour in Europe

Source: *Project on Social Attitudes to Road Traffic Risk in Europe (Sardi & Evers 2004). Cyprus result (21.8%) is off the displayed scale.*

[15] ICD-10 V01-X59, Y40-Y86, Y88,Y89; road traffic fatalities based on ICD-9 E810-819, E826-829, E929.0 (HFA database and GBD sources do not give ICD-10 codes).

than the rest of the EU15 and much of the EU10, something that has become much more apparent over the last 30 years. Although one third of Europeans say they never drink and drive, the variations are so wide that this is true for five-times the proportion of Swedes than Italians (Sartre 1998). Respect for the legal limits follows a similar pattern, with southern Europeans being far more likely to say they exceed this than others in the EU15 and EU10 (see Figure 6.7; Sardi and Evers 2004). The differential between the EU10 and EU15 is also much worse than before the mid 1980s, where a lower EU10 rate for women has been replaced by a 50% greater rate than the EU15 in recent years.

Other **accidental causes of death** show an even larger gap across Europe, with EU10 death rates from injury and poisoning, accidental falls, accidental drowning and other external causes all at least double the EU15 rate. Interestingly, the EU15 has more work-related accidents, yet the death rate for these is higher in the EU10 (other than Portugal, Spain and Italy), suggesting differences in accident reporting, health and safety practice, or accident severity across the EU. Similarly, when school students are asked about accidents due to alcohol, more EU15 students report either an injury or going to hospital due to their drinking than those in the EU10, although the highest values were found in the UK and Ireland (Hibell *et al.* 2004).

The cost due to alcohol in human lives is even higher for this group of 'other accidents' than for drink-driving, with a toll of 27,000 deaths. Together with road traffic accidents this accounts for 1.1m DALYs, the majority for men, and accounting for one quarter of the male burden of disease and disability from alcohol.[16]

Neuropsychiatric conditions [17]

Neuropsychiatric disorders include depression and epilepsy, as well as directly alcohol-attributable disorders such as alcohol psychoses and dependence. On their own these account for an enormous part of ill-health in Europe, equivalent to 4% of the entire burden of Europe's death and disease. This also means that the alcohol-attributable part of them is the single most important aspect of alcohol-attributable morbidity, with the associated 2.5m DALYs corresponding to over 45% of the alcohol burden. A conservative estimate of depression accounts for 150,000 DALYs of this, equivalent to over 200,000 major depressive episodes across Europe each year.[18] Given that most neuropsychiatric conditions are damaging to health rather than fatal, it is unsurprising that they lead to 'only' 17,000 deaths (a much smaller proportion of the total burden than for morbidity).

Neuropsychiatric conditions are also one of the few areas that affect the EU15 much more than the EU10. Mental and behavioural disorders have been falling in the EU10 since the mid-1990s while rising in the EU15, reaching the stage in 2001 that the standardized death rate in the EU15 compared to the EU10 was double for males and sevenfold for females. Unusually, male deaths ascribed to alcohol psychoses and alcohol dependence (ICD-9 codes 291 and 303; ICD-10 F10) are now more evenly distributed across Europe, following the 'spike' in deaths in the Baltic countries and Hungary in the mid-1990s.

[16] For clarity of meaning, the shares of particular conditions within the burden of disease and disability (as well as mortality) are expressed as the percentage of the detrimental (gross) impact.

[17] ICD-10 F01-F99, G06-G98.

[18] Estimate obtained by combining the GBD alcohol-attributable fraction for depression with the HFA figures on the numbers of depressive episodes in the EU countries each year.

Gastrointestinal conditions [19]

Cirrhosis of the liver is one of the most well-known harms stemming from alcohol consumption, and is often used as a general indicator of alcohol-related harm. Looking across the whole of the EU, over 45,000 cirrhosis deaths are caused by alcohol, accounting for nearly two thirds of all cirrhosis deaths and one quarter of all alcohol-attributable mortality. The relative impact of cirrhosis is greater in mortality than morbidity, however, with the large number of deaths equivalent to only 75,000 DALYs due to the relatively late onset of much cirrhosis. For both deaths and DALYs, about twice the harm occurs to men as women, probably due in large part to differences in alcohol use (see chapter 4).

Looking at cirrhosis rates more generally, it is interesting to notice that there is a convergence in cirrhosis rates within the EU15.[20] The main cause of this has been the relative fall in deaths in southern European countries, from 6 times that of northern European countries between 1950 and 1980 to less than double the (increased) northern European rates in 2001.[21] This can be attributed to changes in drinking in southern Europe (see Figure 6.8), which saw a large decrease in consumption alongside the fall in cirrhosis rates (see also Chapter 4). This is further supported by a cross-national comparison of 15 western European countries which shows that countries with high per capita consumption generally have high mortality rates from cirrhosis (Ramstedt 1999; Ramstedt 2002).

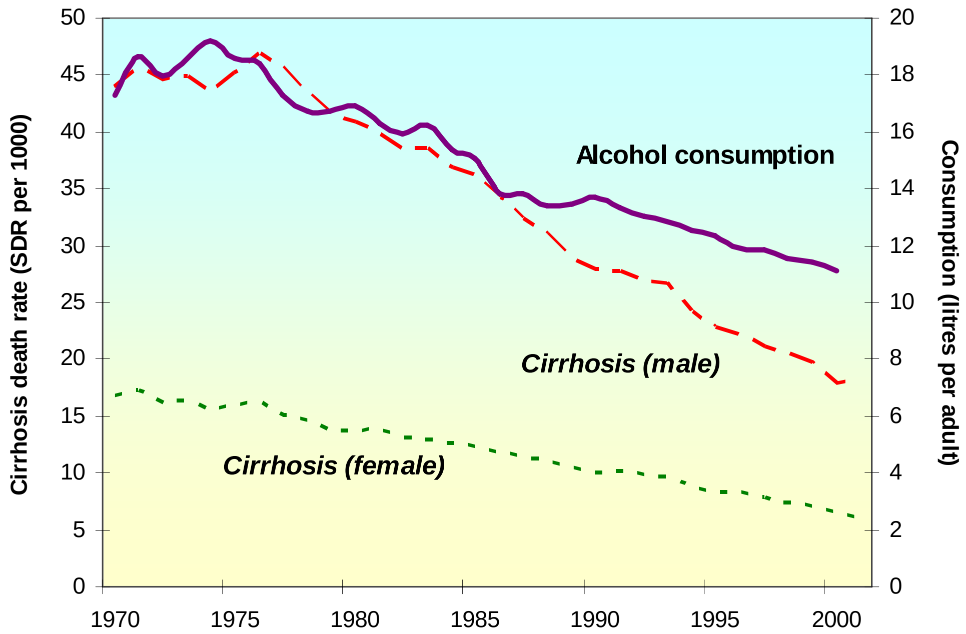

Figure 6.8 – Alcohol consumption and cirrhosis rates in southern Europe
Source: Un-weighted average of France, Italy, Greece, Spain and Portugal data from the HFA database

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[19] ICD-10 K20-92.

[20] Convergence measured using the coefficient of variation (see chapter 4). Historical mortality data taken from the WHO's HFA database (http://www.euro.who.int/hfadb).

[21] 1950s analysis taken from the ECAS study (Ramstedt 2001a); 2001 comparison is authors' own analysis of HFA data.

Cirrhosis levels within the EU10 have also converged slightly, but although some countries have similar levels to the EU15, others – such as Romania and Hungary – have much higher levels. The anomalously high rates in Hungary, Slovenia and Romania have not yet been fully explained, although recent research suggests that hepatotoxic compounds in illegally-produced spirits may be partly responsible (Szücs *et al.* 2005) (see Chapter 5); certainly these countries all have very high levels of unrecorded consumption (see Chapter 4).

Endocrine and metabolic conditions [22]

The GBD included the protective effect of alcohol on type II diabetes within the EURO-A sub-region (there was insufficient evidence to extend this to other regions; see also Chapter 5). It has been estimated that this prevents nearly 6,000 deaths and 50,000 DALYs per annum.

Cancers [23]

Alcohol is an important modifiable risk factor for cancer (Danaei *et al.* 2005), and, although not consistently prominent in public debates on the health risks from alcohol, the more than 50,000 deaths due to cancer represent the single largest cause of death arising from alcohol use. Unlike most alcohol-related harms, cancers are also a particular risk for women, with 11,000 of the deaths being those of female Europeans dying from alcohol-attributed breast cancer every year. In both cases, alcohol-attributable cancer has a greater negative impact through death than disability, due to a combination of relatively higher age of death (and, therefore, fewer life-years lost) and relatively greater case fatality.

Reproductive conditions [24]

Although a number of reproductive conditions have been linked to alcohol (see Chapter 5), only the results for low birth weight were presented within the GBD project. Nevertheless, alcohol is responsible for 1%-2% of low birth weight in Europe, equivalent to 5,000 DALYs, of which nearly half are in the EU10. Using European data on the numbers of births of low birth weight, we can estimate that alcohol is responsible for 60,000 underweight births each year in the EU.[24]

Cardiovascular conditions [25]

Alcohol can be both detrimental and beneficial for heart disease depending on the quantity consumed and the patterns of drinking involved (see Chapter 5). The European Union is a case in point of this ambiguous effect, with 150,000 net deaths being delayed in the EU15 and 17,000 net deaths caused in the EU10 (if the EU countries are instead grouped into regions where alcohol has a positive or negative effect on cardiovascular mortality, then the gross figures are 155,000 deaths delayed and 22,000 deaths caused).[25] Although the cardioprotective effect of alcohol is well established, the size of these estimates may be a significant overestimate (see Chapter 5 and discussion above), and caution should be used in interpreting these numbers.

This situation in Europe contrasts starkly with estimates for the rest of the world, given that alcohol globally causes over 250,000 deaths through cardiovascular

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[22] ICD-10 E10-E14.

[23] ICD-10 C00-C97.

[24] ICD-10 P00-P96; Data on low birth weight (defined as under 2500g in the GBD) and total numbers of births from the WHO's HFA database.

[25] ICD-10 I00-I09. Note that the calculation of mortality outside of western Europe was estimated using a different method based on alternative assumptions (see Rehm *et al.* 2004 for details).

conditions alone. In more similar fashion to global trends though, health and mortality gains for women are much greater than those for men.

Directly alcohol-attributable mortality

Outside of the GBD study, it is possible to look at changing levels of alcohol-attributable harm through conditions that are classified as alcohol-related (e.g. the country reports in WHO 2004). These have been examined in detail among the EU15 in the second half of the 20th century, looking at areas of cultural and geographical similarity (here referred to as southern, northern and central European) and using a combined mortality measure covering several ICD codes (AAA).[26] This found that there was a roughly five-fold difference throughout the last 50 years between the area of Europe with the highest AAA mortality rates compared to the area with the lowest. Perhaps surprisingly, the actual ranking of the areas also reversed in this period. Between 1950 and 1965, AAA mortality rates were highest in southern Europe and lowest in northern Europe for both men and women, but in 1995 the converse was true. This is due to both declining rates in southern Europe and increasing rates in most of northern Europe, although Sweden peaked in the early 1980s. Mortality rates also increased in most of central Europe, with the exceptions of Austria and Belgium which have seen declines in the most recent period.

As discussed in Chapter 5, these conditions are particularly vulnerable to variations in coding practices, which can make them difficult to compare across time and space. In this case, there is no correlation at first sight between average consumption per adult and AAA-deaths across the EU15, Figure 6.9.

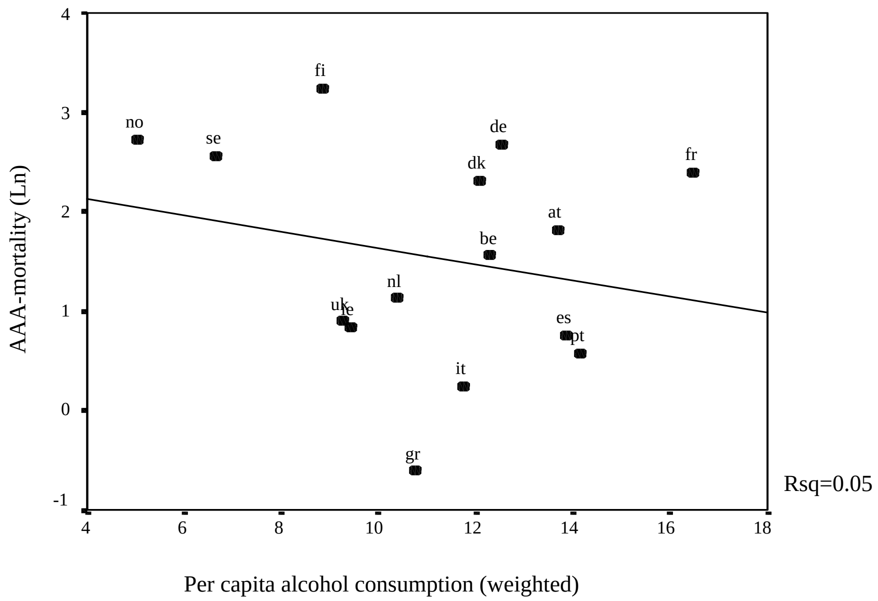

Figure 6.9 Relationship between per capita alcohol consumption and AAA-mortality[27]
Average for the period 1987-1995. Source: Ramstedt (2001c).

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[26] Combined measure includes “alcoholism”/alcohol dependence syndrome (ICD-9 303), alcoholic psychosis (ICD-9 291), alcohol poisoning (ICD-9 E860), “alcohol abuse” (ICD-9 305.0), alcoholic cardiomyopathy (ICD-9 425.5), alcoholic gastritis (ICD-9 535.3) and alcoholic polyneuropathy (ICD 357.5; Ramstedt 2001a).

[27] Combined measure includes “alcoholism”/alcohol dependence syndrome (ICD-9 303), alcoholic psychosis (ICD-9 291), alcohol poisoning (ICD-9 E860), “alcohol abuse” (ICD-9 305.0), alcoholic

This could be seen to confirm a general scepticism towards the use of ecological data for inferences about causal relationships (Robinson 1950) – if another factor that is related with alcohol consumption and alcohol-related mortality is omitted, the estimated effect of alcohol will be biased. However, if the countries are separated into the three groups of countries, then the relationship between consumption levels and AAA-mortality is strongly positive (Ramstedt 2001c), Figure 6.10. This suggests both that recording practices are affected by cultural factors, and that consumption levels are related to AAA-mortality rates within a single culture.

A striking contemporary example of the effect of alcohol consumption on mortality can be seen over the past decades in England and Wales, where sharp rises in directly alcohol-attributable mortality have followed sharp rises in alcohol consumption. A national analysis of mortality where alcohol is an underlying cause found that the rates doubled between 1979 and 2000 (Baker and Rooney 2003), while a regional study found an even steeper increase for the mention of alcohol on mortality certificates (Goldacre *et al.* 2004). These studies show how consumption changes can have both a lagged effect as well as a near-immediate impact on levels of harm (see below; this has also been predicted theoretically, cf. Rehm and Gmel 2001). Here, the rise in mortality coexists with a period of relatively stable alcohol consumption (at least until a rise in the mid-1990s) but immediately follows a period of rapidly expanding alcohol consumption (which rose from 6.5 to 10.5 litres per adult between the years 1961 and 1979).

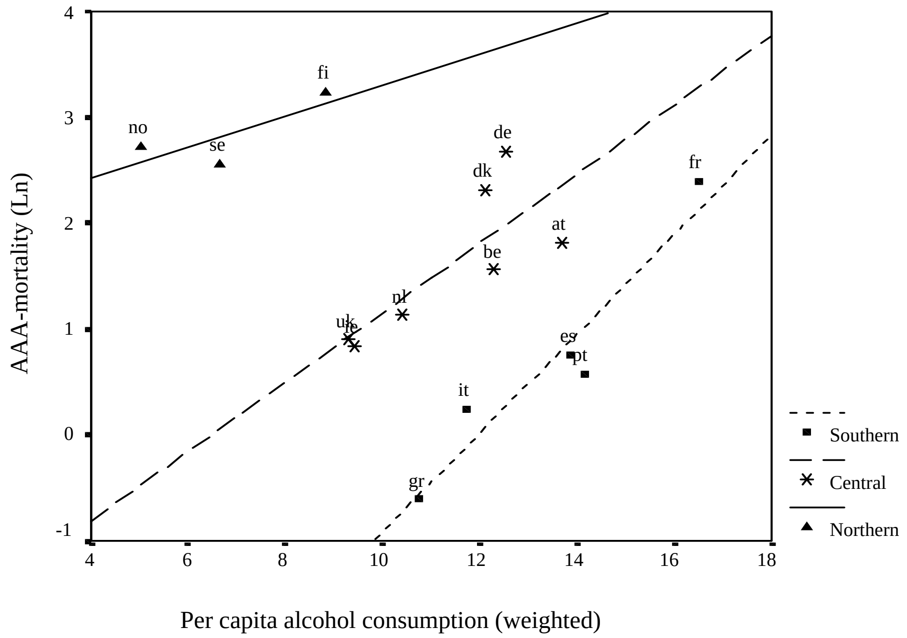

Figure 6.10 Relationship between per capita alcohol consumption and male AAA-mortality[28] in northern, central and southern Europe. *Average for the period 1987-1995. Source: Ramstedt (2001c).*

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cardiomyopathy (ICD-9 425.5), alcoholic gastritis (ICD-9 535.3) and alcoholic polyneuropathy (ICD 357.5; Ramstedt 2001a).

[28] Combined measure includes “alcoholism”/alcohol dependence syndrome (ICD-9 303), alcoholic psychosis (ICD-9 291), alcohol poisoning (ICD-9 E860), “alcohol abuse” (ICD-9 305.0), alcoholic cardiomyopathy (ICD-9 425.5), alcoholic gastritis (ICD-9 535.3) and alcoholic polyneuropathy (ICD 357.5; Ramstedt 2001a).

Cost of ill-health

The cost of treating illnesses caused by alcohol has been estimated at €17bn in 2003 (2.0% of total EU health expenditure). In parallel to the GBD results, this figure takes into account the health benefits from drinking (although using a different and more approximate methodology; see Chapter 3). Beyond this, there is a further €5bn spent on treatment and prevention of harmful alcohol use and alcohol dependence.[29]

Cost of lost life

The significant level of lost life due to alcohol described in this chapter can be valued either in terms of lost potential or production, or in terms of how much people are willing to pay to change risks to their health (see Box 3.3 in Chapter 3 for a discussion of intangible costs). Using the first method, alcohol consumption in 2003 is estimated to cause €36bn of future lost production in the EU. However, this method suffers from a number of disadvantages, not least that future production is not an adequate way of valuing life itself (see discussion in Chapter 3). Alternatively, the cost of lost life in the form of DALYs can be valued intangibly, according to the WHO's Commission on Macroeconomics and Health valuation (three times a country's GDP per capita) (Eichler *et al.* 2004). This leads to an estimate for the intangible cost of lost life as €260bn in 2003. However, this depends heavily on the value given to a DALY, which has varied substantially between studies (Eichler *et al.* 2004). Two other plausible figures are the lower value implied given by the decisions of the UK's National Institute of Clinical Excellence (Raftery 2001), or the higher value used in the UK government's costings of crime and road safety (Carthy *et al.* 1999; Dubourg, Hamed, and Thorns 2005). Applying these to the net loss of DALYs above, we estimate that the intangible cost of lost life in the EU was between €145bn and €712bn in 2003.

THE BURDEN OF ALCOHOL IN EUROPE

Harms to young people

The burden of ill-health due to alcohol is disproportionally shouldered by young men in Europe, 13,000 of whom die in the EU each year.[30] This represents 1 in every 4 deaths of young men, rising to nearly 1 in 3 in the EU10. Alcohol is responsible for a slightly smaller but still substantial death toll in young women, with the 2,000 deaths corresponding to 11% of female mortality at this age across the EU. The extent to which this is a greater burden than at any other age is shown by Figure 6.1 above,

[29] Several studies did not include costs for treatment or prevention, but it is difficult to tell whether this was due to a different organization of costs (where treatment is incorporated under residential psychiatric hospitals under healthcare) or data limitations. The studies reviewed produced a range of €1bn-€18bn for treatment and prevention, in all probability due to actual differences in spending as well as partial inclusions elsewhere and a simple inability to estimate some of the costs. For these reasons, this estimate should be treated with some caution.

[30] Estimates use the same recalculation method for the other GBD statistics, but the data for young people (aged 15-29 years) are taken from the age-disaggregated paper presented by Rehm, using an earlier paper (Rehm and Gmel 2002).

illustrating how the proportion of deaths due to alcohol is greatest on those aged 15-29 for both men and women.

The high level of harms to young people is due to the importance of intentional and unintentional injury as primary causes of death in young people, as opposed to heart disease later in life (see Chapter 5). Even in countries where alcohol is estimated to delay more deaths than it causes (such as England and Wales), drinking is a major cause of death at young ages, and still has a detrimental impact in most of middle age (see Figure 6.11).

Alcohol-related crime and disorder is also considerable among young people, with the only comparison to adults (from Estonia) suggesting that alcohol plays a greater part in assaults committed by juveniles than adults. A third of a million 15-16 year old students in the European Union report fights due to their own drinking (8% of boys and 4% of girls), although less in the South of the EU15 and, for girls, less in the EU10 (Hibell *et al.* 2004). Similarly, 220,000 students report getting into trouble with the police due to their drinking (4%), with higher rates for central European students and northern European girls than elsewhere. These figures are likely to be even higher for older young adults (17-30 year olds), as shown in Danish and Polish research. Young people also seem to see alcohol as an important cause of aggressive behaviour (in research from the Netherlands, the most important cause; KPMG 2001).

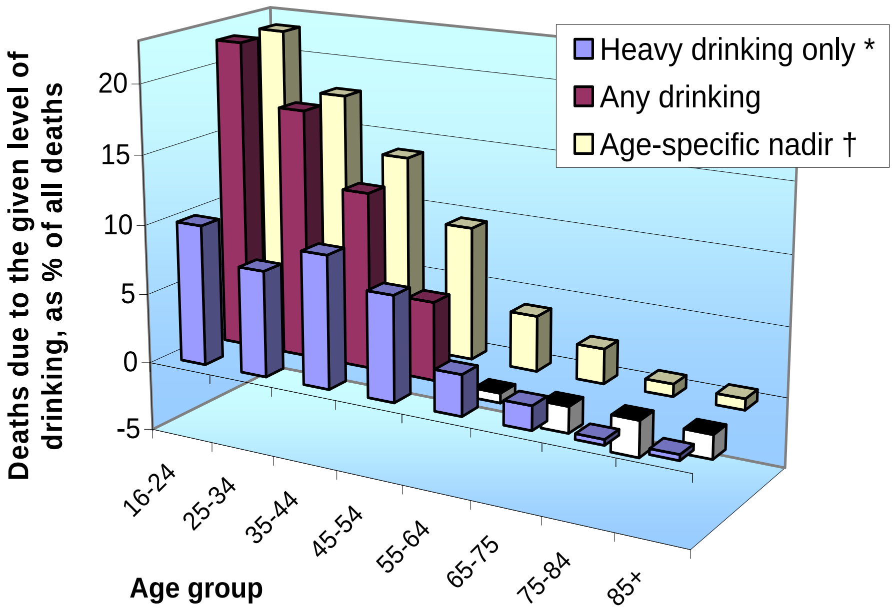

Figure 6.11 Male deaths due to different levels of consumption by age group in England and Wales 1997 **** Heavy drinking defined as 280+ g per week;*** *† Age-specific nadir for men is zero (aged 16-34), 20g/wk (35-44), 50g/wk (45-54), 70g/wk (55-64), 80g/wk (65+). Source: (White, Altmann, and Nanchahal 2004).*

Box 6.5 – The burden of alcohol in Europe	
Crime	Alcohol attributable crime estimated to cost European police, courts and prisons €15bn per year, as well €12bn in crime prevention expenditure & insurance administration and €6bn of criminal damage. The pain and suffering of crime victims has also been valued at €9bn–€37bn.
The family	5-9 million children are estimated to live in families adversely affected by alcohol at any one time.
Workplace	Based on a review of national costing studies, lost productivity due to alcohol-attributable absenteeism and unemployment has been estimated to cost €9bn-€19bn and €6bn-€23bn respectively.
Intentional injuries	Over 2,000 homicides (4 in 10 of all murders) and around 10,000 suicides (1 in 6 of all suicides) are attributable to alcohol each year.
Unintentional injuries	17,000 deaths are attributable to drink-driving each year (1 in 3 of the total), as well as 27,000 accidental deaths.
Neuropsychiatric conditions	Nearly half the burden of alcohol-attributable premature death and disability in Europe is due to neuropsychiatric conditions (alcohol dependence, depression, epilepsy), equivalent to 2.5 million DALYs. These conditions also account for 17,000 deaths each year.
Gastrointestinal, endocrine and metabolic conditions	Alcohol causes 45,000 deaths per year through cirrhosis of the liver, although the protective effect on type II diabetes delays almost 6,000 deaths per annum.
Cancers	Cancers are the largest single cause of alcohol-attributable death, accounting for 50,000 deaths each year. 11,000 of these are breast cancer deaths in women.
Cardiovascular disease	The EU as a whole demonstrates the dual direction of alcohol's potential effect on heart disease, with an estimated 150,000 net cardiovascular disease deaths being *delayed* in the EU15, but 17,000 net CVD deaths being *caused* in the EU10. Health gains for women are much greater than those for men. It should be emphasized that the size of the number of delayed deaths is likely to be an overestimate, and largely occurs at an age of death over 70 years, and particularly over 80 years.
Total health impact	More broadly, alcohol is responsible for 12% of male and 2% of female premature death and disability, after accounting for health benefits. Alcohol is a cause of a net loss of life up to the age of 70 years.

Other results from the ESPAD survey suggest that over 5% of 15-16 year old students have regretted sex they had due to alcohol. Worryingly from a public health perspective, 200,000 students (3.6%) report unprotected sex due to drinking – with girls in some countries being substantially more likely than boys to report this (UK, Sweden, Iceland, Finland). To a lesser extent, students also report having problems at work/school (2.4%) or with their teachers (1.2%) due to their drinking. As discussed repeatedly throughout this chapter, it is unclear how far the perceived role of alcohol in youth crime, education and sexual behaviour reflects its 'actual' role.

Inequalities between European countries

As has been noted even before the expansion of the EU on 1 May 2004 (WHO and European Commission 2002), there is a substantial health gap across Europe, with a difference in life expectancy at birth between EU countries of as much as 10 years. Despite substantial variations between different countries, there is a clear geographical pattern whereby no EU10 country other than Malta has a life expectancy equal to that of the lowest-ranking EU15 state. On average, this means that a child born in the EU10 in 2001 will have five years of life less than the average baby in the EU15.[31] Understanding and acting on the 'health gap' is, therefore, both a new and substantial challenge for the European Union in the coming years.

Against this background, it is clear that many of the individual conditions that contribute to the health gap are linked to alcohol (McKee, Adany, and MacLehose 2004). Death rates from injuries and violence are consistently high in the EU10, as are cirrhosis rates in several countries. Patterns of drinking also ensure that alcohol exacerbates rather than mitigates the numerous other negative effects of drinking in eastern Europe. The estimates above suggest that alcohol is responsible for a difference in the crude death rate of approximately 90 extra deaths per 100,000 people for men and 60 per 100,000 for women (as well as 16,000 DALYs per million people for men and 4,000 DALYs per million for women) in the EU10, compared with the EU15. Although other factors are likely to play a role in the conditions that constitute the gap between countries (e.g. availability of weapons, social insecurity), these figures strongly suggest that alcohol is a key risk factor behind the divide.

Inequalities within European countries

Alcohol also contributes to health inequalities *within* countries, a finding that is unsurprising given the concentration of risky alcohol use in lower socioeconomic groups (see Chapter 4) and the greater mortality from directly alcohol-related conditions (see Chapter 5). For example, alcohol addiction in Sweden is the 2nd most important cause of inequalities in the burden of ill-health for men (7th for women), with several other alcohol-related diseases such as ischaemic heart disease and self-inflicted injuries also prominent (Ljung *et al.* 2005).

Many of the conditions that are responsible for health inequalities are strongly linked to alcohol, including external causes (e.g. violence, accidents), stroke and liver disease (across the EU15), ischaemic heart diseases (northern Europe) and cancer (southern Europe) (Kunst *et al.* 1998; Dalstra *et al.* 2004). Alcohol's role in these inequalities may be different in different countries, however; for example, the two countries with the largest inequalities in men aged 45-59 are France and Finland, but while the former finds this to be mainly due to liver cirrhosis and alcohol-related cancers, the latter is caused primarily through violent deaths (Kunst *et al.* 1998). A review by the International Agency for Research on Cancer (IARC) noted a likely role of alcohol in inequalities found for certain cancers in France and Italy, and were also suggestive of a possible role in Denmark, Switzerland and the UK, but not in Finland or Sweden (Møller and Tønneson 1997).

Research has also looked at alcohol's role in heart disease inequalities (measured by level of education), which show a north-south gradient within Europe – i.e. the levels

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[31] WHO Health for All database, 1 June 2004 edition.

of relative and absolute inequality are higher in northern than in southern Europe. Looking across six EU15 countries, countries with high levels of heavy drinking (>4 glasses a day for men, >3 for women) and low levels of lighter drinking (1-4 glasses a day for men, 1-3 for women) have greater levels of inequality in heart disease between different educational groups. Heavy drinking also positively correlates noticeably with cerebrovascular disease, although there was no link to the level of lighter drinking. These correlations are from a small number of countries only, and are also sensitive to the cut-off point for heavy consumption, but they do suggest that drinking levels are linked to inequalities in heart disease at the population level (Mackenbach *et al.* 2000).

These conditions similarly seem to be linked to inequalities between geographical regions, as well as inequalities between individuals – although data are only available for the UK. There, it has been estimated that alcohol's role in certain cancers, cirrhosis and suicide explain 6% of the 40,000 excess deaths in socio-economically deprived areas (Law and Whincup 1998), although heavy alcohol use appeared to decrease the gap for heart disease mortality (Morris *et al.* 2001). Tobacco- and alcohol-related cancers in the UK are 2-3 times more common in areas of the most deprivation than the least, with the difference between these and lung cancer suggesting a strong role of alcohol in Scotland, Ireland and Northern Ireland in particular (Quinn *et al.* 2005). A study of the North-West of England also found that chronic liver disease mortality and hospital episodes due to directly alcohol-attributable conditions were correlated with the deprivation levels of individual wards (Hughes *et al.* 2004).

Research from Finland further suggests that socioeconomic variables act on the collective as well as the individual level. Areas with the most manual workers had 20% more mortality directly attributable to alcohol than areas with the least, even after accounting for the *individual* relationship of occupation to mortality (Blomgren *et al.* 2004). Similar effects held for unemployment, urbanisation and social cohesion (measured as both 'family cohesion' and voter turnout), which accounted for around 40% of the alcohol-attributable mortality gap between areas *after taking account of all of these variables on the level of the individual*. This suggests that the drinking behaviour of people living nearby may be important for the behaviour of the individual, although further work is needed to separate this out from psychosocial mechanisms, nutritional variables and other possible area-level effects (Galea, Rudenstine, and Vlahov 2005).

It is also worth noting that gender health inequalities are linked to alcohol, which again is unsurprising given the gender differences in drinking discussed in Chapter 4. For example, men were five times more likely to die from a directly alcohol-attributable cause than women across the EU15 in 1995 (see above and Ramstedt 2001a). In Finland in the 1990s for those aged 15 years, alcohol will cause on average the loss of 2 years of life for men but just under ½ year for women. This means alcohol is responsible for 22% of the gender gap in life expectancy, and is more important than smoking for the gap in deaths up to the age of 50-55 years (Martelin, Mäkelä, and Valkonen 2004).

Harm to others

Much of the harm discussed here and in Chapter 5 occurs to people other than the drinker, although it is often difficult to say how much. Box 6.6 describes the key areas in which drinking has consequences for people other than the drinker. However, it is by no means complete, and future research may enable us to quantify deaths due to accidents other than drink-driving, lowered productivity at the workplace, or the un-estimated costs such as lost working time in crime or accident victims.

Box 6.6 – Harm to others in Europe	
Negative social consequences	One in five people in the Nordic countries have been kept awake by 'drunken noises', while 10% of men and 20% of women have been afraid of drunk people in the street.
Crime	Seven million adults report getting in fights due to their drinking each year, while 40% of all murders result from drinking.
Other harms	As shown in Box 6.5, alcohol places a large burden on the ◇ workplace (€9bn-€19bn) ◇ criminal justice system (€33bn) ◇ victims of crime (€9bn-€37bn of pain and suffering) ◇ drinkers' families (5m-9m children adversely affected) and others.
Drink-driving	Based on UK and US data, we can estimate that nearly 10,000 pedestrians, passengers or non-drinking drivers are killed each year due to *other people* who drink and drive.[32]
Babies	60,000 underweight births each year are due to the alcohol consumption of the parents.
Total social cost	The total tangible cost of alcohol in Europe in 2003 was €125bn, and is borne by both drinkers and non-drinkers.

THE BURDEN OF HARM AND CHANGES IN CONSUMPTION

This chapter has so far considered the full scale of harm that would be avoided in a hypothetical Europe without alcohol. However, this is not the goal of European public health policy, which instead needs to be supported by further evidence on how alcohol-related harm at a societal level changes with actual changes in drinking behaviour. This can then be used to inform the discussion on the types of alcohol policies covered in Chapter 7.

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[32] Official UK data suggest that less than half of the people killed or seriously injured in drink-drive crashes are the drink-drivers themselves (Department for Transport 2004), while similar results have been reported in the US (Miller, Lestina, and Spicer 1998). The UK proportion has been applied to the GBD figures above to make an estimate for the whole EU. Motorcyclists, cyclists and undetermined deaths/serious casualties were not included in these calculations as the division between 'drink-rider' and others is not possible from the data. Note that the UK data includes all crashes involving a drunk-driver, while the mortality estimate is for the smaller number of deaths caused by (not just involving) drink-drivers.

Much of the evidence in this context looks at changes in national per capita alcohol consumption over time. This chapter, therefore, starts with a brief discussion of what 'per capita alcohol consumption' actually measures, before moving on to the evidence from 'natural experiments', where consumption levels underwent a sharp change. Finally, the bulk of this section looks at how fluctuations in consumption levels link to fluctuations in harms over time ('time-series analyses').

What does 'average consumption' measure?

At its simplest, 'average adult consumption' refers to the total amount of pure alcohol drunk (calculated from the strength of different alcoholic drinks) divided by the number of adults in a population. This tends to relate to the proportion of heavy drinkers in a population – for example, Rose reported a very high correlation between mean consumption and the prevalence of heavy drinking across 32 countries (Rose and Day 1990). Similarly high correlations have also been shown within English regions (see Figure 6.12; Primatesta, Falaschetti, and Marmot 2002) and for sex- and age-specific subgroups across the Nordic countries (Mäkelä *et al.* 1999; Mäkelä *et al.* 2001).

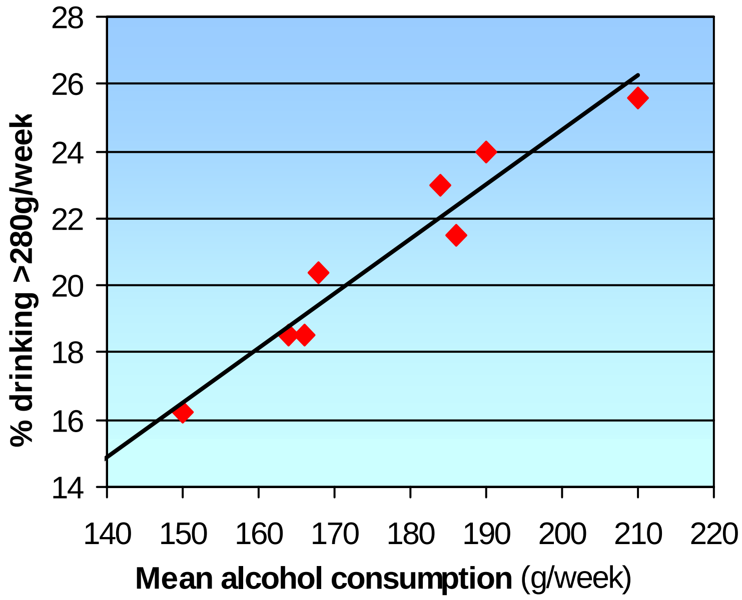

Figure 6.12 Alcohol consumption and the proportion of heavy drinkers in 8 English regions, 2002 (Source: Primatesta 2002)

Yet rather than showing anything useful for policymaking, average consumption could simply measure the drinking of heavy drinkers, who account for much of the alcohol drunk in a country. In the United States, for example, the top 2.5% of drinkers consume around a quarter of the total consumption, and the top 30% of drinkers account for nearly all (85%-90%) of the alcohol drunk (Greenfield and Rogers 1999). Corresponding figures for Europe seem to be slightly lower, but the top 10% of the European *population* still drink between a third and a half of all consumption (compared to 60%-70% in the US).[33]

However, other evidence suggests that there is more to average consumption levels than simply the heavy drinkers. When Figure 6.12 is recalculated to look at the *average drinker* (the median) rather than the *average of all drinkers* (the mean), there was a reduced but still very strong relationship (r>0.7) between average and heavy drinkers (Colhoun *et al.* 1997).[34] More comprehensive analyses from a variety of

[33] France, the Netherlands and Denmark are towards the lower end of this range, while the other Nordic countries plus Switzerland are towards the top (Lemmens 1991; Skog 1991; Mäkelä *et al.* 1999; Lemmens 2001; SFA 2004).

[34] If the amount drunk by each drinker is placed in order, the **median** is the middle value – i.e. there are as many drinkers below it as above it. Thus, 6 is the median number of the set 1, 1, 2, **6**, 20, 20, 27.

countries worldwide (including Germany, the Netherlands, Switzerland and the UK from Europe) further show that there is an 'impressive regularity' in how average consumption links to the consumption levels of groups up and down the consumption scale (Skog 1985; Lemmens 1995).

One explanation of this is that people affect and are affected by the drinking behaviour of people around them, so that changes in drinking levels "spread like waves in water" through a society (Skog 2001c:327). Although this theory (known as the 'theory of collective consumption') has attracted some criticism with the argument that it can be difficult to test in practice, principally due to a lack of explicit definition of terms and mechanisms (Gmel and Rehm 2000), such criticism has been rejected, noting in particular that the 'impressive regularities' mentioned above demand a convincing explanation (Skog 2001c:330).

As a final note, it is worth being aware of how this idea *differs* from the earlier 'Ledermann' theory (Ledermann 1956; Lemmens 2001). The 'theory of collective consumption' rejects the idea of an unvarying mathematical relationship, and instead explains a consistent finding in countries through a lower-level social process (Skog 1985). Where wider forces have different effects on different people, or where this social process breaks down – in particular, where there are group divisions such as gender, class or race – then it is unsurprising when sub-populations move in different directions (Skog 2001c:330). For example, divergent trends in the Netherlands can be seen by age (Garretsen *et al.* 1999), gender (Neve *et al.* 1993) and other combinations of factors (Knibbe *et al.* 1985), as well as very clearly by socioeconomic status in Sweden (Romelsjö and Lundberg 1996). Yet changes in consumption still tend to happen across the whole population, as shown in the 'impressive regularities' noted above as well as several longitudinal studies – including from the Netherlands (Neve *et al.* 1993), Italy,[35] and Finland in the 1960s (Mäkelä 2002) – showing mean consumption and numbers of heavy drinkers moving in tandem.

In conclusion then, changes in 'average adult consumption' will show the behaviour of the heaviest drinkers more than lighter drinkers, but also tap into the wider tendency for populations to change their levels of consumption collectively. This is no unbreakable law, and sub-groups often show distinctive trends, as discussed at length in Chapter 4. Nevertheless, changes in 'average consumption' are *likely* to reflect the parallel movement of the whole population of drinkers – a finding that is important for interpreting the changes in levels of harm, to which we now turn.

Average consumption and levels of harm

The link of consumption levels to levels of harm for the individual has already been discussed in Chapter 5, showing that the mortality risk curve is largely linear at younger ages and J- or U-shaped at older ages. When these are aggregated to the population level, however, we can expect different results simply from theoretical considerations on risk curves.[36] The large amount of alcohol drunk by the heaviest

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[35] Data from Italy in the 1990s (author's calculation from data in Scafato *et al.* 2002) shows a very high correlation (r>0.95) between mean consumption and the proportion of heavy wine drinkers in the male population. Other data from the same period similarly shows a reduction in the numbers of people giving 2 or more affirmative answers to the CAGE questionnaire 1997-2000, alongside a 5% reduction in consumption (Osservatorio Permanente Giovani ed Alcool 2001).

[36] For example, ***a linear risk curve*** would mean that any increase or decrease in average consumption would have a constant effect – so that it would not matter if the change occurred in the heaviest drinkers

drinkers (discussed above) also affects what we should expect, as the lowest-risk *population* consumption level for a U-shaped risk curve will be lower than that of *individuals* (Skog 1991). How much lower will depend on whether changes in average consumption are mainly a reflection of heavy drinkers or of lighter drinkers (see above), as well as on the precise risk curve, the numbers of abstainers, and the incidence of the different diseases associated with alcohol.

Although we do not currently know the population consumption level that leads to the fewest deaths, reasonable assumptions suggest that it could be as much as *five-times less* than that for an individual drinker (Skog 1996). In countries with high rates of coronary heart disease, this level may be around 3 litres of absolute alcohol per capita. In countries with low rates of coronary heart disease, the level is likely to be substantially lower.

Given that all European countries already consume in excess of this estimated level, we may expect reductions in alcohol consumption to lead to a net reduction in mortality (Anderson and Lopez 1996). There are two ways of testing whether these theoretical speculations are borne out in practice – through natural experiments, and through time-series analysis.

Natural experiments

A natural experiment that occurred nearly one hundred years ago illustrates the relationship between alcohol consumption and the harm done by alcohol. Prompted by the shortage of food supply during the First World War (but also motivated by state revenues and temperance concerns (Eriksen 2003)), the Danish government imposed a number of alcohol restrictions and tax increases in 1917 and 1918.

The result of this was that spirits prices multiplied, and that per capita consumption dropped sharply from about 10 litres in 1916 to a little more than 2 litres in 1918. In subsequent years, consumption grew somewhat but remained on a low level, 3-4 litres, until after the Second World War. As can be seen in Figure 6.14, the drop in alcohol consumption in 1917 and 1918 was accompanied by a marked decline in all of the harm indicators. Deaths from alcohol psychosis dropped by 97% between 1916 and 1918, and deaths from cirrhosis of the liver by 48% (Thorsen 1990).

Similar relationships happened in Paris during both world wars, when extreme shortages of alcohol were followed by dramatic declines in cirrhosis mortality (Ledermann 1964). More recently, the anti-alcohol campaign pursued by Gorbachev from 1985-88 was followed by a dramatic *decrease* in death rates, followed by an even steeper *increase* in death rates as alcohol consumption increased in the early 1990s following socio-economic transition (Bobak *et al.* 2004). The changes were particularly seen for AAA-mortality (see footnote 25 above) but were also strong for accidents, violence, cardiovascular diseases and other conditions where alcohol is a risk factor (Anderson 1998; Room 2001). Similarly, the increased alcohol consumption that occurred in Poland at the time of political and economic transition in the 1990s was associated with marked increases in deaths from liver disease and alcohol poisoning (Wojtyniak *et al.* 2005).

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or the previous abstainers. Conversely, a condition with an ***exponential risk curve*** would be more sensitive to any changes in the highest-risk drinkers than changes lower down the distribution (Lemmens 1995).

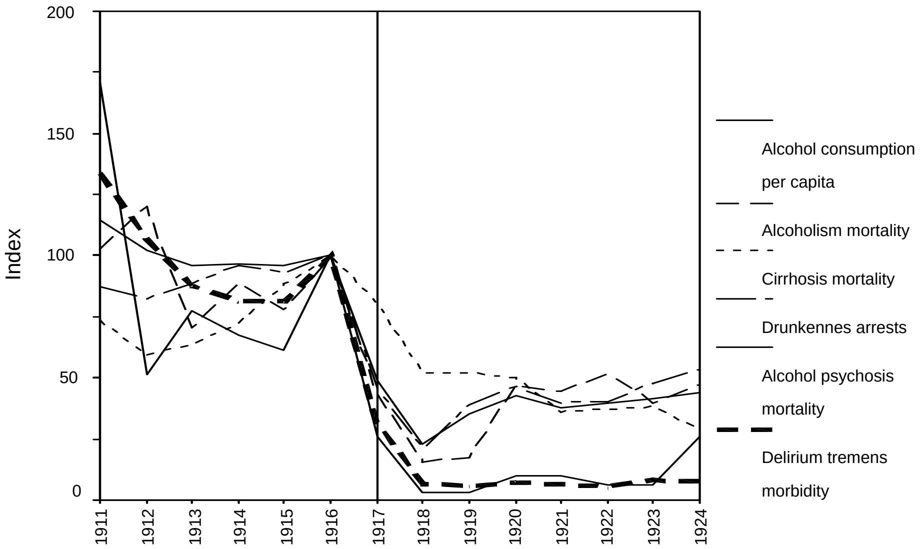

Figure 6.14 Per capita alcohol consumption and indicators of alcohol-related harm in Denmark 1911-1924. *Index, 1916 = 100.* **Source:** (Thorsen 1990)

Time series data

The connection between changes in population drinking and mortality has been comprehensively investigated within the ECAS study (Norström *et al.* 2001), using time-series analysis (ARIMA-modelling; see Box and Jenkins 1976) in 14 European countries for the years 1950 to 1995. [37] This technique analyses the relationship between yearly changes in consumption and harm, and estimates the relative change in mortality for a change in per capita consumption of one litre of pure alcohol.

The country-specific results were pooled for three country-groups that were assumed to represent three different drinking cultures: 'high-consuming' countries (France, Italy, Portugal and Spain), 'mid-consuming' countries (Austria, Belgium, Denmark, Ireland, Netherlands, U.K. and West Germany[38]) and 'low-consuming' countries (Finland, Norway and Sweden).[39] The pooling has the advantage of strengthening the statistical associations, and makes cross-cultural comparisons of alcohol effects possible while preserving country-specific results. Results are summarized in Table 6.3 and results for men in mid-consuming countries shown graphically in Figure 6.15. Heart disease and all-cause mortality are then discussed in more detail given the complexity in transforming the individual-level risk to the societal level.

As can be seen from Table 6.3, nearly all conditions and total mortality showed a stronger effect of a one-litre change in consumption in the low-consuming countries

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[37] Outside of Europe, similar results have been found using a parallel methodology in Canada (Skog 2003; Ramstedt 2004; Rossow 2004; Norström 2004; Ramstedt, in press).

[38] ECAS here looked only at West Germany as sufficient data were not available for Germany as a whole.

[39] These country groups are also described within ECAS as 'wine-drinking' (high-consuming), 'beer-drinking' (medium-consuming) and 'former spirits-drinking' (low-consuming) cultures, in terms of the beverage type that is traditionally associated with the country (see chapter 4). Neither terminology is fully satisfactory: both beverage preferences and consumption levels are changing within Europe, to the extent that the classifications become inaccurate (see chapter 4).

(i.e. northern Europe) than elsewhere. While it has been argued that this stems from the 'explosive' drinking patterns in northern Europe (e.g. Rossow 2001), the stronger effect may also reflect the increased proportional size of a one-litre change in these low-consuming countries (as discussed in more detail under 'crime' above; the total role of alcohol in these harms is discussed midway through this chapter).

Table 6.3 Change in death rates (%) from a 1 litre increase in alcohol consumption
Changes are per capita and are calculated separately for low, medium and high consuming European countries for men (M) and women (F). **Source:** (Norström *et al.* 2001). **Key:** * = Significant at the 5% level

Country group (alcohol consumption)	Low		Medium		High	
	M	F	M	F	M	F
Cirrhosis	32*	17*	9*	5*	10*	11*
Alcohol dependence, psychosis and poisoning	35*	75*	18*	27*	3	1
Accidents	9*	10*	3*	3*	2*	2*
Suicide	9*	12*	0	3*	0	1
Homicide	18*	8	11*	7*	7*	2
IHD	-1	1	1	2*	1	0
Total mortality	**3***		**1***		**1***	

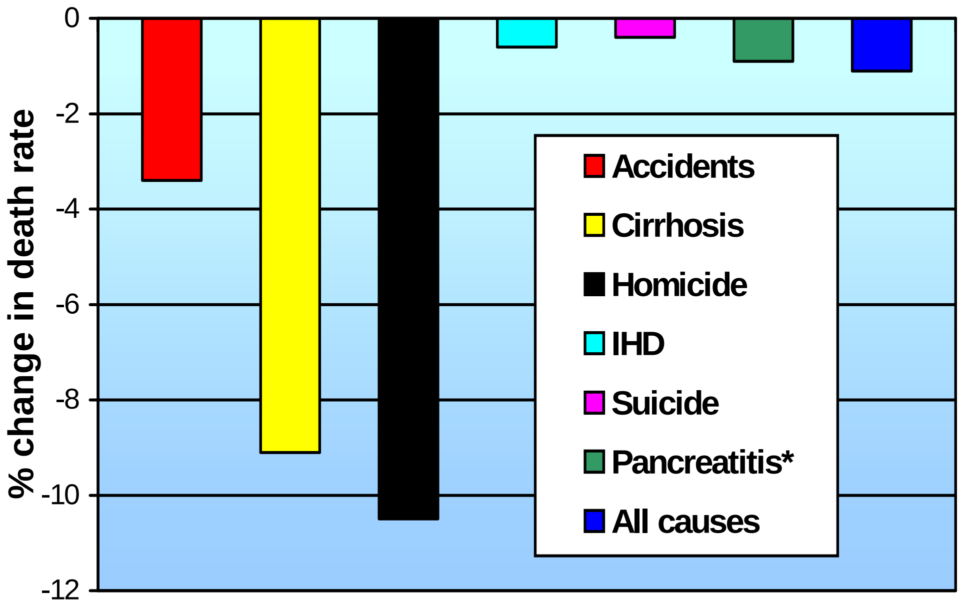

Figure 6.15 Percentage reduction in male death rate when per capita alcohol consumption is reduced by 1L per year. *Medium consuming European countries.* ***Source:*** *(Norström et al. 2001).* ***Key:*** **Both men and women.*

Irrespective of this debate, many of these relationships were found in more than one of the ECAS European regions. Significant positive relationships between consumption and harm were still found for at least one gender in medium- and high-consuming countries for cirrhosis, accidents, and homicide, with medium-consuming countries also showing an effect for at least one gender for directly alcohol-attributable mortality, suicide and heart disease (the latter being discussed in more detail below). When examined in more detail, the higher northern European effect for accident mortality was due to accidental falls and 'other accidents', but a stronger effect was, in fact, found in high- and medium-consuming countries for traffic accident mortality (Skog 2001a).

Out of the 14 individual countries examined, significant relationships for men were found in 14 countries for cirrhosis, 9 for accidents, 8 for mortality, 7 for other alcohol-related diseases (mainly 'alcoholism', alcoholic psychoses and alcohol poisoning) and 6 for homicide (Rossow 2001; Norström *et al.* 2001; Skog 2001b; Ramstedt 2001b; Ramstedt 2001c). Not displayed in Table 6.3 are the results for pancreatitis mortality, which also showed a significant relationship (for men and women combined) in most western European countries of about 5%-15% per litre, and was again stronger in northern Europe with estimated effects of 30% for Sweden and 50% for Norway (Norström *et al.* 2001).

The results for women tended to be significant in fewer countries, but were still found in 9 countries for cirrhosis and accidents, 7 for other alcohol-related diseases, and only one (Sweden) for homicide. The reduced sensitivity of the method to indicators of harm in women is perhaps unsurprising, given that per capita alcohol consumption reflects the heaviest drinkers much more than other subgroups (see above), and that women drink less than men (see Chapter 4).

Time-series analysis outside of ECAS

The ECAS results have generally been supported by other time-series studies in Europe, often using smaller groups of countries or different time periods. For example, a significant and positive relationship between alcohol and mortality of approximately the same magnitude was reported for a more recent time period (1982-1990) in 25 European countries (Her and Rehm 1998). The finding of a significant alcohol effect that was stronger per litre in northern than in southern Europe was also replicated using the ECAS data itself by Gmel *et al.* (Gmel, Rehm, and Frick 2001).

Similarly, a markedly stronger effect has been found for suicide in Sweden (13% per litre) than in France (3% per litre) (Norström 1995) or Portugal (Skog *et al.* 1995), and no effect was found in Switzerland (Gmel, Rehm, and Ghazinouri 1998). In most cases, it seems that consumption of spirits is more closely related to suicide. Thus, only spirit consumption was significantly related to suicide in Sweden, whereas in Norway beer as well as spirits consumption had a significant effect (Norström and Rossow 1999). Of the very small number of studies that have looked at alcohol poisoning specifically, none have found a significant positive relationship with overall consumption, although one (using quarterly data in Finland 1983-99) has also found a relationship to spirits consumption (Poikolainen, Leppanen, and Vuori 2002).

While most of these analyses are performed on mortality data, another study has examined how consumption links to changes in morbidity using quarterly data in Stockholm county (Sweden) from 1980-94. This found that cirrhosis morbidity responded to changes in population drinking in Sweden, whereas an index of other alcohol-related diseases, ("alcoholism", alcohol psychoses and alcohol poisonings) did not (Leifman and Romelsjö 1997). The authors suggested that population drinking might be less important for certain alcohol-specific diagnoses, which are mostly given to the most socially marginalized and severely alcohol-dependent subjects.

Heart disease and patterns of drinking

Most time-series analyses do not consider an independent effect of patterns of drinking, which have been shown to be important for both health and social outcomes (see above and Chapter 5). One way to do this is to try and combine average consumption and patterns within existing methods, by conducting separate levels of time-series analyses for different patterns of drinking (see Box 6.4 and Rehm *et al.* 2004). As discussed in more detail in Chapter 4, it should be borne in mind that there are some severe methodological concerns with the single measure of drinking pattern used here. Nevertheless, the multilevel analysis found that the pattern value was predictive of outcomes – overall consumption levels were significantly associated with injury mortality for both sexes and for all patterns, but the impact of greater consumption was substantially stronger in countries with more detrimental patterns of drinking.

The most ambivalent results are found for heart disease, where the ECAS analysis found *no relationship* between per capita consumption and ischaemic heart disease (IHD) mortality for any region within Europe (Hemström 2001)[40]. In contrast, the GBD study weighted by pattern of drinking suggested a negative effect of alcohol on mortality across the world as a whole, such that a 1 litre *reduction* in per capita consumption would be associated with a 3% *reduction* in deaths from ischaemic heart disease in males, with no change in females. However, these findings differed for different patterns of drinking – in countries with the least harmful patterns of drinking (e.g. France and Italy), reduced alcohol consumption was associated with *increased* mortality, although only at roughly half the level that would be expected if the results of the individual-level studies were linearly extrapolated. The overall negative global effect was due to countries with a more harmful pattern of drinking (e.g. northern and eastern Europe), where there were positive links between trends in overall consumption and IHD-mortality.

These two studies, therefore, offer differing estimates as to whether increasing consumption would provide any protective effect on IHD-mortality in countries with the least detrimental patterns of drinking. However, the research does agree on two points of importance:

1. in eastern Europe there is greater mortality from IHD where consumption increases;

2. even for countries with less detrimental patterns of consumption, the individual-level cardioprotective effect is at best much less strong at the population level (and may even be non-existent) (Norström *et al.* 2001).

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[40] In one country outside of Europe (Canada), a positive relationship has been found between per capita alcohol consumption and male ischaemic heart disease (IHD) mortality, but not female IHD mortality, where no significant relationship was found (Ramstedt, in press).

CONCLUSION

This chapter has presented as complete a picture as currently possible of the harm done by alcohol to Europe. It is clear that alcohol-related harm covers a large number of areas – from family problems to absenteeism at work to loss of life – and it is not possible to gauge the significance of these harms by looking at one area alone. Many of these harms are proportionally more heavily shouldered by young people than other ages, in particular for loss of life where alcohol causes one quarter of all deaths in young men. Much is made of the effect of alcohol in delaying death, but this should be interpreted with much caution. Due to methodological problems, the size of the numbers of deaths delayed is likely to be overestimated, and even without accounting for these problems, it is only at ages 70 years or older that there is a net benefit from alcohol. A sizeable burden is also placed on people other than the drinker, with the harm to others stretching into several domains of human life including crime, health and 'intangible costs'. Alcohol is also heavily implicated in social inequalities, both within and between countries. Finally, research evidence clearly shows that these levels of harm are affected by changes in the population level of consumption. This is a useful point of departure for considering effective policies to reduce the burden of alcohol, which is the subject of the next chapter.

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