

Alcohol-attributable mortality in France

Sylvie Guérin, Agnès Laplanche, Ariane Dunant, Catherine Hill

Service de Biostatistique et d'Epidémiologie, Institut Gustave Roussy, 114 rue Edouard Vaillant, 94805 Villejuif Cedex, France

Correspondence: Sylvie Guérin, Service de Biostatistique et d'Epidémiologie, Institut Gustave Roussy, 94805 Villejuif Cedex, France, Tel: +33 1 42 11 41 36, Fax: +33 1 42 11 52 58, e-mail: guerinrojas@gmail.com

Background: Alcohol consumption is high in France. **Aim:** Estimation of alcohol-attributable mortality in France by sex, age and dose, for year 2009. **Method:** We combined survey and sales data to estimate the prevalence of alcohol consumption by age, sex and dose category. For each cause of death, the relative risk of death as a function of dose was obtained from a meta-analysis and combined with prevalence data to obtain the attributable fraction; this fraction multiplied by the number of deaths gave the alcohol-attributable mortality. **Results:** A total of 36 500 deaths in men are attributable to alcohol in France in 2009 (13% of total mortality) versus 12 500 in women (5% of total mortality). Overall, this includes 15 000 deaths from cancer, 12 000 from circulatory disease, 8000 from digestive system disease, 8000 from external causes and 3000 from mental and behavioural disorder. The alcohol-attributable fractions are 22% and 18% in the population aged 15 to 34 and 35 to 64, respectively, versus 7% among individuals aged 65 or more. Alcohol is detrimental even at a low dose of 13 g per day, causing 1100 deaths. **Conclusion:** With 49 000 deaths in France for the year 2009, the alcohol toll is high, and the effect of alcohol is detrimental even at low dose. Alcohol consumption is responsible for a large proportion of premature deaths. These results stress the importance of public health policies aimed at reducing alcohol consumption in France.

Introduction

In many countries, the majority of adults consume alcohol. In France, the amount of alcohol available for consumption was traditionally high and reached a maximum of 65 g per adult per day at the end of the thirties. Since 1960, it has decreased regularly by 1.7% per year and was equal to 27 g per adult and per day in 2009.¹

The estimation of alcohol-attributable mortality provides a useful indicator for developing national public health strategies. These estimations are available for many countries.^{2–10} In France, estimations were published by Pignon and Hill for the years 1985 and 1995.^{11,12} In 2007, the International Agency for Research on Cancer (IARC) published an estimation of alcohol-attributable cancer morbidity and mortality for the year 2000.¹³ Recently, Rey et al. published estimations of alcohol-attributable deaths for the year 2006.¹⁴ The aim of this study was to estimate the number of alcohol-attributable deaths for the year 2009, overall and by cause of death, according to gender, age and alcohol dose.

Methods

To estimate the number of deaths attributable to alcohol, we need to know the distribution of alcohol consumption by gender and age group in the French population, we need to identify all causes of deaths with a risk modified by alcohol consumption and we need to know the dose–effect relationship between exposure to alcohol and the risk for each of these alcohol-related causes of death. This study is based on the French mortality data for the year 2009.

Alcohol consumption by gender and age

A representative sample of 20 178 French individuals aged 15+ were interviewed on their alcohol drinking habits in 2002–03 by the National Institute of Statistics and Economic Studies. The data on alcohol consumption have not been published, but they are available from Réseau Quetelet on request.¹⁵ There was a marked discrepancy between the reported average alcohol consumption in this survey

(11 g/day) and the average estimated based on the French alcohol sales statistics reported to the tax authorities (27 g/day in 2009). This corresponds to a rate of underreporting equal to 2.4 (27/11); therefore, we multiplied the daily alcohol consumption each individual declared in the national survey by 2.4 to adjust the declared daily alcohol consumption on 2009 alcohol sales. Supplementary table 1 shows the adjusted results of the survey, by gender and age category, for five dose categories. The alcohol-attributable number of deaths in 2009 was estimated based on these adjusted consumption data.

Causes of deaths associated with alcohol

Conditions wholly attributable to alcohol

A number of conditions, listed in supplementary table 2, are, by definition, wholly attributable to alcohol consumption.

Conditions partly attributable to alcohol

Supplementary table 3 lists all conditions partly attributable to alcohol. Cancer sites with a risk increased by alcohol consumption are the oral cavity, pharynx, oesophagus, colon and rectum, liver, larynx and breast.^{16–21} Alcohol increases the risk of cardiac arrhythmias,²² haemorrhagic stroke²³ and of hypertensive diseases among men and decreases the risk of hypertensive diseases among women for a daily consumption below 12 g of ethanol.²⁴ Alcohol reduces the risk of ischemic heart disease¹⁹ and ischemic stroke²³ at daily doses below 78 and 35 g of ethanol, respectively. The risk of cholelithiasis is reduced by alcohol consumption.²² Alcohol increases the risk of pancreatitis.²⁵ The risks of accidents, falls, suicides and homicides, that is external causes of death, are increased by alcohol consumption. Low to moderate alcohol consumption is known to have a protective effect on type 2 diabetes.^{26,27} The risk of death from epilepsy is increased by alcohol.²⁸

Risk functions

For each alcohol-attributable condition except for external causes, the dose–response relationship between alcohol consumption and the risk of death was provided by the most recent meta-analysis of epidemiological studies comparing groups of individuals with at least three categories of alcohol consumption.^{16–25,27–29} This relationship has the general form of a fractional polynomial of degree two that fits a variety of dose–response relations with only three parameters.

Supplementary table 3 shows, for each cause of death, the estimated fractional polynomial provided by the corresponding meta-analysis and the relative risks for the doses of alcohol of supplementary table 1. The dose–effect relationships are shown in web figure.

Supplementary table 3 also shows the dose–effect relationships between alcohol consumption and the risk of liver cirrhosis²⁹ used to distribute the alcohol-attributable deaths for conditions wholly attributable to alcohol between dose categories, see below.

Alcohol-attributable fraction

Partially alcohol-attributable conditions

The alcohol-attributable fraction (AAF) for a specific cause of death is the proportion of deaths from this specific cause due to alcohol consumption. The AAF was estimated for each condition, gender and age group using Levin's formula³⁰:

$$AAF = \frac{\sum_{i=1}^4 p_i(RR_i - 1)}{\sum_{i=1}^4 p_i(RR_i - 1) + 1},$$

where p_i is the proportion of the population exposed to the i^{th} dose category (13, 28, 46 and 117 g of pure alcohol per day for men and 13, 28, 46 and 85 g of pure alcohol per day for women) and RR_i is the relative risk associated with the i^{th} dose category compared with non-regular drinkers (see supplementary table 3).

From this formula, one can deduct the AAF associated with the i^{th} dose category (AAF_i):

$$AAF_i = \frac{p_i(RR_i - 1)}{\sum_{i=1}^4 p_i(RR_i - 1) + 1}$$

External causes

For external causes, particularly for accidents which represent a main external cause, the increase in risk depends on acute rather than on average exposure. The risk is also increased for any individual, drinker or non-drinker, involved in an accident caused by a drinker. For these reasons, we have used the attributable fractions proposed by Ezzati et al.³¹ for the main external causes in Western Europe. We have not included external causes of death in the estimation of mortality according to alcohol dose.

Wholly alcohol-attributable conditions

By definition, all deaths associated with wholly alcohol-attributable conditions are due to exposure to alcohol. To distribute this total number of deaths between the four dose categories, we need a dose–response relationship. Liver cirrhosis is the unique wholly alcohol-attributable condition for which we have an estimation of the dose–response relationship in the literature.²⁹ The AAF associated with each dose category i : AAF_i was estimated using the relative risks of liver cirrhosis presented in supplementary table 3 with '13 g per day' as the reference dose category:

$$AAF_i = \frac{p_i RR_i}{\sum_{i=1}^4 p_i RR_i}.$$

This estimation was used for each wholly alcohol-attributable condition.

Sensitivity analysis

Sensitivity analyses estimated the number of alcohol-attributable deaths in 2009 under the assumptions that 10 or 20% of the alcohol available in 2009 was not consumed, but wasted or undrinkable. The daily alcohol consumption estimated from sales was then equal to 24.3 or 21.6 g, respectively, of pure alcohol per adult per day. We multiplied the daily alcohol consumption each individual declared in the national survey by 2.2 (24.3/11) in the first situation and by 2.0 (21.6/11) in the second one, to adjust the 2003 declared daily alcohol consumption on 2009 alcohol actually consumed.

In another sensitivity analysis, the consumption of alcohol was taken as declared and, therefore, not corrected to account for the amount of available alcohol estimated from sales.

Mortality data

The number of deaths observed in 2009 was obtained from the National Institute of Health and Medical Research for each condition related to alcohol, by gender and 5-year age group (<http://www.cepdc.vesinet.inserm.fr>) (table 1). The number of deaths attributable to alcohol was calculated for each condition, by gender and age group, for each dose category by multiplying the total number of deaths by the corresponding AAF. For each cause of death and each gender, the age-specific numbers of deaths attributable to alcohol were summed, and the result was divided by the total number of deaths to generate the AAF.

Results

Out of 535 000 deaths in 2009, 49 000 were attributable to alcohol: 36 500 among men and 12 500 among women, which represent 13 and 5%, respectively, of total deaths. Table 1 shows by gender for each cause of death, the number of deaths observed in 2009, the estimated AAF and the number of deaths attributable to alcohol or prevented by alcohol consumption. The total of about 36 500 deaths attributable to alcohol among men is obtained after subtracting 50 deaths from cholelithiasis prevented by alcohol. Similarly among women, the 12 500 deaths due to alcohol are obtained by subtracting about 700 deaths, mostly from ischemic heart disease and type 2 diabetes, prevented by alcohol. Alcohol consumption is a major cause of premature death. The AAFs are highest in the populations aged 15 to 34 (22%) and 35 to 64 (18%) versus 7% in the population aged 65 or over (table 2). This is particularly true among men with one death in four attributable to alcohol between ages 15 and 34 and one death in five between ages 35 and 64.

Table 3 presents mortality in France for 2009, excluding external causes, according to the dose of alcohol. The AAF increases with the dose of alcohol from 0.4% at a dose of 13 g per day to 32% at the dose of 117 g per day among men and from 2 to 29% at the dose of 85 g per day among women. Figure 1 shows the total number of deaths and the number of deaths attributable to alcohol among men and women, for each dose category. The number of deaths not attributable to alcohol reflects the distribution of alcohol consumption in the population.

The sensitivity analyses gave estimations of 45 000 and 42 000 alcohol-attributable deaths in 2009 when 10 and 20%, respectively, of 2009 alcohol sales were supposed not to have been consumed. Using the declared alcohol consumption gave an estimation of 28 000 deaths.

Discussion

We estimate a total of 49 000 alcohol-attributable deaths in France for 2009, 36 500 among men and 12 500 among women. Alcohol consumption is responsible of a large proportion of premature deaths. Even at the lowest dose of 13 g per day, where alcohol is associated with a reduced risk of cholelithiasis, ischemic heart

Table 1 Total number of deaths, alcohol-attributable fraction and number of deaths due to alcohol by gender and cause of death

Cause of death	Men			Women			Total		
	Deaths in 2009	Attributable fraction (%)	Deaths due to alcohol	Deaths in 2009	Attributable fraction (%)	Deaths due to alcohol	Deaths in 2009	Attributable fraction (%)	Deaths due to alcohol
Cancer ^a	89 824	12	11 197	62 941	6	4 003	152 765	10	15 200
Oral cavity	1 270	75	951	491	36	178	1 761	64	1 129
Pharynx	2 139	86	1 842	352	49	172	2 492	81	2 014
Oesophagus	3 402	84	2 860	882	53	467	4 284	78	3 327
Colon-rectum	9 792	30	2 949	8 523	9	750	18 314	20	3 699
Liver	6 203	30	1 850	2 215	9	201	8 418	24	2 051
Larynx	1 240	60	745	150	24	35	1 390	56	781
Breast	220	0	0	12 547	18	2 199	12 767	17	2 199
Circulatory system diseases	66 833	14	9 523	77 510	3	2 710	144 343	8	12 233
Hypertensive disease	3 099	46	1 420	5 834	15	866	8 933	9	2 286
Ischemic heart disease	20 774	5	938	15 765	−3	−529	36 539	0	409
Alcoholic cardiomyopathy	74	100	74	10	100	10	84	100	84
Cardiac arrhythmia	4 236	53	2 250	6 277	22	1 366	10 513	34	3 615
Haemorrhagic stroke	7 734	48	3 704	10 139	8	827	17 874	25	4 531
Ischemic stroke	5 532	19	1 050	8 581	2	150	14 112	9	1 200
Oesophageal varices	88	100	88	20	100	20	108	100	108
Digestive system diseases	12 543	45	5 627	10 888	20	2 145	23 431	33	7 772
Alcoholic gastritis	0	100	0	0	100	0	0	100	0
Alcoholic liver disease	3 543	100	3 543	1 317	100	1 317	4 860	100	4 860
Chronic hepatitis, not elsewhere classified	15	100	15	10	100	10	25	100	25
Fibrosis and cirrhosis of the liver	1 684	100	1 684	767	100	767	2 451	100	2 451
Cholelithiasis	109	−47	−51	201	−10	−19	310	−23	−70
Pancreatitis	596	74	438	428	17	71	1 024	50	509
Other diseases	95 382	13	3 441	104 926	5	634	200 308	9	4 075
Type 2 diabetes	3 048	21	638	3 311	−4	−143	6 359	8	494
Wernicke's encephalopathy	6	100	6	4	100	4	10	100	10
Mental and behavioural disorders due to alcohol	2 251	100	2 251	608	100	608	2 859	100	2 859
Degeneration of nervous system due to alcohol	75	100	75	26	100	26	101	100	101
Epilepsy and status epilepticus	859	53	459	752	18	137	1 611	37	596
Alcoholic polyneuritis	12	100	12	4	100	4	16	100	16
External causes	22 620	25	5 545	14 748	18	2 609	37 368	22	8 154
Unknown ^b	7 671	16	1 250	6 848	5	363	14 519	11	1 613
Total	272 253	13	36 584	263 113	5	12 465	535 366	9	49 048

^aWe added to each site of cancer, a proportion of deaths from cancer of an ill-defined, secondary or unspecified site (ICD codes: C76–C80) and independent multiple sites (ICD code: C97) equal to the gender- and age-specific fraction of cancers of specified sites attributed to alcohol.

^bA fraction of ill-defined and unknown causes of death (ICD codes: R96–R99) equal to the fraction of specified causes of deaths attributable to alcohol was attributed to alcohol for each gender and age group.

disease, ischemic stroke and type 2 diabetes, the overall effect is detrimental.

These estimates rely on many assumptions and are, therefore, subject to uncertainty. Major sources of uncertainty are the distribution of alcohol consumption, the lag time between alcohol consumption and mortality, the pattern of drinking, the selection of causes of deaths with risk modified by alcohol, the quality of the death certification process and the estimation of the risk functions.

Alcohol consumption estimation

The literature discussing the various sources of bias in alcohol consumption measurement is considerable,³² and there is no consensus on the estimators that should be used to assess alcohol-attributable mortality. Estimations of alcohol consumption from survey data and alcohol available from national statistics are markedly different, resulting in different estimates in number of alcohol-attributable deaths: 28 000 versus 49 000 in our study. The dose–effect relationships are estimated from epidemiological studies based on self-reported alcohol consumption, and therefore, survey data may be preferable. However, underreporting may be less in epidemiological studies than in surveys of a national sample of the population because individuals interviewed in the context of an

epidemiological study, knowing its public health objective, may be more truthful about their consumption of alcohol. The aim of this study being a realistic estimation of the number of deaths attributable to alcohol for the year 2009, we chose to use the distribution of drinkers available in a large recent representative survey of the French population¹⁵ adjusted on the amount of alcohol available for the year 2009. The underreporting of 2.4 is assumed to be independent of the amount of alcohol, but it is quite possible that it depends on the sex, the age and the true consumption of the person. Therefore, the hypothesis of a constant underreporting factor is a crude approximation; however, we are not aware of any data on which to base an improved estimation. The underreporting rate of 2.4 may be too high if part of the alcohol available is not drunk: the sensitivity analyses indicate that a reduction of 10 or 20% in the average alcohol consumption leads to a reduction of 4000 or 7000 deaths. Our estimates of 10 or 20% of alcohol wasted or spilled might be overestimates: a recent report³³ quoting industry estimates states that less than 10% of alcohol is wasted or spilled.

Lag time

Methodological approaches for analysing the relationship between changes in alcohol consumption and changes in rates of

Table 2 AAF according to age, by gender and cause of death

Sex	Cause of death	Age (years)							
		15–34		35–64		65+		Total 15+	
		Deaths due to alcohol	AAF (%)	Deaths due to alcohol	AAF (%)	Deaths due to alcohol	AAF (%)	Deaths due to alcohol	AAF (%)
Men	Cancer	14	3	4 336	16	6 847	11	11 197	12
	Circulatory system	33	10	1 316	13	8 174	15	9 523	14
	Digestive system	33	40	3 371	73	2 223	28	5 627	45
	External causes	1 215	35	2 202	25	2 128	21	5 545	25
	Other diseases	90	11	2 010	17	1 341	2	3 441	5
	Unknown	137	26	706	22	407	11	1 250	16
	Total	1 522	26	13 941	21	21 120	11	36 584	13
Women	Cancer	14	3	1 361	9	2 628	6	4 003	6
	Circulatory system	3	2	120	4	2 588	3	2 710	3
	Digestive system	6	15	1 172	64	966	11	2 145	20
	External causes	153	19	551	18	1 905	18	2 609	18
	Other diseases	8	2	468	8	159	3	634	1
	Unknown	17	9	148	12	197	4	363	5
	Total	201	9	3 820	12	8 443	4	12 465	5
Both	Total	1 724	22	17 761	18	29 563	7	49 048	9

Table 3 France 2009 mortality (excluding external causes): number of deaths due to alcohol and not due to alcohol, according to dose of alcohol, by gender and cause of death

Cause of death	Men						Women						Total
	Average dose of alcohol in grams per day					Total	Average dose of alcohol in grams per day					Total	
	2	13	28	46	117		2	13	28	46	85		
Cancer	—	238	553	389	10 017	11 197	—	349	692	261	2 702	4 003	15 200
Circulatory system	—	−342	−211	37	10 039	9 523	—	−128	262	117	2 459	2 710	12 233
Digestive system	—	265	406	692	4 264	5 627	—	685	397	196	867	2 145	7 772
Other diseases	—	−19	−10	56	3 413	3 441	—	22	20	51	542	634	4 075
Unknownb	—	30	57	73	1 090	1 250	—	44	56	28	236	363	1 613
Deaths attributable to alcohol	0	172	796	1 247	28 824	31 038	0	972	1 426	652	6 806	9 856	40 894
Deaths not attributable to alcohol ^a	69 116	41 492	30 537	17 005	60 446	218 595	153 994	41 909	19 149	7 094	16 363	238 509	457 104
Total number of deaths excl. ext causes	69 116	41 664	31 332	18 251	89 270	249 633	153 994	42 881	20 575	7 745	23 169	248 365	497 998
Attributable fraction (%)	0	0.4	3	7	32	12	0	2	7	8	29	4	8

^aThe total number of deaths not attributable to alcohol is distributed between dose categories according to proportion of drinkers in this dose category. For instance $69\,116 = (249\,633 - 31\,038) \times 31.6\%$.

alcohol-related harm have been suggested; however, the problem of time lags is not well addressed.³⁴ The choice of the lag time is more crucial in France than in other countries, because the consumption of alcohol has decreased by 50% over the last 50 years. It was 33 g per adult per day in 1994, 30 g in 2002–03 and 27 g in 2009. For cancer, it would probably have been more appropriate to use alcohol consumption 15 or 20 years before 2009. However, most published estimates combine consumption and mortality data for the same year.^{2–7,9,10}

Characteristics of drinking habits

We studied the effect of alcohol drinking, summarizing consumption by the average daily alcohol intake. This ignores possible different effects of binge drinking versus regular daily exposure. There is only fragmentary information on this factor. A recent meta-analysis showed that the cardioprotective effect of moderate alcohol consumption on ischemic heart disease disappeared when light to moderate drinking was mixed with irregular heavy drinking episodes.³⁵ Mortality from external causes is increased by binge drinking.³⁶

Causes of death associated with alcohol

We did not include conditions for which a link with alcohol is probable but not proven. Recent meta-analyses show no evidence of an association between alcohol consumption and prostate cancer,³⁷ oesophageal and gastric cardia adenocarcinoma,³⁸ and bladder cancer.³⁹ There is some uncertainty in the sorting out of causes of death between the underlying cause and associated causes. We have not taken secondary causes into account.

Previous estimations of alcohol-attributable mortality in France

Several estimations of alcohol-attributable mortality have been published for France. Early studies, estimating alcohol exposure from a 1974 survey by the Institut Français d'Opinion Publique uncorrected for the amount of available alcohol, and ignoring the protective effects of alcohol, estimated 52 000 deaths in 1985 and 45 000 deaths in 1995.^{12,13} An estimation of alcohol-attributable cancer deaths in France was published by the IARC for the year 2000, using the total amount of alcohol available in 1985 (www.

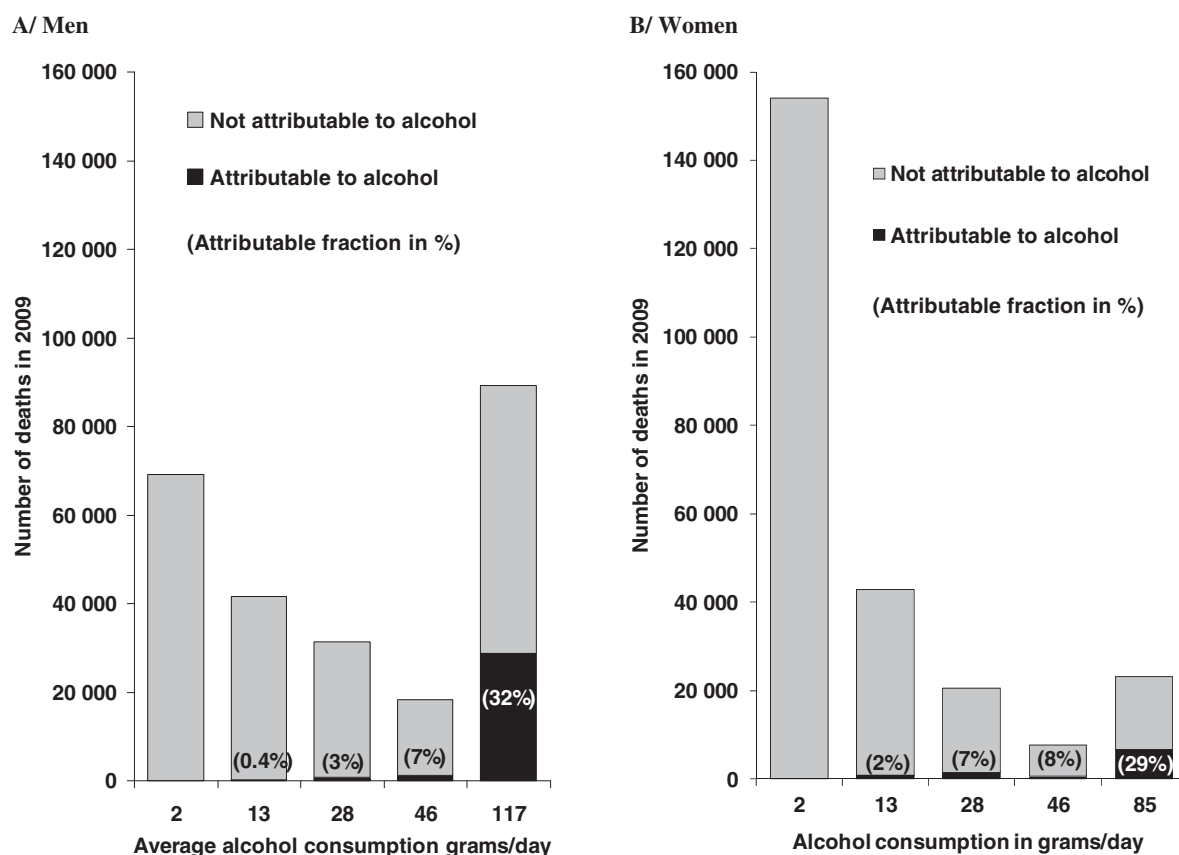


Figure 1 Number of deaths attributable and not attributable to alcohol by dose category and gender, for causes other than external

who.int); AAFs for all cancers were estimated at 9% for men and 3% for women in 2000 versus 12 and 6% in our study, and the total number of cancers attributable to alcohol was equal to 9900 versus 15 200 in our study; the difference comes essentially from different dose–effect relationships for oesophageal, colorectal and breast cancer. A recent estimation used data from a 2002 survey: the number of deaths attributable to alcohol for the year 2006 was equal to 33 000 after adjustment for the available amount of alcohol in 2002¹⁴; this estimation is lower than ours due to the use of different surveys and risk equations. None of the previous studies presented the results by dose category.

Comparison with other countries

The proportion of deaths attributable to alcohol in France among men is 13%, much higher than in other countries; for instance, it is 6.8% in Scotland,⁴ 5% in Switzerland,⁶ 3% in East Germany³ and Italy,⁵ 1% in West Germany and Denmark³ and –2.8 or –0.8%, that is a protective effect in the United Kingdom.^{3,10} Among women, the proportion of deaths attributable to alcohol is 4.7%, also higher than the 3.3% estimated for Scotland, the 2% observed in Italy, 1.4% in Switzerland, 1% in Denmark, 0.3% in West Germany and effects varying between 0.1 and –0.9% in the United Kingdom^{3,10} and –0.3% in East Germany. Liang et al.⁸ found that 4.4% of all cancer deaths were attributable to alcohol consumption in China in 2005, which is to be compared with 10% in our study.

The overall protective effect of alcohol in England and Wales^{9,10} can be directly compared with the highly detrimental effect of alcohol in France inasmuch as the methods used are quite similar. White et al. use the consumption as declared in the general household survey, whereas we adjust the declared consumption to account for the alcohol available for consumption. When we use the declared consumption, in our sensitivity analysis, we attribute 28 000 deaths to alcohol in France, whereas alcohol has an overall protective effect in England and Wales with 1800 deaths avoided. However,

the distributions of causes of deaths in the populations are different. Our results in terms of age and dose effects are nevertheless similar to those observed by White et al.: an increased risk of mortality exists even among people drinking a low dose of alcohol, especially among young people.

Alcohol is a major public health issue in France

This study demonstrates the overall detrimental effect of moderate alcohol consumption, even at the low dose of 13 g of pure alcohol per day. More generally, it shows the major harmful effect of alcohol on health in France, leading to 49 000 deaths in the year 2009, 40% among individuals younger than 65 years. Our study addresses the effect of alcohol on mortality; it ignores the morbidity of drinkers, the morbidity of individuals involved in alcohol-related accidents and the morbidity of newborns exposed *in utero*. In 2005, France had the fourth highest consumption of alcohol among 48 European Member States after the Czech Republic, Estonia and Ireland.⁴⁰ Efforts should be made to reduce further alcohol consumption in France and thus avoid many premature deaths.

Supplementary data

Supplementary data are available at *EURPUB* online.

Acknowledgements

The authors thank Lorna Saint Ange for editing.

Funding

This work was funded by Institut Gustave Roussy and a grant from the French “Institut National du Cancer” 2010.

Conflicts of interest: None declared.

Key points

- Our work presents an estimation of the number of deaths attributable to alcohol in France, in 2009, for each cause of death related to alcohol consumption.
- The harmful effect of alcohol is larger in the younger population.
- We estimated the number of deaths and the risks for different dose categories and showed that the overall effect of a moderate alcohol consumption is detrimental in France.

References

- Hill C, Laplanche A. [The French drink too much alcohol]. *Presse Med* 2010;39: 158–64.
- Jones L, Bellis MA, Dedman D, et al. Liverpool: Center for public Health, Faculty of Health and Applied Social Sciences. *Alcohol-Attributable Fractions for England*. Liverpool John Moores University, 2008: 1–53.
- Britton A, Nolte E, White IR, et al. A comparison of the alcohol-attributable mortality in four European countries. *Eur J Epidemiol* 2003;18:643–51.
- Grant I, Springbett A, Graham L. *Alcohol Attributable Mortality and Morbidity: Alcohol Population Fractions for Scotland*. Edinburgh: National Services Scotland, 2009: 1–50.
- Corrao G, Rubbiati L, Zambon A, Arico S. Alcohol-attributable and alcohol preventable mortality in Italy. A balance in 1983 and 1996. *Eur J Public Health* 2002; 12:214–23.
- Rehm J, Taylor B, Roerecke M, Patra J. Alcohol consumption and alcohol attributable burden of disease in Switzerland, 2002. *Int J Public Health* 2007;52:383–92.
- Rehm J, Patra J, Taylor B. Harm, benefits, and net effects on mortality of moderate drinking of alcohol among adults in Canada in 2002. *Ann Epidemiol* 2007;17: S81–S86.
- Liang H, Wang J, Xiao H, et al. Estimation of cancer incidence and mortality attributable to alcohol drinking in China. *BMC Public Health* 2010;10:730–5.
- White IR, Altmann DR, Nanchahal K. Alcohol consumption and mortality: modelling risks for men and women at different ages. *BMJ* 2002;235:191–7.
- White IR, Altmann DR, Nanchahal K. Mortality in England and Wales attributable to any drinking, drinking above sensible limits and drinking above lowest-risk level. *Addiction* 2004;99:749–56.
- Pignon JP, Hill C. [Estimation of alcohol-related deaths in France in 1985]. *Gastroenterol Clin Biol* 1991;15:51–6.
- Hill C. Alcohol et risque de cancer. *Actualité et Dossier en Santé Publique* 2000;30:14–7.
- Boffetta M, Tubiana C, Hill C, et al. The causes of cancer in France. *Ann Oncol* 2009; 20:550–5.
- Rey G, Boniol M, Jouglé E. Estimating the number of alcohol-attributable deaths: methodological issues and illustration with French data for 2006. *Addiction* 2010; 105:1018–29.
- Réseau Quêtelet, French Data Archives for Social Sciences, Centre Maurice Halbwachs, France. 2012.
- Turati F, Garavello W, Tramacere I, et al. A meta-analysis of alcohol drinking and oral and pharyngeal cancers. Part 2: results by subsites. *Oral Oncol* 2010;46:720–6.
- Rota M, Bellocchio R, Scotti L, et al. Random effects meta-regression models for studying nonlinear dose-response relationship, with an application to alcohol and esophageal squamous cell carcinoma. *Stat Med* 2010;29:2679–87.
- Fedirko I, Tramacere V, Bagnardi M, et al. Alcohol drinking and colorectal cancer risk: an overall and dose-response meta-analysis of published studies. *Ann Oncol* 2011;22:1958–72.
- Corrao G, Bagnardi V, Zambon A, La Vecchia C. A meta-analysis of alcohol consumption and the risk of 15 diseases. *Prev Med* 2004;38:613–9.
- Islami F, Tramacere I, Rota M, et al. Alcohol drinking and laryngeal cancer: overall and dose-risk relation—a systematic review and meta-analysis. *Oral Oncol* 2010;46: 802–10.
- Key J, Hodgson S, Omar RZ, et al. Meta-analysis of studies of alcohol and breast cancer with consideration of the methodological issues. *Cancer Causes Control* 2006; 17:759–70.
- Gutjahr E, Gmel G, Rehm J. Relation between average alcohol consumption and disease: an overview. *Eur Addict Res* 2001;7:117–27.
- Patra J, Taylor B, Irving H, et al. Alcohol consumption and the risk of morbidity and mortality for different stroke types—a systematic review and meta-analysis. *BMC Public Health* 2010;10:258–69.
- Taylor B, Irving HM, Baliunas D, et al. Alcohol and hypertension: gender differences in dose-response relationships determined through systematic review and meta-analysis. *Addiction* 2009;104:1981–90.
- Irving HM, Samokhvalov AV, Rehm J. Alcohol as a risk factor for pancreatitis. A systematic review and Meta-analysis. *JOP* 2009;10:387–92.
- Baliunas DO, Taylor BJ, Irving H, et al. Alcohol as a risk factor for type 2 diabetes: a systematic review and meta-analysis. *Diabetes Care* 2009;32:2123–32.
- Koppes LL, Dekker JM, Hendriks HF, et al. Moderate alcohol consumption lowers the risk of type 2 diabetes: a meta-analysis of prospective observational studies. *Diabetes Care* 2005;28:719–25.
- Samokhvalov AV, Irving H, Mohapatra S, Rehm J. Alcohol consumption, unprovoked seizures, and epilepsy: a systematic review and meta-analysis. *Epilepsia* 2010;51:1177–84.
- Rehm J, Taylor B, Mohapatra S, et al. Alcohol as a risk factor for liver cirrhosis: a systematic review and meta-analysis. *Drug Alcohol Rev* 2010;29:437–45.
- Hanley JA. A heuristic approach to the formulas for population attributable fraction. *J Epidemiol Community Health* 2001;55:508–14.
- Rehm J, Room R, Monteiro M, et al. Alcohol use. In: Ezzati M, Lopez AD, Rodgers A, Murray CJL, editors. *Comparative Quantification of Health Risks: Global and Regional Burden of Diseases Attributable to Selected Major Risk Factors*. Geneva: World Health Organization, 2004: 959–1108.
- Greenfield TK, Kerr WC. Alcohol measurement methodology in epidemiology: recent advances and opportunities. *Addiction* 2008;103:1082–99.
- Robinson M, Thorpe R, Beeston C, McCartney G. A review of the validity and reliability of alcohol retail sales data for monitoring population levels of alcohol consumption: a Scottish perspective. *Alcohol Alcohol* 2013;48:231–40.
- Holmes J, Meier PS, Booth A, et al. The temporal relationship between per capita alcohol consumption and harm: a systematic review of time lag specifications in aggregate time series analyses. *Drug Alcohol Depend* 2012;123:7–14.
- Roerecke M, Rehm J. Irregular heavy drinking occasions and risk of ischemic heart disease: a systematic review and meta-analysis. *Am J Epidemiol* 2010;171: 33–644.
- Taylor BJ, Shield KD, Rehm JT. Combining best evidence: a novel method to calculate the alcohol-attributable fraction and its variance for injury mortality. *BMC Public Health* 2011;11:265.
- Rota M, Scotti L, Turati F, et al. Alcohol consumption and prostate cancer risk: a meta-analysis of the dose-risk relation. *Eur J Cancer Prev* 2012;21:350–9.
- Tramacere I, Pelucchi C, Bagnardi V, et al. A meta-analysis on alcohol drinking and esophageal and gastric cardia adenocarcinoma risk. *Ann Oncol* 2012;23:287–97.
- Pelucchi C, Galeone C, Tramacere I, et al. Alcohol drinking and bladder cancer risk: a meta-analysis. *Ann Oncol* 2012;23:1586–93.
- WHO Regional Office for Europe. European status report on alcohol and health, Geneva, 2010. Available at: <http://apps.who.int/gho/data/showonly?GISAH®ion=euro#> (18 February 2013, date last accessed).