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Alcohol Concern's Quarterly

Information and Research Bulletin

## Alcohol and mortality

### Introduction

Alcohol is a factor in many deaths in the United Kingdom each year. Certain deaths can be directly attributed to excess drinking, but it is also implicated in a much larger proportion of deaths whether they result from illness or causes such as accidents, violence and suicide. Currently the Department of Health estimates that the total number of alcohol-related deaths ranges from 5000 - 40,000 per year in England and Wales<sup>1</sup>. The World Health Organisation (WHO) has identified alcohol misuse as the third highest risk to health in developed countries after tobacco and high blood pressure, responsible for 9.2% of the disease burden in these countries<sup>2</sup>. Many of the diseases

and conditions to which alcohol contributes are life-threatening. WHO estimates that alcohol causes 3.2% of deaths worldwide (5.6% of male deaths and 0.6% of female deaths).<sup>3</sup>

**This factsheet looks at figures for alcohol-related deaths and patterns of mortality across sexes and different age groups. It also considers the health protective benefits of alcohol and suggests methods of estimating the overall numbers of deaths attributable to alcohol.**

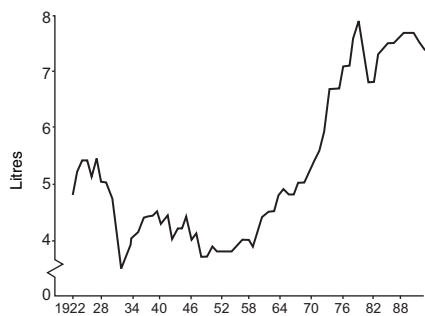
### Alcohol consumption

Despite a decline in UK alcohol consumption in the first half of the century, between 1945 and 1979 per capita consumption doubled.

Although Customs and Excise figures suggest that adult per capita consumption in the '90s stabilised at around 9.2 to 9.7 litres per annum rising to 10.5 litres in 2001, national surveys such as the General Household Survey indicate that drinking among certain groups, notably women and young people, continues to rise (see AC factsheets on these groups).

In the same period, mortality statistics indicate that there has been a corresponding rise in alcohol-related deaths. It is generally accepted that there is an association between alcohol-related morbidity, mortality and trends in per capita consumption.<sup>5</sup> As such, alcohol-related mortality is a key public health issue, with mortality figures providing one indicator of the level of harm caused by alcohol misuse in society.

**Figure 1: Annual alcohol consumption per person 1922-1992<sup>4</sup>**



Sources: HM Customs and Excise, and Brewers and Licensed Retailers Association

**Figure 2: Alcohol mortality statistics for 2001<sup>6</sup>**

ICD 10 Code	Cause of death	Male	Female	Total
F10	Mental and behavioural disorders due to use of alcohol	332	145	477
I42.6	Alcoholic cardiomyopathy	103	17	120
K70	Alcoholic liver disease	2,292	1,172	3,464
K73	Chronic hepatitis – not elsewhere classified	23	55	78
K74	Fibrosis and cirrhosis of the liver	956	736	1,692
X45	Accidental poisoning and exposure to alcohol	94	45	139
		<b>3800</b>	<b>2170</b>	<b>5,970</b>
			<b>Total</b>	

### Deaths directly attributable to alcohol - the current situation

Statistics on deaths are collected by the Office for National Statistics and published annually.

From 2001 onwards deaths attributable to alcohol have been categorised according to the Tenth revision of the International Classification of Diseases (ICD 10). The ONS carried out a bridging study to compare the number of deaths and varying codes for different deaths using ICD 9 and ICD 10 for 1999.<sup>7</sup> They found that the total number of deaths using each set of codes was very similar - 5,473 deaths using ICD 9 and 5,480 using ICD 10. In addition the age-standardised rates remained the same for women in both revisions at 7.0 deaths per 100,000. For men the rate was 12.8 per 100,000 for ICD 10 compared to 12.9 for ICD 9. However, there were changes in which deaths were assigned to different causes making pre- and post-

2001 comparisons less straightforward. Examination of trends in mortality in this paper will be confined to pre 2001 statistics.

### Differences in gender

Figure 1 shows that 83% more men die of alcohol-related causes than women. With the exception of K74 (Chronic hepatitis) male deaths in all categories outnumber female deaths. This pattern of male to female deaths is similar for preceding years and reflects higher levels of consumption in men with just over a quarter drinking over 21 units a week between 1988 and 2000 and 6-7% drinking over 51 units. In comparison, the number of females drinking over 14 units has been significantly lower, but it has increased from 11% in 1988 to 17% in 2000 and furthermore the proportion of women drinking over 26 units has increased from 4% in 1988 to 6% in 2000.<sup>8</sup>

As liver cirrhosis, the principal cause of alcohol-related death listed here, can take many years to develop, there may be a timelag before the effects of increased drinking among women are evident. Examination of long-term trends in mortality will also provide a clearer idea of the effect of excess drinking on death rates in men and women. (See Trends in alcohol-related mortality)

### Differences in age

Using the list of disorders given in Figure 1, the statistics show that only 8% approx. (487 of these deaths affect people under the age of 20 years). These types of disorder generally take years to progress to death so the greatest numbers of deaths (around 51% of alcohol-related deaths) involve people aged 45 to 60 years, and next largest number of deaths occur in those aged 60 to 75 years (around 27% of alcohol-related deaths).<sup>9</sup>

### Limitations

The figures provide only a partial picture of alcohol-related mortality as they include only those deaths where alcohol is recorded as a primary factor in the death. There is a considerable level of under-reporting

### Death certification

The certification of death provided by a doctor records the underlying causes of death with part 1 giving the condition or sequence of conditions leading directly to death and part 2 giving details of associated conditions which contributed to the death. The underlying cause of death recorded in the mortality statistics is taken from pt 1 of the certificate, so the figures do not take account of alcohol where it is only a contributive factor. Furthermore the ONS definitions do not take account of external causes of death such as accidents where alcohol has played a role. This is particularly significant in the case of young people where death is more likely to result from accidents or violence involving alcohol.

of alcohol as a cause of death partly because doctors may believe there is a stigma to recording alcohol as a cause on the death certificate. Also the certification and recording process itself tends to downplay the role of alcohol - see **Death certification**.

The section **Estimating an overall figure** will look in more detail at ways of estimating the overall toll of alcohol.

### Trends in alcohol-related mortality

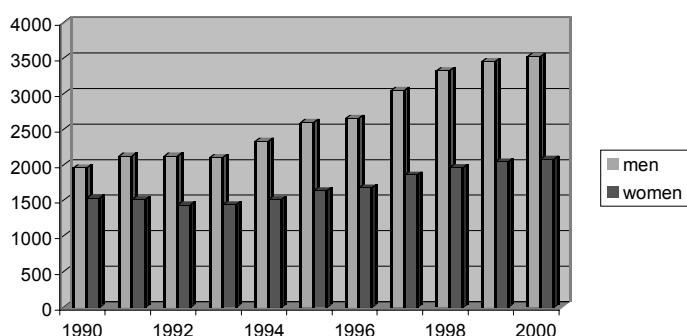
Overall trends show that the rates of alcohol-related deaths, where alcohol has been identified as an underlying cause of death, have risen in England and Wales since World War II (1945). The number of deaths more than doubled from 2,506 in 1979 to 5,543 in 2000 (note: ICD-9 was in use throughout this period).<sup>10</sup> The increase in the numbers of deaths from 1990 to 2000 is shown in figure 3. In addition, the rates of alcohol-related deaths in the population also rose between 1979 and 2000:

- among men the age-standardised rate of alcohol-related deaths rose from 6 deaths per 100,000 to 13 deaths per 100,000
- among women the age-standardised rate rose from just under 4 deaths per 100,000 to 7 deaths per 100,000.

### Deaths from liver cirrhosis

The close association between heavy alcohol consumption and liver cirrhosis means that trends in liver cirrhosis deaths are often taken as a marker of alcohol problems in society. The 2001 report of the Chief Medical Officer pointed to the significant increase in liver cirrhosis in England and Wales in the last 30 years with a 4 fold increase in men aged 45-54 years and a 3 fold increase among women in this age range. Among those aged 35-44 years the increase was around 8 fold for men and 7 fold for women. Figure 4 shows the rate of increase over the last decade.

**Figure 3: Numbers of alcohol-related deaths 1990-2000<sup>11</sup>**



Some concern has been expressed that external factors could be contributing to this dramatic rise, such as:

- Death certification practices. From July 1984 onwards coroners were no longer automatically required to hold an inquest into deaths involving alcoholism, which might have led to more certificates mentioning alcohol. In addition the stigma surrounding the mention of alcohol on certificates may have reduced.
- Hepatitis C. Viral infections such as hepatitis B and C can speed the progression towards liver cirrhosis so intravenous drug use from the late 1960s to the early 1980s may be contributing to alcohol-related deaths in people 40-60 years.<sup>12</sup>

The more recent rises in alcohol-related liver disease need to be placed in context of more long-term rates of alcohol-related mortality. Figures 5 and 6 show rates of alcohol-related deaths in England and Wales since 1950 and how these compare to other European countries with similar drinking patterns.

### Trends in age-specific patterns in alcohol-related deaths

There have been increases in death rates for all ages apart from young people aged 15-24 from 1979 to 2000.

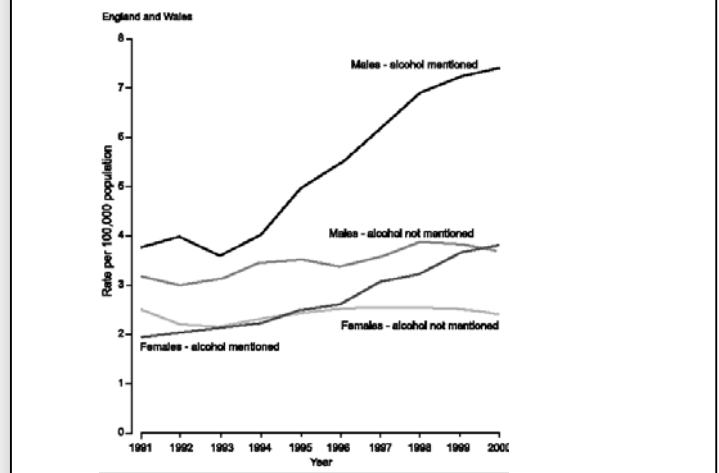
- The highest rates of alcohol-related deaths occurred in men over 65 (ranging from 15 to 23 deaths per 100,000 between 1979-2000) but from 1996 onwards the greatest increase was among men aged 45-64 (from around 16 to 30 deaths per 100,000 between 1994 and 2000).
- Among women there has been an upward trend in all age groups over 25. The highest rate was among women over 65 (ranging from around 12 to 14 deaths per 100,000 between 1979 and 2000). Death rates for women aged 25-44 tripled from 1.5 to 4.9 deaths per 100,000.

Figure 7 shows age-specific death rates for two periods -1991-1993 and 1998-2000 and highlights some worrying trends - in particular:

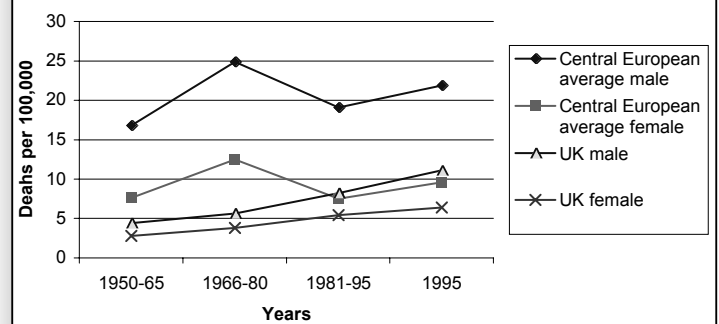
- In 1998-2000 women aged 45-49 had a death rate of 13 deaths per 100,000, only slightly less than men of this age group in 1991-1993
- In 1991-1993 rates for men increased with age and reached a peak for ages 65-74. However, in 1998-2000 the rates peaked earlier at ages 55-64 showing a faster rise at earlier ages. In 1998-2000 the rates for men aged 45-54 are considerably higher than in 1991-1993.

Although the total number of deaths where alcohol has been identified as an underlying cause was just under 6000 deaths in 2001, it is clear from looking at trends in deaths rates for the population, that alcohol-related mortality in England and Wales is on the increase.

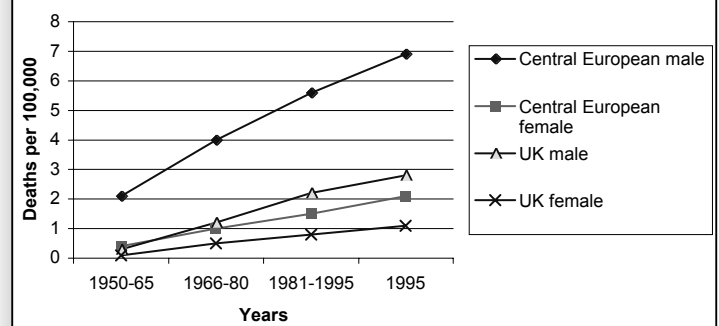
**Figure 4: Male and female age standardised death rates from chronic liver disease per 100,000 (ICD9: 571) 1991-2000. Baker, A. and Rooney, C. (2003) Recent trends in alcohol-related mortality and the impact of ICD-10 on the monitoring of deaths in England and Wales**



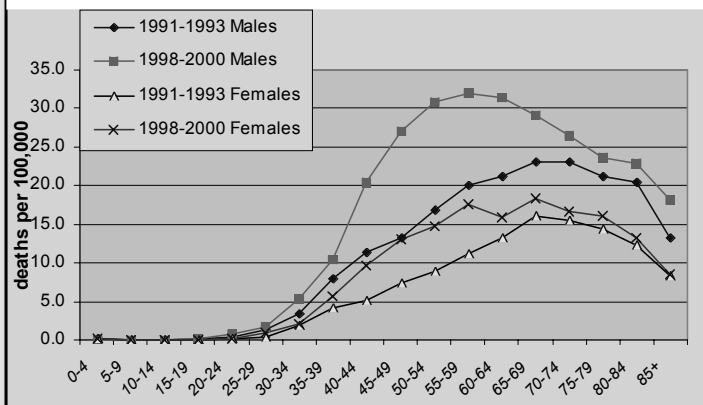
**Figure 5: Age adjusted liver cirrhosis mortality rates (per 100,000, 15+) for the UK compared to Central European average.**<sup>13</sup>



**Fig. 6 Adjusted mortality rates for explicitly alcohol related causes (AAA) (per 100,000, 15+) including alcohol dependence (303), alcoholic psychosis (291), alcohol poisoning (E860), alcoholic cardiomyopathy, alcoholic gastritis (535.3), alcoholic polyneuropathy (357.5) and other (305.0)**<sup>14</sup>



**Fig. 7 Male and female alcohol-related age-specific death rates, 1991-1993 and 1998-2000. Baker, A. and Rooney, C. (2003) Recent trends in alcohol-related mortality and the impact of ICD-10 on the monitoring of deaths in England and Wales.**



### Alcohol and all-cause mortality - The J-shaped curve

Alcohol is widely accepted as having both beneficial and detrimental effects on an individual's health and wellbeing. WHO estimates that there is a causal relationship between volume of consumption and 60 different types of disease and injury.<sup>15</sup> Most of these relationships are detrimental, but there is evidence that alcohol significantly reduces the risk of ischaemic heart disease and ischaemic stroke. However, it also increases the risk of other diseases such as aero-digestive disorders, cancer, liver cirrhosis and alcoholic psychosis and is a major factor in personal injuries. And although regular moderate drinking has been shown to protect against heart studies, recent studies suggest that heavy drinking sessions, ie binge-drinking, can result in sudden cardiac death.<sup>16 17 18</sup>

On the whole the evidence suggests a J-shaped curve between all-cause mortality and alcohol consumption. In this model non-drinkers are at a higher risk of mortality than light or moderate drinkers and heavy drinkers are at a higher risk than either of these groups.<sup>19</sup> However, researchers have recently started to question its accuracy.<sup>20</sup>

This J-shaped analogy is a useful model for identifying relative risk of death for different levels of consumption, however, there are problems in applying it to minimise alcohol-related mortality in a public health context, for example:

- Are the 'abstainers' in the various studies life-long non-drinkers or do they consist of people already at risk of coronary heart disease or ex-heavy drinkers who would experience ill effects from alcohol consumption? If they are not actually long term non-drinkers then it's not correct to say that abstainers are at increased risk and they should not be advised to take up drinking to protect against CHD.<sup>21</sup>
- The relationship between consumption and mortality varies with age. For young adults CHD and liver cirrhosis make little contribution to overall mortality so for younger people the relationship is more linear with alcohol-related accidents and

violence playing a greater role. The J-shape is more apparent in older people from the late 40s onwards as they contribute more to overall mortality and are already more at risk of CHD.<sup>22</sup>

- The relationship between alcohol consumption and all-cause mortality depends upon the distribution of the causes of death within a population and the risk curves for each of these different causes of mortality. So the relationship will vary greatly between developing countries where ischaemic heart disease is rare and established market economies such as the UK where it is common.<sup>23</sup>
- In practice, it is quite difficult to identify a point where risk starts to increase to a significant extent in relation to level of consumption. There is also the consideration that the point of increased risk changes with age. In terms of public health messages, this means suggesting a "band of minimal mortality associated with a weekly consumption of 7-28 units of alcohol per week" but this band cannot be guaranteed to be risk free.<sup>24</sup>

A recent study from the London School of Hygiene and Tropical Medicine presented the results of a statistical analysis to estimate the relation between levels of alcohol consumption and risk of death in men and women across a range of ages within the UK. It found that:

- Lowest rates of mortality are associated with levels of alcohol consumption varying from 0 units per week in men and women under 35 years of age to 3 units a week in women aged over 65 or over and 8 units per week in men aged 65 or over.
- The level at which the risk increases by 5% above the minimum is 8 units a week in women aged 16-24 and 5 units a week in men of this age, increasing to 20 units and 34 units a week in men and women over 65 years, respectively.

As a result the researchers advise that women restrict their drinking to 1 unit a day up to the age of 44, 2 units up to the age of 74 and 3 units after 75 years. Men are advised to drink 2 units per day up until the age of 44, 3 units to age 54, 4 units to age 84. While these recommendations are in line with DoH guidelines in the case of older people, they are probably unattainable in the case of younger people. However, as the risk of mortality in younger people usually relates to injuries resulting from heavy sessional drinking, prevention programmes for young people could usefully focus on "avoiding risky drinking rather than reducing average consumption."<sup>25</sup>

### Estimating overall alcohol-related mortality

#### Years of life lost

So far this paper has focused on numbers of deaths and rates of mortality per 100,000 of the population. Estimating the number of years of life lost (YLL) is

an alternative way of presenting the toll alcohol takes. Alcohol-related deaths are avoidable and a major cause of premature death, particularly for young people. The measure depends on which year is taken as the cut-off line for premature death. Figure 8 shows estimates of years of life lost at 55 and 75 between 1991 and 2000

Note that WHO also use a measure of Disability-Adjusted Life Year (DALY) to estimate the global burden of alcohol which basically looks the years of ill health and disability caused by alcohol. It is estimated that alcohol was responsible for 58 million DALYs in 2000 worldwide<sup>27</sup>. It would be useful if such a figure could be calculated for England and Wales to complement figures for years of life lost to alcohol. Such figures have yet to be published.

### Estimating an overall figure

The number of deaths in which alcohol is implicated, but is not the underlying cause is much higher, but there is no consensus on the figure or the correct method of establishing it

Several attempts have been made to calculate the total number of deaths in which alcohol plays a role - including accidents, suicides and the whole gamut of diseases to which alcohol contributes. (Figure 9 lists some of the key estimates to date) Two principal approaches used excess mortality and attributable fractions. Both have flaws and no method has been developed that can chart year-on-year changes or in different age groups (figure 11 lists some of the drawbacks to these methods). Interestingly, despite the different methods used and their related flaws, the overall totals are widely divergent.

One recent UK analysis by Britton and McPherson attempted to establish overall figures for 1996 using attributable fractions to establish the number of deaths that can be attributed to current alcohol consumption and the number of deaths that are prevented by this level of consumption. The analysis includes all those diseases/conditions that can be directly attributed to alcohol, conditions where alcohol is implicated and a range of injuries and adverse effects where alcohol is known to play a role. Key findings from this study indicate that:

- Based on 1996 levels of consumption, there were 1.8% fewer deaths (2.8% fewer males deaths and 0.9% fewer female deaths) among the drinking population than among non-drinkers due to the protective effect of alcohol on ischaemic heart disease.
- Leading causes of alcohol-related death vary between different age groups. For men and women aged 16-24 years road traffic accidents, suicide and assaults top the list and with suicide and road traffic accidents remaining the 2 most common causes up until the age of 35. After age 35 liver cirrhosis becomes much more common.
- The favourable mortality balance from alcohol consumption favours men aged over 55 years and women aged over 65 years.
- Using the list of causes of death provided (see

**Figure 8: Years of life lost (YLL) for alcohol-related deaths per 100,000 population (1991-2000 (England Wales))**

	YLL Deaths before age 55	Rate Deaths before age 55	YLL Deaths before age 75	Rate Deaths before age 75
<b>Men</b>				
1991	9,321	4.9	37,119	15.8
1992	9,390	5.0	37,186	15.8
1993	9,916	5.2	38,227	16.3
1994	10,766	5.7	42,179	17.9
1995	12,048	6.3	42,457	20.1
1996	13,188	6.9	52,261	22.1
1997	14,633	7.7	58,422	24.7
1998	16,811	8.8	65,143	27.5
1999	16,090	8.4	65,898	27.7
2000	15,933	8.3	66,942	28.1
<b>Women</b>				
1991	5,036	2.7	21,476	9.1
1992	4,476	2.4	19,577	8.2
1993	5,082	2.7	21,429	9.0
1994	5,365	2.9	23,001	9.6
1995	5,908	3.1	25,056	10.5
1996	6,353	3.4	27,093	11.3
1997	7,034	3.7	29,515	12.3
1998	6,977	3.7	30,774	12.8
1999	8,586	4.5	35,028	14.5
2000	8,584	4.5	35,380	14.6

**Figure 9 Estimates of the death toll from alcohol per annum - various sources**

Study	Age group	Method	How many?
Royal College of Physicians , 1987 <sup>28</sup>	35-64	Based on Swedish data	25,000
Anderson, 1988 <sup>29</sup>	15-74	Excess mortality	28,000
Godfrey and Maynard, 1992 <sup>30</sup>	All	Attributable fractions	33,000
Royal College of General Practitioners <sup>31</sup>	15+	Attributable fractions	40,000

figure 10) the researchers found that alcohol contributed to around 11, 263 deaths for 1996 which was just over 3 times as many deaths as recorded by the Registrar General as being directly attributable to alcohol.

- More research is required to look into the effects of different patterns of consumption and variables such as age and sex.

The authors explain that their estimate of mortality attributable to alcohol is considerably lower than others and that this is usually because other estimates do not take account of the protective factor of alcohol consumption. Comparing like with like, the WHO Global Burden of Disease<sup>32</sup> does take account of the protective factor but still estimates 1.2% of all deaths in Established Market Economies such as the UK are attributable to alcohol, which would clearly provide a much higher figure.

This is a controversial area. It is hoped that the forthcoming Alcohol Prevention strategy (expected Autumn 2003) will provide an up-to-date estimate based on all the existing evidence. In the meantime Alcohol Concern uses the estimate provided by Godfrey and Maynard in 1992 of around 33,000 deaths per annum.

**Figure 10 Alcohol attributable deaths by cause (>15) England and Wales 1996<sup>33</sup>**

	Conditions	Deaths attributable to alcohol	
		Men	Women
<b>Cancers</b>	Rectum cancer	174/2819	358/2136
	Colon cancers	934/5001	401/5491
	Oropharyngeal cancer	356/874	97/462
	Laryngeal cancer	74/635	9/174
	Liver cancer	108/1049	36/766
	Oesophageal cancer	829/3567	233/2268
	Breast cancer	-	667/12179
<b>Circulatory illnesses</b>	Haemorrhagic stroke*	598/2848	426/4465
	Essential hypertension	12/64	15/177
	IHD (ischaemic heart disease)	- 14485/70488	-6813/58556
	Alcoholic cardiomyopathy	116/116	24/24
<b>Gastrointestinal</b>	Alcoholic liver disease	1370/1370	689/689
	Chronic pancreatitis	10/46	2/32
	Alcoholic gastritis	3/3	2/2
<b>Injuries and external causes</b>	Assaults	75/160	24/50
	Accidental drowning	50/131	16/43
	Accidental falls	486/1439	690/2177
	Fire accidents	101/229	77/176
	Inhalation and ingestion	6/127	6/126
	Occupation injuries	4/63	0/2
	Accidental poisoning by alcohol	13/13	9/9
	Road traffic accidents	654/2145	104/803
	Suicide	797/2648	200/794
	Non-dependent abuse of alcohol	100/100	44/44
	Alcohol dependence syndrome	172/172	78/78
	Alcoholic psychosis	10/10	4/4
	<b>Total excluding prevented IHD deaths</b>		<b>7052</b>
<b>Total including prevented IHD deaths</b>		<b>-7,433</b>	<b>-2602</b>
<b>Deaths from all causes</b>		<b>261 571</b>	<b>287 796</b>
<b>% Alcohol attributable</b>		<b>-2.8%</b>	<b>-0.9%</b>

- highlight the wide range of illnesses and injuries to which alcohol contributes
- make use of existing research to calculate a band of low risk consumption as a guide for moderate or sensible drinking.

However, there are limitations to this type of review - for example, it is difficult to obtain an accurate estimate of the true toll of alcohol misuse in relation to mortality. Estimates of total alcohol-related mortality need to be balanced by more detailed investigation of the relationship between alcohol consumption, including different patterns and various disease outcomes across different ages and genders. Furthermore alcohol-related mortality is only one part of the overall picture of the harm alcohol causes and needs to be complemented by investigation of the on-going health problems and social problems that people experience.

\*estimated number of deaths

**Figure 11 Calculating indirect mortality**

**Methods**

**Excess mortality**

Anderson compared death rates for people at different levels of consumption using 5 large-scale longitudinal studies. All these studies showed a J-shaped relation between alcohol consumption and death – that is, those drinking 1-10 units a week have lower death rates than either abstainers or those drinking more than 10 units. If for the purpose of calculation, all adults in England and Wales were to drink at the 1-10 unit level, he estimated that 28,000 fewer deaths would occur.

**Attributable fractions**

Lists the causes of death to which alcohol is believed to contribute and calculates, according to research evidence available, what proportion can be assigned to alcohol – the “attributable fraction”.

Godfrey and Maynard’s estimate uses the list of attributable fractions compiled by the US Centre for Disease Control.

**Problems**

- No single basic study of the association between death and alcohol consumption exists.
- Estimates are based on 1 British and 4 US studies, not all include women.
- Data from the US, with different demographic characteristics and drinking habits that are not applicable to the UK.
- Data gathered over a long period so risk factors might change over time.
- Estimates associated with deaths in general not specific diseases and causes
- The calculation is complex and does not offer an easily comprehensible framework for refinement.
- For many causes of death, there is no consensus on what proportion can be assigned to alcohol.
- While accurate figures exist for numbers of alcohol-related road traffic deaths, the same cannot be said for other types of accident.
- The mix of causes of death can vary from country to country.
- A more accurate method is needed to take account of alcohol’s role in protecting against IHD.

**Conclusion**

The opening section to this article explained that alcohol-related mortality is frequently used as an indicator to gauge the level of harm caused by alcohol misuse in society. It is clear from figures for deaths attributable to alcohol and trends in death rates in the population that alcohol-related mortality has increased over the long term in line with consumption.

Investigation into this subject is useful as it can:

- show trends in alcohol-related mortality

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