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The Smoking Epidemic: Death and Sickness among Australian Smokers

Peter D. Finch[a]

Recently I asked a class of eighteen young psychiatrists from the Royal Bethlem Hospital in London what they would do if they decided I was psychotic but was not a danger to self or others, was not jeopardising myself or family economically and did not want their treatment. Most of them felt that under the circumstances it would be their medical responsibility to 'treat' me if I 'needed' treatment, whether I thought I needed it or not. I can see exactly how they got to that position, but, I must admit - and I told them - it scares me.
R.D. Laing. Wisdom, Madness and Folly. MacMillan, 1985, p. 17.

1. Introduction

It is now widely accepted, both in Australia and elsewhere, that smoking leads to illness and premature death, largely because the anti-smoking movement is perceived as having presented compelling arguments that have not been refuted. While that perception has been challenged in Australia, by Finch[1,2], by Johnstone and Ulyatt[3] and more recently by Luik[4], these criticisms have failed to penetrate the mainstream of public awareness. This is not surprising because they involve complex methodological problems of a technical nature that do not normally form part of the public discussion of contentious issues, such as, for example, the extent to which an observed association can be seen as meaning that a cause has been identified, just what data should be used to substantiate one's claims and how that data should be interpreted. Here we consider some of the claims made by the anti-smoking movement, and the public perception of them, without questioning the validity of the figures on which they are based. Instead we focus on what those figures mean for individual smokers, how the risk of death from smoking compares to that from other causes, the way in which ages at death from smoking differ from ages at death attributed to alcohol, illicit drugs and other causes, the annual rates at which each smoker contributes to the huge burdens of mortality and morbidity attributed to tobacco and how those rates compare with those due to other causes.

As we will show below, the overall harmful effects attributed to smoking pose annual risks to the individual smoker that he or she might see as relatively small, in

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[a] *Emeritus Professor of Statistics, Department of Mathematics, Monash University, Melbourne, Australia.*

[1] Peter D. Finch, (a) The Lalonde Doctrine in Action: The Campaign Against Passive Smoking, *Policy*, **6**, No. 2, pages 22-25, (b) The Health Effects of Smoking: Misreading the Evidence, *Policy*, **6**, No. 3, pages 22-25, 1990.
[2] Peter D. Finch, Creative Statistics, *Health, Lifestyle and Environment*, The Social Affairs Unit & Manhattan Institute, 1991, pages 78-86.
[3] J.R. Johnstone and C. Ulyatt, *Health Scare: The Misuse of Science in Public Policy*, Australian Institute for Public Affairs, Perth, 1991.
[4] John Luik, *Smokescreen: 'Passive Smoking' and Public Policy*, Institute of Public Affairs Ltd, Victoria, 1996.

the sense that they might regard themselves as unlucky if they should fall to them. This does not mean that smoking is harmless, nor that its aggregate effects are not large. It says only that the magnitudes of the burdens allegedly caused by smoking represent the large-scale aggregation of relatively small individual effects. To understand how this comes about, it is helpful to keep in mind that a chance of 1 in 500 is about the same as that of tossing 9 heads in a row with a fair coin. But while a particular fair coin tosser is unlikely to obtain only heads in 9 successive tosses, it is still the case that when each of a very large number of people do perform such a series of tosses, many of them will get that extreme result. For example, if there are 3 million such coin tossers then about 6,000 of them will obtain 9 heads in a row. Such large-scale aggregation of small individual effects is well illustrated by the 6,220 deaths said to be caused by tobacco that occurred in 1992 amongst the estimated 3,419,264 Australian male smokers then aged 20 to 69 years[5]; about 1 in every 550 of them succumbing in that way in that year.

The effect of this large-scale aggregation of small individual effects can be seen also in the huge loss of life that has been attributed to smoking. It has been claimed that during 1992 in Australia as many as 88,266 potential person-years of life before 70 years of age were lost because of smoking and it is difficult not to be impressed by the sheer enormity of this figure[5]. But in Australia during 1992 there were an estimated 3,419,264 male ever-smokers and an estimated 2,450,058 female ever-smokers in the 20 to 69 year-old age bracket[5]. Dividing the 88,266 potential person-years of life before 70 years of age in 1992 because of smoking by 5,869,322, the number of ever-smokers between 20 and 69 years of age in that year, shows that this huge loss of life amounts to a yearly $5\frac{1}{2}$ days per ever-smoker in that age-bracket. Since we have ignored smokers who were less than 20 years of age in 1992, the actual yearly loss of potential life before 70 years of age per smoker at risk of contributing to it would be even smaller than $5\frac{1}{2}$ days. The enormity of the 88,266 potential person-years of life lost before 70 years of age does not arise from a correspondingly enormous per person smoking effect but from the fact that one is aggregating a small per person smoking effect over an enormous number of smokers. Even as small an annual smoking penalty as 3 hours of life lost before 70 years of age per ever-smoker aged between 20 and 69 years of age in 1992 would have resulted in smoking being blamed for 2,010 potential person-years of life lost before 70 years of age in that year.

Similarly it is claimed that a large part of the burden of hospital episodes and hospital bed-days is attributable to tobacco. Figures for 1992 suggest that for those aged 20 to 69 years as many as 67,400 hospital episodes and 459,618 hospital bed-days were caused by tobacco[5]. Such large numbers are impressive and seem worrying simply because they are so large. But while they may well estimate the total burdens in question, their magnitudes have to be balanced against the number of people at risk of contributing to them, viz. the number of smokers in the age-bracket

[5] D.R. English, C.D.J. Holman, E. Milne, M.G. Winter, G.K. Hulse, J.P. Codde, B. Corti, V. Dawes, N. de Klerk, M.W. Knuiman, J.J. Kurinczuk, G.F. Lewin and G.A. Ryan, *The Quantification of Drug Caused Morbidity and Mortality in Australia, 1995,* Commonwealth Department of Human Services and Health, Canberra, 1995.

under consideration. This provides a somewhat different perspective. For Australians 20 to 69 years of age in 1992, the 459,618 hospital bed-days, said to be caused by tobacco in that year, average out at only 2 hours 14 minutes for each male smoker and 1 hour 24 minutes for each female smoker; the average duration of the episodes said to be caused by tobacco being about 7 days for male smokers and 6 days for female smokers, about the same as the corresponding average durations of the hospital episodes for tobacco-related diseases and conditions amongst those in the same age-bracket who had never smoked. Expressed in this way the alleged burden of tobacco-caused morbidity seems small rather than large, scarcely enough to justify large punitive taxes on tobacco-products to pay for it and, perhaps, so small as to call into question the reasonableness of claiming that smoking is very harmful.

On the other hand the common perception fostered by the anti-smoking movement is that, on the contrary, smoking is very harmful. There are inter-connecting strands to this perception and among them are a number of firmly held convictions, e.g.

1. Smoking must be harmful because it has been associated with a number of illnesses, e.g. lung cancer, heart disease and stroke.

2. Tobacco is a leading cause of morbidity and premature mortality and is responsible for a correspondingly large burden on hospital services.

3. Smoking kills at unusually young ages and that, as a consequence, the ages at death of smokers are in general younger than those of non-smokers.

4. Smokers usually die when they do because of their smoking and the longer they smoke the more likely it is that smoking rather than something else will kill them.

5. The number of deaths for which smoking is responsible has been accurately determined.

6. The morbidity of smokers places a large unfair burden on hospital services.

7. Smoking is to blame for the smoking-related illnesses experienced by ex-smokers and tobacco companies should be made to compensate them accordingly.

We will examine how far these convictions are supported by the figures about the harmful effects of smoking that are presented in the influential report "The Quantification of Drug Caused Morbidity and Mortality in Australia, 1995" by English et al[5]. For brevity we refer to that report as QDM. To avoid a confusing plethora of data we focus on just one year and choose 1992 because of the ready availability of data for that year. Diamantopoulou[6] discussed tobacco-related morbidity and mortality in Australia for both 1986 and 1992, but not that due to all causes which is also discussed here. We will be concerned in the main with annual

[6] Kathy Diamantopoulou, *Tobacco-Related Mortality and Morbidity in Australia*, Master of Science Thesis, Department of Mathematics, Monash University, Melbourne, Australia, 1996.

morbidity and mortality per person at risk rather than with their aggregate population effects. The reason for this is that we will be comparing annual morbidity and mortality from various causes in differently sized groups of people, viz. smokers and non-smokers of various ages. The total annual burdens of morbidity and mortality that are said to be caused by smoking are indeed huge but, while emphasising their hugeness does serve to amplify the message that smoking is harmful, one cannot compare how those burdens affect different groups of people without allowing for the different sizes of those groups. An appendix presents the basic data and explains how nothing more complicated than simple arithmetic can be used to obtain from it the results presented here. It would be interesting to see the methods described in that appendix used to analyse similar data from countries other than Australia. We have no grounds for suspecting that this would lead to results that are substantially different from those presented here.

The matters discussed in this paper have no direct bearing on the issue of passive smoking, viz. the extent, if any, to which the smoking of smokers harms non-smokers. Controversial issues about passive smoking are discussed in the important paper by Luik[4]. We do not consider them here. The issue here is simply what the figures in the QDM report that claim to say how much morbidity and mortality in Australia during 1992 is to be attributed to active smoking actually say about the annual risks smoking poses to smokers themselves, and how those risks compare to the common background risks due to other causes that smokers share with non-smokers.

2. Is Association with Disease necessarily harmful?

The fact that smoking poses relatively small annual risks to the individual smoker does not contradict claims about how much more risky it is to smoke than not to smoke, because the corresponding annual risks to the individual non-smoker may be very much smaller. Such claims rest largely on studies that estimate relative risks, either of smokers themselves or, in the case of passive smoking, of smokers' non-smoking spouses. But, as noted in Finch[1], relative risk measures the strength of an association; it does not measure how harmful it is. To see this in a neutral non-smoking context, consider the following short story.

In a few years time an accidental by-product of genetic engineering leads to the discovery that certain living vibrating crystals can be manufactured very cheaply. When encased in a suitable holder and inserted in the ear one can hear, just for a few minutes, until body heat kills the crystal, beautiful melodies, rhythms and fascinating counterpoint. They are marketed as aural contrapuntive devices. Since they are cheap and become very popular, the Government taxes them. Users of the device become known as contrapuntists. Some years later a new disease is identified when an increasing number of people drop dead, suddenly, for no apparent reason. Autopsies reveal a strange deterioration in the brain cells of those affected. An observant pathologist notes that in most of her associated post-mortem examinations an aural contrapuntive device was found in an ear of the deceased and the disease

becomes known as SADS, an acronym for Sudden Aural Death Syndrome. Epidemiologists find that people who are not contrapuntists seldom fall victim to SADS and that, in fact, about 98 per cent of all such deaths are either current or former contrapuntists. The strength of association between aural contrapuntism and SADS is undeniable, the relative risk is as high as 50, i.e. a contrapuntist has about 50 times the chance of falling to SADS as does a non-contrapuntist. An anti-contrapuntist health campaign is initiated and aural contrapuntive devices are taxed more and more heavily in an attempt to dissuade people from using them. The campaign is very successful and is vigorously supported by an unexpected alliance between animal liberationists, the music industry and the tone-deaf. Attention then shifts to passive aural contrapuntism, viz. the dangers posed by the sidestream melodic overflow from the devices in the ears of contrapuntists, in particular on the occurrence of SADS in non-contrapuntal spouses of contrapuntal men, the harm contrapuntal parents may do their children and the possible ill-effects suffered by the foetus of a contrapuntal pregnant woman. After great initial success, however, the campaign falters when it becomes widely known that even though aural contrapuntism is so strongly associated with SADS, relatively few contrapuntists die from it each year and those that do have lived, on average, about one year longer than do non-contrapuntists and, moreover, at each age, are much more likely to die of other causes than of SADS itself. Politicians realise very quickly that they can now, with profit, tax aural contrapuntal devices even more heavily.

While this story is an obvious parody it does highlight the fact that the mere existence of a strong association between a particular lifestyle and a fatal disease does not, by itself, mean that a high proportion of those who adopt that lifestyle will succumb to the disease and die at an earlier age than those who do not adopt it. Nevertheless that could be true. We examine now the extent to which it is true of smoking.

3. Tobacco, Alcohol, Illicit Drugs and Other Causes of Mortality and Morbidity

Table 1. Deaths, Person-Years of Life Lost before age 70 years (PYLL), Hospital Episodes and Hospital Bed-days by All Causes, Alcohol, Tobacco and Illicit Drugs in Australia 1992[a]

ATTRIBUTED CAUSE	NO. OF DEATHS	PYLL (before age 70)	HOSPITAL EPISODES	HOSPITAL BED-DAYS
All Causes	123,651	758,917	2,913,538	16,540,136
Alcohol	3,660	55,450	71,593	731,169
Tobacco	18,920	88,266	98,373	812,866
Illicit Drugs	488	17,899	5,390	40,522
Other Causes	100,583	597,302	2,738,182	14,955,579

[a] Source: the Summary Table in QDM[5].

Some informative figures are presented in Table 1. Each entry in the 'other causes' row is the amount by which a combined alcohol, tobacco and illicit drugs figure falls short of the corresponding all causes figure. Except for person-years of life lost before age 70 years (PYLL), the entries are simply the numbers for deaths, hospital episodes and hospital bed-days that are not attributed to alcohol, tobacco and illicit drugs. Strictly speaking, the 'other causes' PYLL entry cannot be interpreted as years lost from other causes because the technical procedure by which PYLL numbers are calculated means that they cannot be added over different risk factors. The 'other causes' PYLL entry is simply the difference between the all causes PYLL and the combined total for alcohol, tobacco and illicit drugs. For brevity, we will refer to it as the 'other causes' PYLL but it should be interpreted as only a balancing deficit. In terms of percentages, alcohol, tobacco and illicit drugs contribute respectively 2.9, 15.3 and 0.4 percent of deaths; 7.3, 11.6 and 2.4 percent of PYLL; 2.5, 3.4 and 0.2 percent of hospital episodes and 4.4, 4.9 and 0.3 percent of hospital bed-days.

Figures such as those in Table 1 have been seen as supporting the claim that tobacco is the leading addictive substance causing death and premature mortality and morbidity, and is responsible for a large burden on hospital services. But all they tell us is that more deaths, more hospital episodes and bed-days are attributed to tobacco than to alcohol and illicit drugs. It is perhaps a matter of predisposition rather than considered judgement to see the excess 3.4 percent of hospital episodes that are said to originate from the large number of ever-smokers, about 50 percent of the adult population, as a disproportionately large burden on hospital services. Moreover we are not given the perspective of corresponding percentages from other specific causes.

For example in Victoria for the year from July 1990 to June 1991, fractures and accidental falls accounted for about 3.1 percent and 2.5 percent respectively of all hospital episodes in that period[7]. For the same period, reported misadventures during surgical and medical care whilst in hospital accounted for about 1.3 percent of hospital episodes with somewhat larger than average annual patient bed-days[7]. However this counts only iatrogenic illness arising after admission into hospital and does not include non-hospital medical injuries that led to hospitalisation in the first place. Moreover reported iatrogenic injuries induced in hospital do not include unreported cases that might have been so classified by an independent external agency. Perhaps that is why higher rates of iatrogenic injury have been reported from the USA where investigations have been carried out by independent external agencies. The 1977 California Medical Association's Medical Insurance Feasibility Study[8] estimated medical injuries to occur in about 4.6 percent of cases and the

[7] Graeme M. Watt, *Hospitalised Injuries Victoria, July 1987-June 1993*, Report No. 67, Monash University Accident Research Centre, Melbourne, Australia, 1995.
[8] California Medical Association, *Report of the Medical Insurance Feasibility Study,* San Francisco, California Medical Association, 1977.

Harvard Medical Practice Study[9] found hospital medical injuries to occur in about 3.7 percent of cases. Both of these rates are comparable to the Australian 1992 percentage of hospital episodes attributed to tobacco. In the same vein it is worth noting that Prescott[10] has argued that higher nursing to patient ratios can decrease patient morbidity and mortality by as much as 5 to 10 percent.

Recognising that causes other than tobacco might impose comparable burdens on hospital services does not exonerate tobacco, but it does help one view the problems posed by it from a wider perspective and hence in a more balanced way. Moreover it raises the possibility that Health Promotion schemes financed by a special tax on tobacco to fund ad hoc health programmes may not be the most advantageous way of using that money. It might for instance yield more immediate and greater benefits to use it to finance higher nursing to patient ratios. Again, while most iatrogenic injuries are not the result of negligence, it may be more sensible, if the American estimates are reliable and applicable here, to improve hospital facilities and provide a less stressful workplace for the medical profession than to fund extensive anti-smoking campaigns and sponsor sporting activities that previously relied on tobacco advertising.

The plain fact is that, by themselves, gross numbers like those in Table 1 serve little purpose other than to provoke shock and horror, and promote unthinking concern about how large they are. To see them in a balanced way we have to see them, not only in the light of other burdens, but also from the perspective of the corresponding numbers of people at risk of contributing to them. For example, while Table 1 states that in 1992 more people died from tobacco than from alcohol, it does not tell us whether there were more or less smokers than drinkers of alcohol; it does not tell us which of alcohol or tobacco is the more likely to kill us; nor indeed does it indicate whether either of them is more or less likely to kill us than are other causes and if so at what sorts of ages. One can give a limited, but nonetheless informative, internal perspective to the figures in Table 1 by dividing each of the PYLL, Hospital Episodes and Hospital Bed-days by the number of deaths in question to give corresponding per death rates. These are presented in Table 2.

Table 2. Person-Years of Life-Lost before age 70 years, Hospital Episodes and Hospital Bed-days PER DEATH by All Causes, Alcohol, Tobacco and Illicit Drugs in Australia 1992

ATTRIBUTED CAUSE	PYLL (before age 70 per death)	HOSPITAL EPISODES per death	HOSPITAL BED-DAYS per death
All Causes	6.1	23.6	133.8
Alcohol	15.2	19.6	199.8
Tobacco	4.7	5.2	43.0

[9] R.A. Brennan, et al., Incidence of Adverse Events and Negligence in Hospitalized Patients: Results of the Harvard Medical Practice Study, *New England Journal of Medicine,* **324**, 1991, pages 370-376.
[10] P.A. Prescott, Nursing: An Important Component of Hospital Survival Under a Reformed Health Care System, *Nursing Economics*, **11**, No. 4, 1993, pages 192-198.

Illicit Drugs	36.7	11.1	83.0
Other Causes	5.9	27.2	148.7

Table 2 shows that the greatest years of life-lost per death were due to illicit drugs whereas the *least* were for tobacco-attributed deaths. Moreover the PYLL per death for tobacco-attributed deaths was almost 1.5 years *less* than that for all causes and over 14 months *less* than that for causes other than alcohol, tobacco and illicit drugs. There were almost 4 times *more* hospital episodes per death due to alcohol than due to tobacco and over 5 times *more* hospital episodes per death from other causes than from tobacco. Furthermore there were almost 5 times as many bed-days per death spent in hospital due to alcohol than due to tobacco and almost 3.5 times as many hospital bed-days per death from other causes as from tobacco. Thus the figures in Table 2 reveal that the per death loss of life and the per death burden on hospital services that are said to be due to tobacco are in fact *smaller* than those due to each of alcohol, illicit drugs and other causes. This does not mean that people would live longer or have shorter hospital episodes if they smoked, but it does call into question the extent to which the gross numbers in Table 1 can be said to portray tobacco as a leading cause of mortality and morbidity.

One might be tempted to say that on the contrary Table 2 suggests that if only more people smoked then there would be fewer person-years of life lost before 70 years of age and a much smaller burden on hospital services. But amongst the deaths from other causes are those of children and infants unlikely to die from smoking and these young deaths could contribute substantially to the all cause and 'other causes' PYLL, thereby inflating the corresponding per death rates. The effect of such age differences is examined in the next section.

4. Ages-at-Death Patterns

We present ages-at-death patterns for males in figure 1 and for females in figure 2 by plotting the percentage of deaths in question by age and cause of death. To interpret these figures observe that figure 1 tells us that about 21 percent of male deaths from alcohol occur in the 25-44 years age group whereas that age group accounts for almost 70 percent of the male deaths from illicit drugs, about 2 percent of tobacco-related male deaths and about 6 percent of male deaths from other causes. Inspection of figures 1 and 2 shows that, for both males and females, the age-distribution of deaths from tobacco is similar in shape to that from causes other than tobacco, alcohol and illicit drugs, both of them suggesting steady increases with age, whereas those for alcohol and illicit drugs are markedly different in shape, though for alcohol the disparity is less extreme in females.

Figures 1 and 2 suggest that the deaths attributed to alcohol and to illicit drugs form two separate subgroups of all deaths, both of which are distinguished by an unusual pattern of ages-at-death. In both cases it is the abnormality of that pattern which indicates that something unusual might be going on and suggests one search for

underlying reasons, perhaps alcohol abuse in the one case and the abuse of illicit drugs in the other but, at a deeper level, perhaps social factors such as unemployment, a childhood history of sexual or physical abuse and so on.

FIGURE 1: Percentage of MALE Deaths by AGE and CAUSE OF DEATH in Australia, 1992

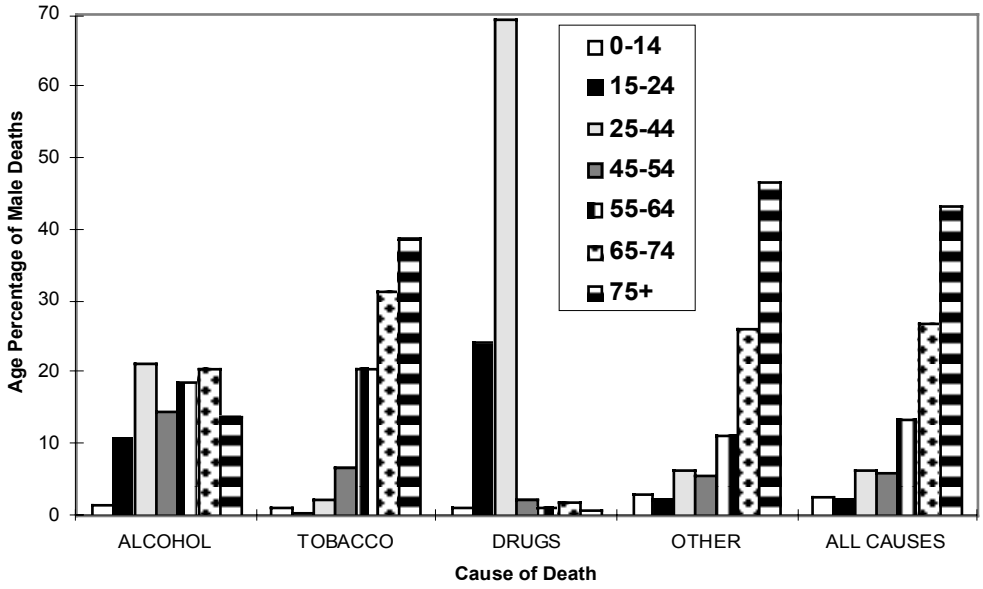
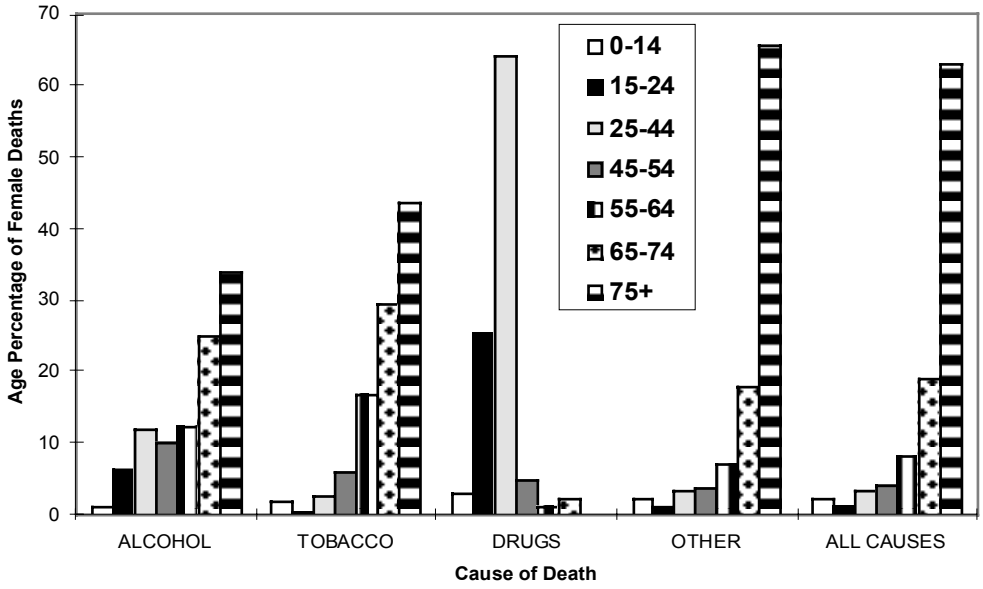


FIGURE 2: Percentage of FEMALE Deaths by AGE and CAUSE OF DEATH in Australia, 1992



The disparity between the ages-at-death patterns for tobacco and all causes is not so immediately eye-catching and, on closer analysis, seems to have a number of conflicting interpretations. For although those patterns do have roughly similar shapes, there is an indication that the proportion of tobacco deaths occurring after 74

years of age is smaller than the corresponding proportion of all causes deaths, in fact about 39 percent and 43 percent for males, 44 percent and 63 percent for females. This could be seen as suggesting that tobacco kills an undue proportion of smokers before they can reach 75 years of age, especially female smokers. On the other hand the same sort of logic could be seen as suggesting, on the contrary, that tobacco use provides some protection against other causes of death, at least for males, because about 90 percent of the male tobacco deaths occur after 54 years of age whereas only about 83 percent of both all causes and other causes do so. But for females the corresponding three proportions are all much the same, each of them is about 90 percent, and it could be argued that the alleged protective effect for males arises because other causes account for a much higher proportion of male deaths before 45 years of age than they do for corresponding female deaths, viz. about 11 percent against 3.1 percent for males and only 5.9 percent against 4.4 percent for females. Nevertheless it would be difficult to claim, on those grounds alone, that the alleged effect for males is harmful, even if one did not see it as protective. In the same vein one could note that for males the proportion of deaths at age 65 years or more is, at about 70 percent, much the same for both tobacco and all causes, whereas for females all causes now accounts for the higher proportion, viz. 82 percent as against only 73 percent.

The ambiguous message in these conflicting results calls into question the extent to which the ages-at-death pattern for tobacco can be said to be substantially different from that for all causes. By itself this does not mean that smoking is relatively harmless because it is conceivable that an avoidable cause of death, while causing death at about the same ages as do other harmful but unavoidable causes, does so more frequently. But it does make it problematical that the label 'tobacco-use' does in fact identify a definite subgroup of the general population that is characterised by markedly unusual ages-at-death, as might be claimed for the labels 'alcohol use' and 'illicit drug use'. In other words it suggests that there is perhaps something amiss with the common perception that smoking kills at younger ages than is normal and that, as a consequence, the age at death of a smoker is, in general, younger than that of a non-smoker.

Table 3. Age-at-Death Patterns and Nominal Mean Age at Death for ages 25 to 74 years for Tobacco and Causes other than Tobacco and Illicit Drugs in Australia 1992

Age Group (yrs)	MALES		FEMALES	
	Tobacco (%)	Other[a] (%)	Tobacco (%)	Other[a] (%)
25-29	0.17	3.00	0.39	1.52
30-34	0.45	3.43	0.79	2.18
35-39	0.92	3.29	1.11	2.64
40-44	2.16	4.02	2.33	3.86
45-49	4.04	4.83	3.98	4.99
50-54	6.98	6.12	6.81	6.63

55-59	11.79	8.44	11.00	8.89
60-64	21.84	14.06	19.75	13.61
65-69	25.08	23.62	23.30	22.87
70-74	26.57	29.18	30.54	32.83
25-74	100	100	100	100
Mean age at death in yrs	63.66	61.13	63.77	62.45

[a]Causes other than tobacco and illicit drugs.

To investigate that perception more closely, Table 3 gives the Australian ages-at-death patterns in the 25 to 74 years old age-bracket for tobacco and causes other than tobacco and illicit drugs by sex for the year 1992. We restrict ourselves to those ages to avoid the biasing effect of the higher proportion of deaths at less than 25 years of age that are attributed to other causes, viz. for males 4.9 percent as against only 0.9 percent for those attributed to tobacco and, for females, 2.8 percent as against 1.9 percent. It should be noted, however, that 38.6 percent of the male and 43.5 percent of the female tobacco deaths, and 46.5 percent of the male and 65.6 percent of the female other causes deaths occur after 74 years of age. We also give nominal mean ages at death for both causal categories. These were obtained by supposing that deaths are uniformly spread throughout each age group, so that its average age at death is its mid-point. Multiplying each mid-point by the corresponding percentage of deaths and adding over age-groups gives the nominal mean age at death for the category in question. For the age range in question, this Table shows that of those who allegedly died because of tobacco, the males had lived on average a little over 2 years and six months longer and the females on average about 1 year and 4 months longer than those who had died from causes other than tobacco and illicit drugs. While this casts doubt on the correctness of the perception that smokers die at unusually young ages it does not mean than an individual smoker is likely to live a little longer than a comparable non-smoker, because proportionally more smokers than non-smokers may die in a given year. At most it says only that in 1992, dead smokers in the 25 to 74 years old age-bracket died on average at an older age than did comparable dead non-smokers. It could still be the case that in any given year a live smoker is more likely to become a dead smoker than a similarly aged live non-smoker is to become a dead non-smoker. It needs to be noted too that if one considers only the 45 to 74 year old age-bracket, then one does find that the nominal mean age at death for deaths attributed to smoking is smaller than that due to other causes, by nearly 7.5 months for males and 4.5 months for females. This reinforces the overall impression that smoking deaths do not occur in the main at young ages but from middle age onwards and then at about the same sorts of ages as do deaths from other causes.

This could be seen as confirming our earlier suspicions about Table 2, viz. that the more favourable per death person-years of life lost for tobacco may well reflect only differences between ages at death; tobacco accounting for proportionally fewer young deaths than do causes other than alcohol, tobacco and illicit drugs. However it does so in a way that calls into question procedures that inflate the total burdens imposed by tobacco by including such young deaths. It seems a matter of predisposition to include them, and so obtain a larger estimate of the total burdens tobacco imposes, but to ignore the fact that the corresponding per death rates then put tobacco in a more favourable light than other causes of death. Moreover the fact that to turn the balance against tobacco one has to focus on the 45 to 74 years age-bracket, where the estimated differences in nominal mean age at death are, in any event, at most a matter of a few months, does not support the common perception that tobacco kills at considerably younger ages than do other causes. It might, of course, be objected that the smokers in question, though hardy enough to resist other causes of death that long, would have lived even longer had they not smoked. But such an objection, though

possibly true, adds little of substance because it is nothing more than a tautology to note that people would have lived longer than they did had they not died, when they did, from the particular causes that did kill them; this is as true of a death due to a motor vehicle accident as it is of one allegedly due to tobacco.

5. How Frequently does Smoking Kill?

While deaths allegedly caused by tobacco do not occur at ages that are predominantly very much younger than those of deaths from causes other than alcohol, tobacco and illicit drugs, it could still be the case that, at each age, the death rate among smokers is higher than it is among non-smokers. If that is true, then at each age smokers face, in addition to those risks of dying at that age which they share with non-smokers, an excess risk of death at that age which, because the non-smoker avoids it, could be attributed to something that is closely associated with smoking, perhaps indeed simply to smoking itself. That there is such an excess risk and that it is due to smoking is the principal message of the anti-smoking movement. It is not our purpose here to question the correctness of that message but, granting it, to estimate the magnitudes of the risks in question.

Table 4 gives annual death rates by age and sex, first for deaths from tobacco-related conditions split into two separate groups, those due to some cause other than smoking itself and those among past and present smokers that are attributed to smoking, and then for all causes of death, including conditions that have not been related to smoking but excluding smoking itself. These death rates are compared in Table 5, firstly by comparing ever-smokers and never-smokers vis-a-vis their respective death rates from tobacco-related conditions and secondly by comparing the ever-smokers' chance of dying from causes other than smoking with that of their dying because of their smoking. The first relative risk in Table 5 is the overall death rate for ever-smokers, viz. the sum of the two rates for tobacco-related conditions in Table 4, divided by the first of them, viz. the death rate for never-smokers. It assesses how much more likely an ever-smoker is to die of a tobacco-related condition than is a never-smoker of the same age and sex, and is the figure usually stated in warnings about the harmfulness of smoking. The second relative risk in Table 5 is simply the death rate for ever-smoker deaths caused by something other than smoking divided by the corresponding rate for those that are caused by smoking. For each age group it assesses how much more likely an ever-smoker is to die from causes other than smoking than he or she is to die because of smoking.

Table 4. Annual Death Rates: In tobacco-related conditions both for causes other than smoking, among smokers and non-smokers alike, and those among ever-smokers because of their smoking, together with those for all conditions, other than smoking, among smokers and non-smokers alike, by Age and Sex in Australia 1992

	MALES			FEMALES		
	Tobacco-Related Conditions		All Conditions	Tobacco-Related Conditions		All Conditions
Age Group (yrs)	Causes other than smoking among smokers & non-smokers	Caused by smoking among ever smokers	Causes other than smoking among smokers & non-smokers	Causes other than smoking among smokers & non-smokers	Caused by smoking among ever smokers	Causes other than smoking among smokers & non-smokers
20-24	1 in 45,405	1 in 35,888	1 in 850	1 in 50,458	1 in 39,481	1 in 2,411
25-29	1 in 36,450	1 in 27,702	1 in 791	1 in 34,434	1 in 32,618	1 in 2,433
30-34	1 in 14,808	1 in 11,265	1 in 769	1 in 19,072	1 in 16,570	1 in 1,887
35-39	1 in 7,244	1 in 5,390	1 in 739	1 in 11,649	1 in 9,634	1 in 1,453
40-44	1 in 3,073	1 in 2,171	1 in 581	1 in 5,738	1 in 4,093	1 in 974
45-49	1 in 1,623	1 in 1,071	1 in 422	1 in 3,150	1 in 2,183	1 in 620
50-54	1 in 815	1 in 487	1 in 266	1 in 1,602	1 in 865	1 in 376
55-59	1 in 433	1 in 265	1 in 167	1 in 804	1 in 460	1 in 244
60-64	1 in 226	1 in 142	1 in 99	1 in 426	1 in 241	1 in 160
65-69	1 in 102	1 in 116	1 in 54	1 in 201	1 in 194	1 in 92
70-74	1 in 58	1 in 75	1 in 33	1 in 102	1 in 119	1 in 53
75-79	1 in 32	1 in 49	1 in 19	1 in 50	1 in 70	1 in 29
80 plus	1 in 15	1 in 28	1 in 9	1 in 15	1 in 36	1 in 10
20 plus	1 in 243	1 in 273	1 in 121	1 in 221	1 in 530	1 in 123
20-69	1 in 800	1 in 550	1 in 282	1 in 1,462	1 in 1,258	1 in 469

Table 5. Annual Relative Risks by Age and Sex for Australia 1992 that an ever smoker has of dying (1) from a tobacco-related condition and (2) from causes other than smoking rather than because of his or her smoking

Age	MALES		FEMALES	
Group (yrs)	(1)	(2)	(1)	(2)
20-24	2.3	42.2	2.3	16.4
25-29	2.3	35.0	2.1	13.4
30-34	2.3	14.7	2.2	8.8
35-39	2.3	7.3	2.2	6.6
40-44	2.4	3.7	2.4	4.2
45-49	2.5	2.5	2.4	3.5
50-54	2.7	1.8	2.9	2.3
55-59	2.6	1.6	2.7	1.9
60-64	2.6	1.4	2.8	1.5
65-69	1.9	2.1	2.0	2.1
70-74	1.8	2.3	1.9	2.2
75-79	1.7	2.6	1.7	2.4
80 plus	1.5	3.0	1.4	3.5
20 plus	1.9	2.3	1.4	4.3
20-69	2.5	1.9	2.2	2.7

These two Tables need to be studied together. The first thing to notice is that Table 5 shows that for male ever-smokers of all ages the annual relative risk of dying from a tobacco-related condition fluctuates about 2, roughly the overall value of all male ever-smokers 20 years of age or older, sometimes above it, sometimes below it, increasing with age up to 64 years and thereafter decreasing with age. Female ever-smokers exhibit a similar but slightly more variable pattern with a somewhat overall lower relative risk of 1.4. For both sexes the relative risk peaks between 50 and 64 years of age. But while, for both sexes, these relative risks remain roughly constant at all ages before 65 years, Table 4 shows that the magnitude of the underlying actual risk to the ever-smoker varies enormously with age. For both sexes the actual annual risk that smoking will kill an ever-smoker at an early age is quite small, of the order of 1 in 30,000 before 30 years of age, about the same sort of chance as that of throwing 15 heads in a row with a fair coin. This annual risk increases steadily with age. By 60 years of age it has risen to 1 in 142 for males and 1 in 241 for females, about the same respective odds as those of throwing only 7 and 8 heads in a row with a fair coin. As they approach 70 years of age about 1 in every 100 male ever-smokers and 1 in every 200 female ever-smokers die each year because of their smoking and the corresponding figures for those who reach their eighties are 1 in 28 for males and 1 in 36 for females. At all ages ever-smokers of both sexes are more likely to die of causes other than smoking than they are to die because of their smoking and until they reach 40 years of age considerably more likely to do so. Overall, male ever-smokers are each year more than twice as likely, and female ever-smokers over four times as likely, to do so.

While what is deemed to be rare on the one hand and common on the other are largely matters of taste and colouring, it is nevertheless true that we regard young adult male deaths as rare events even though they occur needlessly often. Since deaths among 20 to 24 year old males from causes other than smoking occur among smokers and non-smokers alike at an annual rate of 1 in 850, it is consistent with ordinary linguistic usage to regard deaths that occur at an annual rate that is less than 1 in 1,000 as rare events. The terminology is also consistent with medical practice. For example in the 1970s anticipated mortality rates of one per thousand from diagnostic coronary arteriography were seen as acceptable because iatrogenic death would occur from it only rarely and its benefits would outweigh the small risk involved[11]. With that terminology in mind, Table 4 shows that deaths from tobacco-related conditions are rare before 45 years of age for males and before 50 years of age for females, among both smokers and non-smokers. Moreover smoking rarely kills male ever-smokers before 50 years of age and female ever-smokers before 55 years of age, and does so very rarely at earlier ages. While deaths attributed to smoking do occur much more frequently with increasing age, so too do deaths from other causes and it is not clear how the ever-smoker's age-increasing annual risk of death due to his or her smoking should be apportioned between smoking on the one hand and simply aging on the other. The anti-smoking movement's message that smoking kills has to be interpreted from the balanced perspective of not only how likely it is to do

[11] Richard Taylor, *Medicine Out of Control*, Sun Books, Melbourne, 1979, page 63.

so but of how likely it is that other causes will pre-empt that possibility by leading to death before it eventuates. For instance, while it may be a cause of concern to a 65 to 69 year old male ever-smoker and to a 70 to 74 year old female ever-smoker to be told that they have a yearly chance of about 1 in 100 that their smoking will kill them, that particular concern will not, perhaps, seem quite so overwhelming when they learn that, in any event, they also have about a 1 in 50 chance that they will die from other causes. To put the extreme case, an 80 plus year old ever-smoker is unlikely to be overly concerned that he or she has about a 1 in 30 yearly chance that it is their smoking that will kill them, when the yearly chance that other causes will do so is about 1 in 10.

The stark message that "smoking kills" deliberately suppresses salient facts about when and how likely it is to do so in order to evoke a fearful response. For the young and middle-aged ever-smoker the chance of it doing so soon are very small and, in the light of the much bigger chance of dying from other causes, perhaps too small to worry about. For the older ever-smoker the likelihood of imminent death due to smoking, though no longer small, is overshadowed by the concomitant higher chance of impending death from other causes. For ever-smokers of all ages the risk that their smoking will kill them is always less than the risk of dying from other causes, even if it is additional to it. If never-smokers have age-specific chances of imminent death that are small enough for them to go through life without constantly fretting about when death will come, then it seems just as reasonable that the ever-smoker should not be overly concerned about the even smaller additional chance that smoking may be the cause of his or her death.

6. How Accurate are the Figures?

The preceding comparison of smoker and non-smoker death rates is based on the estimated 1992 age-specific deaths attributable to tobacco that are given by English et al. in their QDM report[5]; those estimates were obtained by a "Condition-Specific Analysis". The report also considers another way of estimating those deaths viz. an "All-Cause Mortality Analysis". That analysis gives larger numbers of deaths at young ages, fewer deaths among the oldest, and overall it gives a smaller total number of deaths that can be attributed to tobacco; for those aged 35 years or more, 12,546 such deaths compared to the 18,775 of them attributed to tobacco by the Condition-Specific Analysis. It should come as no surprise that anti-smoking propaganda uses the higher estimate as the authoritative figure, and does not mention the smaller one, even though English et al[5]. do point out that both methods have limitations and that each has its strengths and weaknesses. But of the two estimates one is 50 percent larger than the other and, in the face of that, the layman might well wonder at the accuracy and usefulness of the two statistical methods that purport to estimate the number of deaths caused by smoking. The attitude of the anti-smoking lobby seems to be that the large disparity between the two methods of estimation is of no importance because even with the smaller estimate it can still be claimed that smoking kills a lot of people. While this may well be true it misses the point that it is difficult

to be sure of the accuracy of either method when the discrepancy between them is so large. It is misleading to select one of the estimates to support one's prior convictions and then disregard the other. Perhaps the 'true' number of deaths caused by smoking is even bigger than the higher estimate or even smaller than the lower estimate. One simply doesn't know. It should be noted that the issue here is not the accuracy of a prediction, in the face of great uncertainty, about what might happen,; it is the accuracy of postdiction about what has already happened. If the Bureau of Meteorology stated that *yesterday's* recorded maximum temperature was 45^0C on one thermometer but was 30^0C on another, then one might well question the usefulness of one or other thermometer, perhaps even both. It would rightly be considered unsatisfactory to argue that, while they each had strengths and weaknesses, it didn't matter whether or not the thermometers were entirely accurate because both of them indicate that it was pretty warm yesterday and that is what we want to claim in order to persuade tourists to visit us.

The plain fact is that in medicine it is sometimes difficult to be very confident about the accuracy of one's postdictory estimates. Different methods of estimation can give different estimates. It serves neither medicine itself nor the general public well to create an illusion of accuracy by selecting one set of estimates as authoritative and use them to bolster one's prior convictions. To illustrate this and emphasise that the figures in Tables 4 and 5 should not be regarded as anything more than suggestive guidelines, Table 6 gives the results of analysing the same underlying mortality data in another way. The problem addressed in Table 6 is the same as that considered in Table 4, viz. how do the age-specific death rates due to smoking compare with those of non-smokers and those from other causes? The difference is that we now split ever-smokers into those who are ex-smokers and those who are still smoking, and use an "All-Cause Mortality Analysis" to obtain the death rates in question.

To compare Tables 4 and 6 it is helpful to start with Table 6 and, ignoring its figures for current and ex-smokers, to focus only on the remaining columns which purport to estimate the same quantities as their named counterparts in Table 4. For both sexes, the death rates among smokers and non-smokers from causes other than smoking are on the whole a little smaller in Table 4 than they are in Table 6, whether we focus on tobacco-related conditions only or on all causes of death other than smoking. In compensation the death rates among ever-smokers for deaths caused by smoking tend to be higher in Table 4 than they are in Table 6, markedly so at older ages, and for both sexes are over two and a half times bigger when all age groups are combined; 1 in 273 against 1 in 727 for males and 1 in 530 against 1 in 1,437 for females. This illustrates quite clearly how dependent one's estimates can be on the method adopted for their estimation.

Perhaps the most notable feature of Table 6 is that, for both sexes, ex-smokers in each age group have a very much smaller risk of dying because of their smoking than do comparable current smokers, suggesting that ceasing to smoke leads to an effective reduction in the risk of death that is associated with smoking. But this leads to inconsistencies between some of the estimates in Table 6 and their counterparts in

Table 4. For if the ex-smokers of an age group are dying, because of their smoking, at a lower rate that its current smokers, then so too should its ever-smokers since these consist of its ex-smokers together with its current smokers. While this is true within Table 6 itself, the Table 4 estimates of the ever-smoker death rates due to smoking are not always lower than the Table 6 estimates of those for current smokers; for males that is true for those 20 to 54 years of age but it is false for those 55 years of age and older, for females it is everywhere false except for the 75 to 79 year old age group.

Table 6. Annual Death Rates using All-Causes Mortality Analysis, 1992

MALES	**TOBACCO-RELATED CONDITIONS**				**ALL CONDITIONS**
	Causes other than smoking among smokers & non-smokers	Caused by smoking among			Causes other than smoking among smokers & non-smokers
Age		**ever**	**ex**	**current**	
20-24	1 in 47,358	1 in 33,666	1 in 287,796	1 in 27,383	1 in 850
25-29	1 in 36,183	1 in 27,982	1 in 168,939	1 in 20,934	1 in 791
30-34	1 in 14,135	1 in 12,001	1 in 61,715	1 in 8,076	1 in 767
35-39	1 in 6,793	1 in 5,853	1 in 25,215	1 in 3,815	1 in 734
40-44	1 in 2,710	1 in 2,573	1 in 9,719	1 in 1,522	1 in 566
45-49	1 in 1,360	1 in 1,331	1 in 5,208	1 in 777	1 in 402
50-54	1 in 633	1 in 663	1 in 2,646	1 in 363	1 in 244
55-59	1 in 324	1 in 374	1 in 1,380	1 in 185	1 in 148
60-64	1 in 167	1 in 206	1 in 687	1 in 94	1 in 86
65-69	1 in 67	1 in 581	1 in 656	1 in 455	1 in 42
70-74	1 in 40	1 in 375	1 in 404	1 in 305	1 in 26
75-79	1 in 24	1 in 214	1 in 247	1 in 129	1 in 16
80 plus	1 in 12	1 in 104	1 in 123	1 in 58	1 in 8
20 plus	1 in 180	1 in 727	1 in 903	1 in 616	1 in 103
20-69	1 in 569	1 in 1,005	1 in 2,077	1 in 708	1 in 247
FEMALES	**TOBACCO-RELATED CONDITIONS**				**ALL CONDITIONS**
	Causes other than smoking among smokers & non-smokers	Caused by smoking among			Causes other than smoking among smokers & non-smokers
Age		**ever**	**ex**	**current**	
20-24	1 in 39,888	1 in 67,170	1 in 207,318	1 in 53,822	1 in 2,381
25-29	1 in 28,851	1 in 50,323	1 in 107,189	1 in 38,351	1 in 2,401
30-34	1 in 15,486	1 in 27,617	1 in 61,604	1 in 20,065	1 in 1,845
35-39	1 in 9,490	1 in 16,777	1 in 34,352	1 in 12,384	1 in 1,413
40-44	1 in 4,427	1 in 8,350	1 in 21,178	1 in 5,760	1 in 927
45-49	1 in 2,358	1 in 4,523	1 in 9,836	1 in 3,107	1 in 581
50-54	1 in 1,124	1 in 2,124	1 in 5,163	1 in 1,473	1 in 342
55-59	1 in 578	1 in 1,089	1 in 2,147	1 in 764	1 in 218
60-64	1 in 305	1 in 629	1 in 1,192	1 in 422	1 in 139
65-69	1 in 161	1 in 581	1 in 3,178	1 in 256	1 in 83
70-74	1 in 86	1 in 302	1 in 1,648	1 in 132	1 in 49
75-79	1 in 45	1 in 170	1 in 779	1 in 68	1 in 28
80 plus	1 in 15	1 in 125	n.a.[a]	1 in 20	1 in 10

20 plus	1 in 199	1 in 1,437	1 in 4,750	1 in 941	1 in 115
20-69	1 in 1,112	1 in 3,207	1 in 6,729	1 in 2,353	1 in 426

[a]No deaths attributed to smoking among the female ex-smokers aged 80 years or more.

Table 7. Annual Relative Risks by Age and Sex for Australia 1992 that a current smoker has of dying (1) from a tobacco-related condition and (2) from causes other than smoking rather than because of his or her smoking, calculated by an "All-Cause Mortality Analysis"

Age	MALES		FEMALES	
Group (yrs)	(1)	(2)	(1)	(2)
20-24	2.7	32.2	1.7	22.6
25-29	2.7	26.5	1.8	16.0
30-34	2.8	10.5	1.8	10.9
35-39	2.8	5.2	1.8	8.8
40-44	2.8	2.7	1.8	6.2
45-49	2.8	1.9	1.8	5.3
50-54	2.7	1.5	1.8	4.3
55-59	2.7	1.3	1.8	3.5
60-64	2.8	1.1	1.7	3.0
65-69	1.1	10.8	1.6	3.1
70-74	1.1	11.5	1.7	2.7
75-79	1.2	8.2	1.7	2.5
80 plus	1.2	7.2	1.7	2.1
20 plus	1.3	6.0	1.2	8.1
20-69	1.8	2.9	1.5	5.5

Table 7 gives the "All-Cause Mortality Analysis" estimates of the age-specific relative risks that a current smoker dies from a tobacco-related condition, when compared to a peer never-smoker, and the relative risks that assess how much more likely a current smoker is to die from a cause other than smoking than he or she is to die because of their smoking. It is analogous to Table 5 which gives the corresponding estimates for ever-smokers calculated by a "Condition-Specific Analysis". Disparities between the two Tables are obvious. For example, from Table 5 both male and female ever-smokers aged 65 to 69 years are estimated to be about twice as likely to die soon of a tobacco-related condition as is a never-smoker, whereas for the current smokers in that age-group Table 7 gives not higher estimates, as one might expect, but lower estimates. Again from Table 5, a male ever-smoker of the same age-group is about twice as likely to die soon of a cause other than smoking as he is to die soon because of his smoking, whereas Table 7 says that if he is a current smoker he is almost 11 times more likely to do so.

The discrepancy between the two methods of analysis is disturbing because it makes it difficult to set much store by either of them. Nevertheless there is broad agreement that the risk of imminent death due to smoking, though initially very small, increases steadily with age in concert with that from all other causes. Moreover the relative risks in Table 7 suggest that at all ages both male and female current smokers, and not just the ever-smokers as in Table 5, are more likely to die of causes other than smoking than from their smoking itself, though only marginally so for male smokers in their early sixties. For the young and middle-aged current smoker, the chance of

being killed soon by his or her smoking is remote and very much smaller than the chance of early death due to other causes. For the older current smoker the likelihood of imminent death due to smoking, though no longer remote, is overshadowed by the concomitant higher chance of impending death from other causes. Perhaps the Government message on tobacco-products that "smoking kills" would be closer to the truth if it were emended to read "smoking may kill, but relatively infrequently". Even so, it might be said, the large-scale aggregation of the morbidity associated with smoking imposes an intolerable and unfair burden on hospital services. In the next section we examine the extent to which that is so.

7. Is the Smoker's Morbidity an Unfair Burden on Hospital Services?

As we noted at the beginning of this paper, the anti-smoking movement usually presents the total number of hospital bed-days that are attributed to smoking as if its size alone will move us to see that the virtual elimination of smoking is needed to free the hospital system from that burden. But one does not even need to look at the figures in question to see that this could be a seriously misleading argument. If the burdens a person imposes on hospital services increase with aging, then presumably both smokers who quit smoking, and those who do not now take up smoking because of the perceived danger to their health, are expected to live longer than they would otherwise have done. As they age and eventually become victims of the morbidity due to causes other than smoking, they will enter into the hospital system at older ages than they would have done and at that time, they will impose correspondingly heavier burdens on hospital services. That this is indeed the case is shown very clearly when one compares the age-specific per person annual hospital bed-days rates of smokers and non-smokers, instead of just citing the total number of hospital bed-days for which smoking is claimed to be responsible.

Table 8. Annual HOURS IN HOSPITAL PER PERSON: In tobacco-related conditions both for causes other than smoking, among smokers and non-smokers alike, and those among ever smokers because of their smoking, together with those for all causes of morbidity, other than smoking, among smokers and non-smokers alike, by Age and Sex in Australia 1992

	MALES			FEMALES		
	Tobacco-Related Conditions		All Causes of Morbidity	Tobacco-Related Conditions		All Causes of Morbidity
Age Group (Yrs)	Causes other than smoking among smokers & non-smokers	Caused by smoking among ever smokers	Causes other than smoking among smokers & non-smokers	Causes other than smoking among smokers & non-smokers	Caused by smoking among ever smokers	Causes other than smoking among smokers & non-smokers
20-24	0.2	0.1	8.3	1.2	0.3	16.8
25-29	0.2	0.2	10.3	1.7	0.5	24.5
30-34	0.3	0.3	10.6	1.5	0.5	23.1
35-39	0.5	0.4	10.7	0.9	0.5	16.8
40-44	0.7	0.8	10.9	0.7	0.7	14.9
45-49	1.2	1.5	14.0	0.7	0.9	16.9
50-54	2.1	2.8	18.3	1.3	1.9	19.7
55-59	4.0	5.1	23.4	2.2	3.4	24.3
60-64	6.2	8.2	35.7	3.9	5.7	30.7
65-69	11.7	8.3	48.4	8.1	6.7	43.2
70-74	16.5	11.6	66.1	11.6	8.9	58.9
75-79	25.9	16.9	93.3	21.0	14.3	93.0
80 plus	32.9	19.3	139.5	36.9	18.4	143.1
20 plus	3.8	3.5	22.8	4.5	2.3	31.2
20-69	1.9	2.2	16.0	1.9	1.4	21.7

Table 8 gives the annual hours in hospital per person at risk by age and sex first for tobacco-related conditions, both for those not caused by smoking and those that are, and second for all causes of morbidity other than smoking. Annual per person hospital bed-hours rates do increase with age and, at all ages and for both sexes, the rates due to causes other than smoking are much higher than those due to smoking. The aim of the anti-smoking movement is to delete eventually both the male and female columns of morbidity caused by smoking. But if that goal were achieved, then the people in question would remain at risk from causes of morbidity other than smoking and, if they remained healthy longer for not smoking, they would contribute to 'All Causes' columns in another year at a later age. Thus would-be smokers who had been persuaded never to smoke would swell the ranks of the older age groups where the per person rates at which hospital services are needed to treat morbidity for causes other than smoking are much larger than the would-have-been rates had they smoked and, because of it, become ill earlier. For example, males in the 55 to 59 year old age group who had they smoked would each contribute, on average, about 9 hospital bed-hours to the annual total, would, if they survived as non-smokers to the next age-group, then contribute, on average, almost 36 bed-hours to the annual total, a four-fold increase in the burden in question. If they survived even longer the annual burden would increase further. The only way in which this annual increase could fail to eventuate would be if all the would-have-been smokers became non-smoking

victims of smoking-related conditions shortly after they would have done so as smokers, and that would call into question the extent to which smoking could be seen as a cause of those conditions.

Of course this annual increase has to be set against the possibility that the morbidity then commencing at a later age does not last as long as that which, with smoking, would have occurred at an earlier one. But while the preceding example of male smokers 55 to 59 years of age shifting to higher age groups, and further examination of Table 8, suggest that there would, on balance, still be an overall increase, the possibility in question does highlight the fact that annual figures, whether they be the total numbers favoured by the anti-smoking movement or the rates used here, do not give the whole picture.

It is difficult to see morbidity attributed to smoking as a burden on hospital services, let alone an unfair one, when without smoking the long-run overall burden would, in all likelihood, be considerably higher than it is now. Smokers who have allegedly died prematurely because of their smoking might, if they had not smoked, now be aged members of the population consuming many hospital bed-days. But while one would agree that premature death and sickness due to smoking is regrettable, and accept that people should not smoke if they want to be healthy and live longer, the claim that eliminating smoking will reduce the need for hospital services is misleading; on the contrary, in the long run it is likely to increase the need for them.

It is worth noting that annual per person hospital bed-days rates are much lower for tobacco-related conditions than they are for all causes other than smoking. But annual bed-days per episode are generally a little higher for tobacco-related conditions than they are for all causes other than smoking, even though the former account for fewer annual bed-days per person. Episodes due to conditions that are not related to smoking occur at a higher rate than those due to conditions that are so related but, on average, each of them involves slightly fewer hospital bed-days. We omit the details.

Finally it should be kept in mind that while the morbidity rates in Table 8 are informative guidelines they should not be regarded as any more accurate than the corresponding mortality rates in Table 4.

There have been several attempts to estimate the monetary costs that are said to result from the harmful effects of cigarette smoking. For example Collins and Lapley[12] estimated that the economic costs of tobacco added up to 12,736.2 million dollars in 1992, but ACIL[13] estimated that they were 8,600 million dollars for 1992-93 and the National Centre for Health Program Evaluation and the Australian Institute

[12] D.J. Collins and H.M. Lapsley, *The Social Costs of Drug Abuse in Australia in 1988 and 1992,* Canberra: Australian Government Publishing Service, 1996.
[13] *Smoking Costs and Benefits for Australia*, Canberra: ACIL Economics Policy Pty Ltd, 1994.

of Health[14] found a much lower cost for 1989-90, viz. 1,300 million dollars. The disparity between these estimates does little to suggest that any of them should be accepted with confidence. It should be noted that when Doran, Sanson-Fisher and Gordon[15] compared the publicly financed health care expenditure attributed to smoking with the tobacco taxes paid by smokers they found that the taxation benefit to the government was more than 3 times the cost of that expenditure. Since they also found that medical costs accounted for 57 percent of the government health care expenditure attributed to smoking, tobacco taxes amount to more than five times the medical costs attributed to smoking.

The principal difficulty with current estimates of the costs attributed to smoking is that they do not address the right question. That question is not just "how much does smoking cost now?". For while that amount might well be a short-term gain, should people not smoke, it has to be balanced against the future cost of health care for them if they do not smoke. There would be a long-term financial loss if the people in question then required even greater publicly financed health care expenditure in the future. This could well be the case because Table 8 shows that per-person time spent in hospital escalates with age and is much greater for causes other than smoking than it is for smoking. Figures for the present cost of smoking that are obtained by cost-benefit analyses which adopt a short-term horizon are meaningless by themselves. To determine if eradicating the so-called smoking epidemic would lead to eventual monetary gains or to eventual financial losses, one needs comparative cost-benefit analyses with long-term horizons that compare health costs with smoking against those without it.

8. Leading Causes of Death due to Smoking

The tobacco-related diseases that account for the greatest number of deaths due to smoking are Lung Cancer, Ischaemic Heart Disease (IHD), Stroke and Chronic Obstructive Pulmonary Disease (COPD). Tables 9 and 10 give annual death rates for those diseases by age and sex, first among current smokers due to their smoking and then the corresponding baseline rates for both smokers and non-smokers that are due to causes other than smoking. For brevity we have excluded the very low annual death rates before 40 years of age. The corresponding annual death rates for both smokers and non-smokers from all conditions that are due to causes other than smoking are the condition-specific estimates in Table 4, not the all-cause mortality estimates of Table 6.

[14] Australian Institute of Health and Welfare, *Australia's Health 1994:* the fourth biennial report of the Australian Institute of Health and Welfare, AGPS, Canberra, 1994.
[15] Christopher M. Doran, Rob W. Sanson-Fisher and Moira Gordon, A Cost-Benefit Analysis of the Average Smoker: a Government Perspective, *Australian and New Zealand Journal of Public Health,* **20**, No. 6, 1996, pages 607-611.

Table 9. Annual Death Rates for Lung Cancer, Ischaemic Heart Disease (IHD), Stroke and Chronic Obstructive Pulmonary Disease (COPD), among male current smokers due to smoking and among both smoking and non-smoking males due to causes other than smoking, by Age in Australia 1992

Age Group	Annual death rates among male current smokers due to smoking				Annual death rates among smoking and non-smoking males due to causes other than smoking			
(yrs)	Lung Cancer	IHD	Stroke	COPD	Lung Cancer	IHD	Stroke	COPD
40-44	1 in 8,410	1 in 2,701	1 in 12,538	1 in 100,431	1 in 97,406	1 in 5,702	1 in 26,706	1 in 909,118
45-49	1 in 3,108	1 in 1,334	1 in 7,992	1 in 40,744	1 in 39,328	1 in 2,818	1 in 16,715	1 in 367,064
50-54	1 in 1,132	1 in 663	1 in 4,981	1 in 8,118	1 in 12,762	1 in 1,398	1 in 10,601	1 in 70,979
55-59	1 in 554	1 in 382	1 in 2,303	1 in 2,984	1 in 6,390	1 in 787	1 in 4,931	1 in 27,815
60-64	1 in 310	1 in 199	1 in 1,251	1 in 937	1 in 3,610	1 in 422	1 in 2,602	1 in 8,708
65-69	1 in 188	1 in 264	1 in 1,264	1 in 416	1 in 2,420	1 in 172	1 in 844	1 in 3,865
70-74	1 in 134	1 in 153	1 in 636	1 in 210	1 in 1,547	1 in 99	1 in 418	1 in 1,859
75-79	1 in 107	1 in 84	1 in 260	1 in 105	1 in 1,272	1 in 58	1 in 181	1 in 941
80plus	1 in 93	1 in 45	1 in 112	1 in 56	1 in 1,109	1 in 30	1 in 76	1 in 493

Table 10. Annual Death Rates for Lung Cancer, Ischaemic Heart Disease (IHD), Stroke and Chronic Obstructive Pulmonary Disease (COPD), among female current smokers due to smoking and among both smoking and non-smoking females due to causes other than smoking, by Age in Australia 1992

Age Group	Annual death rates among female current smokers due to smoking				Annual death rates among smoking and non-smoking females due to causes other than smoking			
(yrs)	Lung Cancer	IHD	Stroke	COPD	Lung Cancer	IHD	Stroke	COPD
40-44	1 in 10,369	1 in 10,621	1 in 15,417	1 in 299,882	1 in 107,101	1 in 22,667	1 in 31,891	1 in 2,570,420
45-49	1 in 4,624	1 in 6,130	1 in 7,111	1 in 52,567	1 in 47,790	1 in 12,966	1 in 15,266	1 in 468,343
50-54	1 in 1,818	1 in 2,424	1 in 4,035	1 in 5,519	1 in 19,081	1 in 5,063	1 in 8,577	1 in 48,025
55-59	1 in 1,092	1 in 959	1 in 2,932	1 in 2,368	1 in 11,161	1 in 2,037	1 in 6,131	1 in 20,680
60-64	1 in 574	1 in 499	1 in 1,412	1 in 1,100	1 in 6,176	1 in 1,065	1 in 2,931	1 in 10,018
65-69	1 in 366	1 in 652	1 in 1,889	1 in 501	1 in 3,832	1 in 414	1 in 1,213	1 in 4,600
70-74	1 in 299	1 in 301	1 in 902	1 in 305	1 in 3,068	1 in 198	1 in 601	1 in 2,639
75-79	1 in 195	1 in 147	1 in 347	1 in 187	1 in 2,043	1 in 98	1 in 233	1 in 1,584
80plus	1 in 173	1 in 45	1 in 80	1 in 94	1 in 1,713	1 in 34	1 in 59	1 in 837

Non-smoking males and females rarely die from lung cancer whereas current smokers of both sexes do so much more frequently. Deaths from ischaemic heart disease rarely occur before 65 years of age in non-smoking females or before 55 years of age in non-smoking males, but deaths from that disease are not uncommon 10 years earlier among female current smokers and 5 years earlier among male current smokers. While smoking-caused deaths from stroke are rare among both male and female current smokers before 70 years of age, current smokers of both sexes experience, at all ages, higher death rates from stroke than do their non-smoking peers. Death from chronic obstructive pulmonary disease is rare before 80 years of age in non-smoking females and rare before 75 years of age in non-smoking males, but deaths from that disease are not uncommon 15 years earlier among current smokers of both sexes, at 65 years of age for females and 60 years of age for males. If one accepts these figures unreservedly, as we do here, they paint a convincing picture that smoking can kill and that, in particular, many deaths due to lung cancer, ischaemic heart disease, stroke and chronic obstructive pulmonary disease are caused by smoking. Even so it is instructive to examine them further, to highlight how much more at risk a current smoker is than is a never-smoking peer, to verify that giving up smoking does achieve a reduction in those risks and then, for each of the four diseases

now under consideration, to compare the current smoker's risk of dying from it because of his or her smoking with that of dying from causes other than smoking.

Table 11. By age and sex, current smoker annual relative risks of death from each of Lung Cancer, Ischaemic Heart Disease (IHD), Stroke and Chronic Obstructive Pulmonary Disease (COPD) compared to peer never-smokers with, in parentheses, the corresponding annual relative risks for ex-smokers, Australia, 1992

Age Group (yrs)	MALES				FEMALES			
	Lung Cancer	IHD	Stroke	COPD	Lung Cancer	IHD	Stroke	COPD
40-44	12.6 (6.5)	3.1 (1.4)	3.1 (1.3)	10.1 (6.9)	11.3 (5.0)	3.1 (1.5)	3.1 (1.3)	9.6 (6.5)
45-49	13.7 (7.0)	3.1 (1.5)	3.1 (1.3)	10.0 (6.9)	11.3 (5.0)	3.1 (1.5)	3.1 (1.3)	9.9 (6.7)
50-54	12.3 (6.4)	3.1 (1.4)	3.1 (1.3)	9.7 (6.6)	11.5 (5.1)	3.1 (1.5)	3.1 (1.3)	9.7 (6.6)
55-59	12.5 (6.5)	3.1 (1.4)	3.1 (1.3)	10.3 (7.1)	11.2 (5.1)	3.1 (1.4)	3.1 (1.3)	9.7 (6.8)
60-64	12.6 (6.5)	3.1 (1.5)	3.1 (1.3)	10.3 (7.0)	11.8 (5.2)	3.1 (1.5)	3.1 (1.3)	10.1 (6.8)
65-69	13.9 (7.2)	1.7 (1.1)	1.7 (1.2)	10.3 (7.0)	11.5 (5.0)	1.6 (1.1)	1.6 (1.2)	10.2 (6.9)
70-74	12.5 (6.5)	1.6 (1.1)	1.7 (1.2)	9.9 (6.8)	11.3 (5.0)	1.7 (1.1)	1.7 (1.2)	9.6 (6.6)
75-79	12.9 (6.7)	1.7 (1.1)	1.7 (1.1)	10.0 (6.7)	11.5 (5.0)	1.7 (1.1)	1.7 (1.2)	9.5 (6.5)
80 plus	12.9 (6.6)	1.7 (1.1)	1.7 (1.1)	9.8 (6.7)	10.9 (4.9)	1.7 (1.1)	1.7 (1.1)	9.9 (6.7)

Table 11 compares current smokers to those of the same sex and similar age who have never smoked by giving the current smoker's annual relative risk of death from each of lung cancer, ischaemic heart disease, stroke and chronic obstructive pulmonary disease. These are the type of relative risk that are often quoted to emphasise that smoking is harmful. But it is a mistake to interpret a large such relative risk as more harmful than a smaller one. For instance, a 50 to 54 year old male current smoker has nearly 10 times the risk of dying from chronic obstructive pulmonary disease as does a peer never-smoker, but he is only about 3 times as likely to die of ischaemic heart disease; nevertheless, as Table 9 shows, among male current smokers of that age group the annual death rate from ischaemic heart disease that is due to smoking is some 12 times larger than it is for chronic obstructive pulmonary disease. Inspection of Tables 9, 10 and 11 reveals many other instances of the fact that relative risks like those in Table 11 measure the strength of the underlying association, not its harmfulness. The annual relative risks in parentheses in Table 11 are those for ex-smokers; the fact that these are less than those of current smokers confirms that ceasing to smoke does reduce the risks in question. The effect of this reduction is displayed in Table 12 which gives, by age, sex and disease, the percentage reductions in annual death rates due to smoking that are enjoyed by ex-smokers. Percentage reductions in relative risks do not necessarily translate into comparable percentage reductions in annual death rates. For example, ex-smoker males aged 60 to 64 years enjoy a 48 percent reduction in their lung cancer relative risk and about a 53 percent reduction in their lung cancer annual death rate due to smoking, but the 52 percent reduction in their ischaemic heart disease relative risk translates into a 78 percent reduction in their corresponding annual death rate due to smoking.

Table 12. Percentage reductions in annual death rates due to smoking enjoyed by ex-smokers by age, sex and disease, Australia (1992)

Age Group (yrs)	MALES				FEMALES			
	Lung Cancer	IHD	Stroke	COPD	Lung Cancer	IHD	Stroke	COPD
40-44	52.3	79.9	86.0	35.3	60.8	78.8	87.3	36.0
45-49	52.2	78.0	86.6	34.5	61.2	77.8	85.6	36.0
50-54	52.3	79.9	85.3	35.9	61.0	77.8	87.1	36.1
55-59	52.3	78.9	86.1	34.9	60.1	80.1	84.0	33.6
60-64	52.5	78.0	85.8	35.4	60.7	77.6	85.0	35.9
65-69	52.2	82.7	75.7	35.8	61.9	83.9	75.8	35.5
70-74	52.0	79.9	76.6	35.1	61.1	83.9	75.9	35.7
75-79	52.3	82.1	79.1	36.2	61.6	82.4	73.7	34.6
80 plus	52.9	81.3	78.2	35.7	60.4	80.8	80.8	36.1

Table 11 testifies to the strength of the association between smoking and the four leading causes of deaths due to smoking, and Table 12 testifies to the fact that those who quit smoking have substantially lower death rates from those diseases, because of their past smoking, than do those who continue to smoke. It is facts such as these that have provided strong motivation for the public health policy adopted by the anti-smoking movement. But the constant reiteration of the dangers to health associated with smoking has fostered a climate in which it is politically correct that smokers should be fearful that they are very likely to die prematurely from lung cancer, ischaemic heart disease, stroke or chronic obstructive pulmonary disease because of their smoking. This seems to have engendered a general perception that smokers are much more likely to die of those diseases because of their smoking than they are to die from a cause other than smoking. This is not so. We saw earlier that even though smokers do have a greater risk of dying from a tobacco-related condition than do non-smokers, it is still the case that smokers are more likely to die from causes other than smoking than they are to die because of their smoking; and, as we shall now see, the same is true of each of the four leading causes of death that have been associated with smoking. Table 13 gives, by age, sex and disease, the annual relative risks that indicate how much more likely a current smoker is to die because of something other than smoking than he or she is to die of the disease in question because of his of her smoking.

Table 13. Annual Relative Risk by age, sex, and disease, that a current smoker dies from a cause other than smoking rather than of the disease in question because of his smoking, Australia (1992)

Age Group (yrs)	MALES				FEMALES			
	Lung Cancer	IHD	Stroke	COPD	Lung Cancer	IHD	Stroke	COPD
40-44	14.5	4.7	21.6	172.9	10.6	10.9	15.8	308.0
45-49	7.4	3.2	18.9	96.6	7.5	9.9	11.5	84.8
50-54	4.2	2.5	18.7	30.5	4.8	6.5	10.7	14.7
55-59	3.3	2.3	13.8	17.9	4.5	3.9	12.0	9.7
60-64	3.1	2.0	12.7	9.5	3.6	3.1	8.9	6.9
65-69	3.5	4.9	23.4	7.7	4.0	7.1	20.4	5.4
70-74	4.1	4.6	19.3	6.4	5.6	5.7	16.9	5.7
75-79	5.6	4.4	13.7	5.5	6.6	5.0	11.8	6.4
80 plus	10.2	4.9	12.2	6.1	17.0	4.5	7.8	9.2

Table 13 shows that, for each of the four leading diseases associated with smoking, current smokers of all ages are more likely to die of causes other than smoking than from the disease in question because of their smoking. But the actual values of the relative risks in that Table are not so revealing as an examination of the individual death rates that they compare, viz. the disease-specific annual death rates due to smoking in Tables 9 and 10 and the overall annual death rates from all causes other than smoking in Table 4. When one does compare those annual death rates it becomes apparent that interpretation of them depends very much on age. For the older current smoker, the disease-specific annual death rates due to smoking, though non-negligible increments on the corresponding baseline rates for those who have never smoked, may well seem relatively inconsequential in view of just how likely he or she is to die soon of some cause other than smoking. For example, a 70 to 74 year old female current smoker, whilst accepting that annually about 1 in 300 of her peers will die from ischaemic heart disease because of their smoking, may not see this as a risk to be overly concerned about in view of the fact that each year about 1 in 50 of her peer group will die from some cause other than smoking. For the younger current smoker imminent death from one of the four leading diseases because of his or her smoking may well be seen as only a remote possibility. The chance of it is not very large and, indeed, much smaller than the chance that a similarly aged non-smoking acquaintance of the same sex will die soon from some cause other than smoking; an event which is itself likely to be seen as unexpected and somewhat uncommon, even though one knows that it does happen from time to time. For current smokers who are 55 to 64 years old the situation is somewhat different, particularly for males. Their disease-specific annual death rates due to smoking are no longer all that small and their corresponding annual death rates due to causes other than smoking are not yet so high that they overshadow them. But it is not immediately clear whether the smaller imbalance between those death rates is due to the fact that smoking poses greater risks to smokers at those ages or is simply an aging effect associated with becoming older. We will examine this question in the next section. In any event even

current smokers in the 55 to 64 year old age bracket are also more likely to die of some cause other than smoking than they are to die from one of the four leading diseases associated with smoking, because of their smoking.

9. Aging, Present-Smoking and Duration of Smoking

In Tables 4, 9 and 10 the annual death-rates due to smoking increase rapidly with age and, on the assumption that in the main older smokers have been smoking longer than younger ones, it is possible that some part of that increase is associated with how long people have been smoking. One would not expect all of the increase to be explained in that way because the annual death rates from causes other than smoking also increase with age, and it might be anticipated that aging, present-smoking and duration of smoking are all involved in the fact that annual death rates due to smoking do increase with age. If the longer people smoke does increase their chance of dying because of their smoking, over and above any increases that may be due either to their present smoking or simply to their aging, then one would expect older smokers to be less favourably placed than younger smokers with respect to their peers of the same age and sex who have never smoked. In other words one would expect that the smokers' age-specific relative risks of dying from a tobacco-related condition and, in particular, those for the four leading diseases associated with smoking, would also increase with age. But the relevant relative risks in Tables 5, 7 and 11 do not exhibit this expected increase with age. Indeed the strength of the association with smoking seems to be largely independent of age except that in Table 5 there is a suggestion that it may be weaker in the higher age groups, a pattern that is reproduced for ischaemic heart disease and stroke in Table 11. The overall impression is that duration of smoking is not itself a risk factor but that the increase with age in the annual death rates due to smoking is an aging effect superimposed on a more or less constant age-independent smoking effect. For example, looking at the lung cancer relative risks in Table 11, it is as if for each current-smoker lung cancer death due to causes other than smoking, Lachesis selects by lot a fixed number of other current smokers of a similar age, about 12 for males and about 10 for females, and then Atropos severs the threads of their lives by decreeing that because of their smoking they too must die soon of lung cancer. The aging effect arises because the current-smoker death rate due to causes other than smoking itself increases with age and the roughly age-independent constancy of the smoking effect corresponds to the fact that for each of those deaths Lachesis selects about the same number of similarly aged current smoker victims of the same sex to die because of their smoking, irrespective of the age of the current-smoker death due to causes other than smoking that is then in question.

The relative risks for chronic obstructive pulmonary disease exhibit a similar age-independent pattern, though for that disease Lachesis is not as vindictive towards current smokers as she is for lung cancer and does not then distinguish quite so sharply between the sexes. The corresponding patterns for ischaemic heart disease and stroke are virtually the same, not only as each other but also for both sexes. But

for both diseases and both sexes there is a marked downward shift in the level of constancy at 65 years of age, moreover Lachesis is much less vindictive towards current smokers, victimising only about two of them for each current-smoker death before 65 years of age that is not due to smoking and, at older ages, choosing on average about one victim for every two such deaths. Thus the post 65 years of age Lachesis smoking effect for ischaemic heart disease and stroke is not a large one. When all the tobacco-related conditions are combined, as in Table 5 and 7, the same downward shifting pattern at 65 years of age is evident for both sexes in the ever-smoker relative risks of Table 5 and again in Table 7 for male current smokers, but for female current smokers that downward shift is so slight that it is barely discernible.

Thus contrary to what is commonly believed, duration of smoking does not seem to be a major risk factor in death due to smoking, either when all tobacco-related conditions are combined or when the four major causes of death associated with smoking are considered individually. Recent claims that even small amounts of cigarette smoke can damage a vital gene that affords protection against smoking do not seem to fit well with the roughly constant Lachesis smoking effect. For if damage to such a gene caused by smoking was a key factor in the development of lung cancer in smokers, then one would expect that the longer a person smoked the greater his or her chance of incurring such damage and that this would be manifested in a relationship between duration of smoking and lung cancer in smokers. But the figures seem to suggest that among current smokers the increase with age in their annual death rates due to smoking is an aging effect superimposed on a more or less constant Lachesis smoking effect that is independent of age. If the harmful effects of smoking were cumulative, then one would expect Lachesis to discriminate against older smokers by victimising more of them per death due to causes other than smoking than she does with younger people, on the grounds that they have probably been smoking longer, but on the contrary she does not seem to do so. In particular the small imbalance between the 55 to 64 year old smokers' annual death rates due to smoking and their corresponding annual death rates due to causes other than smoking, which we noted at the end of the last section, can be seen as largely an aging effect associated with the higher death rates of all people at those ages. Current smokers in that age group experience about the same relative risk of death per baseline never-smoker death of a similar age as do both their younger and their older current smoking colleagues. Nevertheless there is a sense in which current smokers do experience a slightly greater actual risk of death due to smoking as they become older. But this has nothing to do with an age-increasing virulence in the mechanisms by which smoking causes death, it is simply a population size effect related to the decreasing size of age groups as age increases. It arises because even though in each age group Lachesis does select the same number of current smoker victims for each smoker death due to causes other than smoking, she does so by lot from the current smokers of that group. Older age groups are usually smaller than younger ones and typically have fewer current smokers. Thus Lachesis is selecting victims by lot from populations that decrease in size with age and, at any casting of her lot, a current smoker in an older age group has a greater chance of then being chosen as a victim

than he or she had at a younger age, simply because there are now fewer potential victims to chose from.

The ex-smoker figures in Table 11 suggest that the age-independent Lachesis constant smoking effect can persist to an appreciable extent among ex-smokers of both sexes, particularly in lung cancer and chronic obstructive pulmonary disease, though it does so hardly at all for ischaemic heart disease and stroke. This is consistent with the finding that lung cancer risks depend strongly on smoking habits in early adult life[16]. The lung cancer figures in Table 12 support that finding because the fact that almost 48 percent of the lung cancer deaths among current smokers that are due to their smoking are not avoided by ceasing to smoke suggests that early smoking may be their cause. But the remaining 52 percent of smoking lung cancer deaths cannot be explained in that way because they are avoided by ceasing to smoke. While the constancy of the lung cancer Lachesis smoking effect with age does not conflict with the belief that "smoking seems to affect both the early and late stages of lung carcinogenesis"[17], it does suggest that the onset of those stages may not be related all that strongly to how long a person has been smoking. Similarly the fact that almost 65 percent of the COPD deaths among current smokers that are due to their smoking are not avoided by ceasing to smoke suggests that early smoking habits may be their cause also. On the other hand it does not seem likely that ischaemic heart disease and stroke are strongly related to early smoking since those who quit smoking avoid about 80 percent of the deaths from those diseases that are caused by smoking.

Nevertheless it is puzzling that the strength of the association between smoking and premature death should be largely independent of age, except possibly for higher age groups where for some diseases it actually decreases. Generally in science, the discovery that something does remain more or less constant points either to an underlying 'law of nature' or to an artefact produced by the way one has obtained or processed the data in question. But it is difficult to see the Lachesis constant smoking effect as a law of nature which is in someway related to biological mechanisms that link smoking to disease; because this would seem to suggest that very similar mechanisms are at work over a broad spectrum of diseases, but with varying intensities. While similar biological mechanisms might be called into play for lung cancer and chronic obstructive pulmonary disease on the one hand, and for ischaemic heart disease and stroke on the other, it does not seem quite so plausible that there is a mechanism aroused by smoking that is common to the development of all four diseases; although, of course, one cannot rule out the possibility that this could be so. But the fact that the harmful effects of smoking are manifested by relative risks of dying that are largely independent of age, not only in each of the four leading tobacco-related diseases but also for all tobacco-related conditions combined, and not only for current smokers but also for those who have stopped smoking, does raise the possibility that there is a systematic bias throughout all age groups due, perhaps, to

[16] R. Doll and R. Peto, *The Causes of Cancer,* Oxford University Press, New York, 1981, page 1293.
[17] R. Doll and R. Peto, *The Causes of Cancer,* Oxford University Press, New York, 1981, page 1291.

confounding smoking with other factors. Eysenck[18] suggested that the relationship of personality not only to susceptibility to disease but also to the likelihood of both smoking and ceasing to smoke, might be such a factor. Again social class might have some role to play because it is well-known that social class is associated with susceptibility to disease and that smoking is also associated with social class. But while such alternative explanations would, if validated, ameliorate the role of tobacco in disease, they would not eradicate it entirely. Even if it should turn out, that smoking is not quite as harmful as has been claimed, the figures presented in the preceding section suggest that many of the smoker deaths from the four leading tobacco-related causes might be prevented by persuading smokers to quit smoking. This is seen by many people as prima facie evidence that even more deaths would be prevented if that practice was not taken up in the first place; even if there are other, as yet undetermined, factors that contribute to smoker deaths.

10. Is smoking nearly always to blame for smokers' illnesses?

Anti-smoking propaganda has created a climate in which the mortality and morbidity of smokers from smoking-related diseases are seen as being almost entirely due to their smoking. But not all of it can be attributed to smoking. Some of it is due to those other causes that impinge upon smokers just as they do upon non-smokers. Yet, from time to time, one still hears the suggestion that smokers should not have the same access as non-smokers to certain medical treatments, as if there can be no doubt that it is always their smoking that is to blame for their condition. In the same vein, class actions for compensation from tobacco companies seem to be based on the supposition that any smoker with a tobacco-related condition is more likely to be so afflicted because of his or her smoking than because of something else. In this section we examine the extent to which the mortality and morbidity of smokers from tobacco-related conditions can be said to support such attitudes.

Table 14. For tobacco-related conditions among ever-smokers in Australia 1992, the percentage proportion of deaths, hospital episodes and hospital bed-days that are attributed to smoking, by age and sex. ("Condition-Specific" Analysis)

Age Group (yrs)	Deaths		Episodes		Bed-days	
	Male	Female	Male	Female	Male	Female
20-24	55.9	56.1	45.0	23.4	45.3	22.7
25-29	56.8	51.4	46.9	22.5	44.5	21.0
30-34	56.8	53.5	47.8	25.2	48.3	25.3
35-39	57.3	54.7	51.6	32.8	48.6	34.0
40-44	58.6	58.4	53.5	45.6	53.7	48.6
45-49	60.3	59.1	55.3	53.8	56.1	55.8

[18] H.J. Eysenck, *The Causes and Effects of Smoking*, Maurice Temple Smith, London, 1980.

50-54	62.6	64.9	56.3	57.5	56.9	58.9
55-59	62.0	63.6	55.9	58.7	56.1	60.6
60-64	61.3	63.8	56.2	58.4	56.9	59.4
65-69	46.9	50.8	40.2	44.8	41.4	45.5
70-74	43.5	46.1	40.5	42.6	41.3	43.3
75-79	39.4	41.7	39.4	41.8	39.4	40.5
80 plus	35.4	30.2	38.3	36.4	37.0	33.3
20 plus	44.8	42.9	46.5	40.0	45.3	41.6

Table 14 gives the percentages that correspond to the proportions of ever-smoker deaths, ever-smoker hospital episodes and ever-smoker hospital bed-days due to tobacco-related conditions that are claimed to be caused by smoking rather than by something else. For the combined age group of all those 20 or more years of age, the percentages show that if one is given an adverse ever-smoker event associated with a tobacco-related condition, whether it be a death, a hospital episode or bed-days in hospital, then the balance of probability points not to smoking but to some cause other than smoking as the more likely culprit. This is also true for those 65 or more years of age, with the possible exception of a female ever-smoker death from a tobacco-related condition in the 65 to 69 year old age-bracket. But it is not true of all age groups. For the age groups in which the percentage in question exceeds 50 per cent, the balance of probability points the other way, to smoking rather than to something else as the more likely culprit. But even then the balance is not heavily weighted towards smoking; at their highest the odds are only slightly more than 6 to 4 in favour of smoking being the likely culprit. The figures in Table 14 do not suggest that one can be all that sure that smoking, and not something else, is to blame for an adverse ever-smoker event associated with a tobacco-related condition, whether it be a death, a hospital episode or bed-days in hospital. The indictment of tobacco is at most somewhat marginal and even that may depend strongly on the fact that the percentages in Table 14 are based on the so-called "Condition-Specific Analysis"[5], for as noted in section 6 the alternative "All-Cause Mortality Analysis" gives slightly different results. To investigate that possibility Table 15 presents the results of using that alternative methodology to calculate for each category, ever-smoker, ex-smoker and current smoker, the proportion of deaths from tobacco-related conditions in that category which have been attributed to tobacco. As explained in the Appendix, in that analysis the corresponding proportions for morbidity are numerically the same as those for mortality.

Table 15. For tobacco-related conditions among smokers in Australia 1992, the percentage of mortality and morbidity that is attributed to smoking, by age and sex. ("All-Cause Mortality" Analysis)

Age Group (yrs)	Smoking Status: Males			Smoking Status: Females		
	Ex	Current	Ever	Ex	Current	Ever
20-24	14.1	63.4	58.4	16.1	42.6	37.3
25-29	17.6	63.3	56.4	21.2	42.9	36.4

30-34	18.6	63.6	54.1	20.1	43.6	35.9
35-39	21.2	64.0	53.7	21.6	43.4	36.1
40-44	21.8	64.0	51.3	17.3	43.5	34.7
45-49	20.7	63.7	50.6	19.3	43.1	34.3
50-54	19.3	63.6	48.8	17.9	43.3	34.6
55-59	19.0	63.6	46.4	21.2	43.1	34.7
60-64	19.5	63.9	44.7	20.4	42.0	32.7
65-69	9.2	12.8	10.3	4.8	38.6	21.7
70-74	9.0	11.7	9.7	5.0	39.4	22.3
75-79	8.8	15.5	10.0	5.5	39.7	21.0
80 plus	9.0	17.4	10.4	-	42.2	10.5

There is considerable disparity between the ever-smoker percentages in Table 15 and those in Table 14, and this illustrates once again how dependent one's estimates can be on the method adopted for their calculation. In particular the percentages for females in Table 15 are all less than 50 percent. According to that Table, even the death of a female *current* smoker from a tobacco-related condition is, at all ages, more likely to have been caused by something other than smoking than it is to have been caused by her smoking. The same is true for male ever-smokers 50 or more years of age. Table 15 provides little support for the belief than when an ever-smoker dies from a tobacco-related condition it is more likely that smoking rather than something else was to blame. What small support there is pertains only to male ever-smoker deaths from tobacco-related conditions at ages younger than 45 years of age which, in any event, as Table 6 shows, occur only rarely, in each smoker category. On the other hand Table 15 does support the view that male current-smoker deaths from tobacco-related conditions before 65 years of age are mainly due to their smoking, but only by odds of little more than 6 to 4 in favour of smoking being the culprit. Against this, however, that Table also says that the odds are more than 8 to 1 against smoking being the cause of such a death when it occurs at 65 or more years of age.

We do not know which of the ever-smoker figures in Tables 14 and 15 are closer to the truth. If the true picture lies somewhere between the two extremes of those Tables, then one is left with few grounds for claiming that mortality and morbidity from tobacco-related conditions amongst ever-smokers are due mainly to their smoking; except possibly for younger males where, in any event, their occurrence is quite rare.

Perhaps the most informative feature of Table 15 is that it suggests that death and sickness from tobacco-related conditions amongst ex-smokers of all ages are very largely due to causes other than their having smoked. Overall the odds *against* smoking being to blame for their condition are of the order 9 to 1 for males and 20 to 1 for females. This is dramatic testimony to the benefits to be enjoyed by those who quit smoking. Indeed those benefits seem so great that they cast doubt on the merits of class actions for the compensation of ex-smokers who have experienced adverse events from tobacco-related conditions unless, perhaps, they occurred before or fairly

soon after they had stopped smoking. While it is not clear how soon is 'fairly soon', the possibility that smoking poses roughly constant age-independent relative risks and that duration of smoking per se is not a major risk factor are clearly relevant factors.

While these results show that there is little overall evidence to suggest that smoking is predominantly to blame for the adverse events among smokers that are due to tobacco-related conditions, when these are considered in combination, it could still be true that smoking is very largely to blame for those events in specific tobacco-related diseases. Table 16 presents by age and sex the common percentage of mortality and morbidity due to lung cancer among ex-smokers and current smokers that is attributed to smoking. The corresponding percentages for chronic obstructive pulmonary disease are virtually the same as those for lung cancer and we do not reproduce them here. These figures show that smoking is very largely to blame for lung cancer and chronic obstructive pulmonary disease, even among ex-smokers.

Table 16. For lung cancer among ex-smokers and current-smokers in Australia 1992, the percentage of mortality and morbidity that is attributed to smoking by age and sex

Age Group (yrs)	Males		Females	
	Ex-Smokers	Current-Smokers	Ex-Smokers	Current-Smokers
20-24	84.5	92.3	79.6	91.0
25-29	85.3	92.2	80.4	91.4
30-34	85.1	92.3	80.6	91.3
35-39	84.5	92.1	81.0	91.4
40-44	84.7	92.1	80.2	91.2
45-49	85.8	92.7	80.0	91.2
50-54	84.3	91.9	80.4	91.3
55-59	84.6	92.0	80.3	91.1
60-64	84.7	92.1	80.9	91.5
65-69	86.0	92.8	80.0	91.3
70-74	84.7	92.0	80.0	91.1
75-79	85.0	92.2	80.1	91.3
80 plus	84.8	92.2	79.7	90.8

Table 17. For ischaemic heart disease among ex-smokers and current-smokers in Australia 1992, the percentage of mortality and morbidity that is attributed to smoking by age and sex

Age Group (yrs)	Males		Females	
	Ex-Smokers	Current-Smokers	Ex-Smokers	Current-Smokers
20-24	26.4	67.5	28.8	67.5
25-29	32.3	68.0	31.6	68.0
30-34	29.4	67.4	29.7	68.1
35-39	30.7	67.8	31.2	68.1
40-44	29.8	67.9	31.2	68.1
45-49	31.7	67.9	32.0	67.9
50-54	29.8	67.8	31.7	67.6
55-59	30.2	67.3	29.7	68.0
60-64	31.9	68.0	32.4	68.1
65-69	10.1	39.4	9.3	38.8
70-74	11.5	39.4	9.6	39.7
75-79	11.0	40.7	10.5	40.0
80 plus	11.1	40.1	12.5	42.7

However this is not true of ischaemic heart disease and stroke. Table 17 presents by age and sex the common percentage of mortality and morbidity due to ischaemic heart disease among ex-smokers and current smokers that is attributed to smoking. The corresponding percentages for stroke are so like those for ischaemic heart disease

that we do not reproduce them. For ex-smokers of both sexes, but particularly for those 65 or more years of age, ischaemic heart disease and stroke are largely due to causes other than smoking. On the other hand mortality and morbidity from ischaemic heart disease and stroke among current smokers less than 65 years of age are more likely to have been caused by their smoking than by something else, though not to the overwhelming extent that this is so with lung cancer and chronic obstructive pulmonary disease. For current smokers 65 or more years of age, where the main burden falls, 60 percent of the male and 70 percent of the female current smoker deaths from ischaemic heart disease occurring at those ages, something other than smoking is more likely to be the cause.

But while a current-smoker death from ischaemic heart disease or stroke before 65 years of age is more likely to have been caused by smoking than by something else, this does not, in itself, mean that such smoking-caused deaths occur very frequently. Tables 9 and 10 show that, for both male and female current smokers, smoking-caused deaths from stroke before 65 years of age are somewhat rare events. Even smoking-caused deaths from ischaemic heart disease are rare among male current smokers before 50 years of age and among female current smokers before 55 years of age. For male current smokers it is only in the 50 to 64 year old age-bracket that smoking-caused deaths from ischaemic heart disease cease to be rare events, in concert with, though more common than, their deaths from that disease due to causes other than smoking. For female current smokers the corresponding window of non-rarity is the 55 to 64 year old age-bracket , where their deaths from ischaemic heart disease due to causes other than smoking are still rare events. Similarly while it is true that at all ages a current smoker death from lung cancer or chronic obstructive pulmonary disease is some 9 times more likely to have been caused by smoking than by something else, it is nonetheless the case that lung cancer is rare among male current smokers before 55 years of age and rare among female current smokers before 60 years of age, whereas chronic obstructive pulmonary disease is rare among male current smokers before 60 years of age and before 65 years of age for female current smokers.

While smoking does seem to be a prime factor in lung cancer and chronic obstructive pulmonary disease, especially for males, it plays a much less pronounced role in stroke and ischaemic heart disease. To highlight this we focus on deaths at 60 or more years of age, the ages at which the vast majority of deaths from those diseases actually occur and an age group in which about 31 percent of the females and 72 percent of the males are classified as ever-smokers. For females 83 percent of lung cancer deaths, 94 percent of deaths from chronic obstructive pulmonary disease, 96 percent of deaths from ischaemic heart disease and also 96 percent of those from stroke occur at those ages. For males the corresponding percentages are 83, 97, 88 and 93 respectively. For both of lung cancer and chronic obstructive pulmonary disease about 64 percent of the female deaths are attributed to smoking, whereas only 7 percent of them are for both ischaemic heart disease and stroke. Of the corresponding male deaths, 84 percent of those due to lung cancer and 81 percent of those due to chronic obstructive pulmonary disease are attributed to smoking, but only

17 percent of those due to ischaemic heart disease and 16 percent of those due to stroke are attributable to smoking.

It is true that there is a very strong association between smoking and both lung cancer and chronic obstructive pulmonary disease, that the vast majority of deaths from those diseases do arise from that association, and that if one is satisfied that due allowance has been made for other possible factors, such as occupation, social class, general lifestyle, selection bias in one's data and so on, then smoking rather than something else is suggested as the likely culprit. But while deaths from ischaemic heart disease and stroke have also been associated with smoking, one can blame smoking for only a relatively small minority of the deaths from those diseases; that this amounts to a sizeable number of deaths arises more from the fact that many people do die from ischaemic heart disease and stroke than from the high culpability of smoking. Of the deaths at 60 or more years of age in Australia during 1992, 10,964 were due to lung cancer and chronic obstructive pulmonary disease and 8,440 of them were attributed to smoking, but while ischaemic heart disease and stroke accounted for as many as 40,119 deaths only 4,639 of them could be attributed to smoking.

11. Summary

The fact that smoking causes many deaths and much sickness does not necessarily mean that the associated risks to an individual smoker are high ones. The basic fact is that of the many causes of sickness and early death some seem to affect smokers more than they do non-smokers. This is an important finding, but the enormity of the aggregate burdens associated with it arises from the aggregation of small per person smoking effects over an enormous number of smokers, not from enormous per person smoking effects. Reducing the number of smokers might lead to corresponding reductions in those burdens, and this might well be seen as sufficient grounds for not encouraging smoking, and something about which smokers should be concerned, but it is not grounds for encouraging smokers to see the risk to which their smoking exposes them as something that they ought to find very worrying. Indeed, without in any way questioning the finding that smoking can be harmful, the figures we have discussed suggest that decreasing the number of smokers might well *increase*, rather than decrease, long-term burdens of morbidity, and suggest too that smoking may sometimes have been perceived as more harmful than is actually the case. In the introduction we listed some common perceptions about the harmfulness of smoking and it is informative to review them now in the light of the matters we have discussed.

1. *Smoking must be harmful because it has been associated with a number of illnesses.*

   As the fictitious example discussed in section 2 shows, this assertion is based on faulty logic. By itself association with disease does not necessarily entail harmfulness. It may or may not result in harm.

2. *Tobacco is a leading cause of morbidity and premature mortality, and is responsible for a correspondingly large burden on hospital services.*

This claim was examined in section 3. We pointed out that it is usually supported by figures such as those in Table 1 which presents numerator data without the corresponding denominators that are needed to make sense of them. In other words that Table gives only population aggregates without reference to the numbers of people at risk of contributing to them. When those figures are converted to per death rates it turns out that both the per death potential person-years of life lost before 70 years of age and the morbidity per death that are said to be due to tobacco are in fact smaller than they are for alcohol, illicit drugs and all causes other than tobacco, alcohol and illicit drugs. Whilst this does not exonerate tobacco, it does suggest that figures usually presented to indict it may not in fact do so. We pointed out too that the burdens associated with smoking need to be seen, not only in the light of how many people do smoke, but also in the light of other comparable burdens such as the morbidity associated with accidental falls, fractures, iatrogenic injuries and nursing-to-patient ratios.

3. *Smoking kills at unusually young ages and that, as a consequence, the ages at death of smokers are in general younger than those of non-smokers.*

In section 4 we saw that the available data was somewhat ambiguous about the correctness of this claim. Whereas deaths due to alcohol and illicit drugs clearly occurred predominantly at younger ages than those due to other causes, including tobacco, the same could not be said of tobacco-deaths themselves when they are compared to deaths due to causes other than tobacco, alcohol and illicit drugs. Indeed, among those aged 25 to 74 years of age, the smokers dying in 1992 had lived *longer* on average than the non-smokers who died in that year, about two and a half years longer for males and about one and a third years longer for females. Against this the position was reversed for those aged 45 to 74 years of age where the non-smokers dying in 1992 did live longer on average than the smokers who died in that year, but only by about seven and a half months for males and about four and a half months for females. On balance there is little evidence to suggest that the ages at death of smokers are substantially younger than those at which non-smokers die.

4. *Smokers usually die when they do because of their smoking and the longer they smoke the more likely it is that smoking rather than something else will kill them.*

As shown in section 5 this claim is not borne out by the facts. Each year ever-smokers of both sexes and all ages are more likely to die of causes other than smoking than they are to die because of their smoking, and until they reach 40 years of age considerably more likely to do so. Moreover the discussion in section 6 shows that this is also true of current smokers. The discussion in both section 5 and section 6 shows that while the smoker's annual risk of death due to smoking does increase steadily with age, it does so in concert with the annual risk of death from all other causes and that it is not immediately clear whether the increase with age of the former is due to increasing exposure to the harmful

effects of smoking or is simply an aging effect. That question was examined in section 9 where we found that duration of smoking does not seem to be a major risk factor in death from smoking, either when all tobacco-related conditions are combined or when the four major causes of death associated with smoking, lung cancer, chronic obstructive pulmonary disease, ischaemic heart disease and stroke, are considered individually. The figures seem to suggest that among current smokers the increase with age in their annual death rates due to smoking is an aging effect superimposed on a more or less constant smoking effect that is independent of age and hence, presumably, largely independent of how long they have been smoking.

5. *The number of deaths for which smoking is responsible has been accurately determined.*

In section 6 we saw that this is by no means so. Different methods of estimation lead to markedly different estimates of age-specific death rates, not only for those attributed to smoking but also for those due to other causes. In section 10 we found that the same is true for age-specific morbidity. What is true is that the different methods of estimation are in broad agreement that smoking can be harmful, that ex-smokers benefit from no longer smoking and that mortality and morbidity attributed to smoking increase steadily with age in concert with that due to other causes. But this does not mean that one should have no doubts about the accuracy of estimates that claim to say just how harmful smoking is, nor that one can be all that sure that smoking is always the likely culprit when a smoker suffers an adverse event from a tobacco-related condition.

6. *The morbidity of smokers places a large unfair burden on hospital services.*

If one accepts the figures on which the anti-smoking movement bases its case, as we do here, then it is true that morbidity due to smoking does place a burden on hospital services. But, as we noted in section 7, it would seem that revenues from tobacco-taxes provide more than five times the cost of it. More importantly, however, while reducing current and future smoking might well lead to corresponding reductions in the burden due to smoking, the subsequent increase in the costs associated with the morbidity of the elderly due to causes other than smoking would, in the long run, very probably lead to even greater financial burdens that would require taxes on things other than tobacco to pay for them.

7. *Smoking is to blame for the smoking-related illnesses experienced by ex-smokers and tobacco-companies should be made to compensate them accordingly.*

We saw in section 10 that, even for a current smoker, there is little or no evidence to suggest that one can be all that sure in general that smoking, rather than something else, is to blame for an adverse event from a tobacco-related condition. Moreover the benefits to be derived from quitting smoking seem to be so great that among ex-smokers the balance of probability points, in general, to something

other than smoking as the more likely cause of such an event. Nevertheless the culpability of smoking varies from one tobacco-related disease to another. An instance of lung cancer or chronic obstructive pulmonary disease in either a past or a present smoker is more likely to have been caused by smoking than by something else. However such instances rarely occur before about 60 years of age. On the other hand an instance of ischaemic heart disease or stroke in an ex-smoker is more likely to have been caused by something other than smoking, than by smoking itself. This is also true of a current smoker 65 or more years of age; ages which account for 60 percent of the male and 70 percent of the female current-smoker deaths from ischaemic heart disease. About two-thirds of the instances of death from ischaemic heart disease and stroke among current smokers before 65 years of age are due to smoking and the remaining one-third are due to causes other than smoking. However, among current smokers, death from stroke rarely occurs before 70 years of age and death from ischaemic heart disease is somewhat rare before 55 years of age in males and before 60 years of age in females.

12. Concluding Remarks

In scientific research both the choice of which facts to collect and then what one sees in them are inevitably influenced by prevailing climates of opinion, the extent and nature of that influence being a matter for continuing debate among philosophers of science, some of whom have argued that political and social attitudes are often no less important than purely scientific ones. In his study of social and political factors in the treatment of child abuse, Parton[19] argued that initial developments in that area were stimulated by the early successes of antibiotics in the treatment of childhood diseases together with the subsequent need for paediatricians to maintain their status and the need for forensic pathologists to promote theirs, by establishing that they too had an important role to play. One can see similar needs at work in the role of epidemiologists in the discovery that smoking can be harmful, both in the way that this promoted epidemiology as an important life-saving area of modern medicine and in the way that this in turn helped to attract research funding into that area. This does not mean that one should doubt the validity of their findings, for there was no conspiracy to invent facts, but it does help one to understand how it became fashionable to actively seek certain types of fact and why those facts were then seen in the way they were. In particular, in order to reinforce the message that epidemiology, like other areas of medicine, could also save lives, it became important, at least initially, for epidemiologists to quite properly emphasise that many lives could be saved by taking heed of their findings; a refrain that has since been taken over by the anti-smoking movement.

If the anti-smoking message was simply that there is evidence to suggest that smoking can have harmful effects, and that smokers can largely avoid them by

[19] Nigel Parton, *The Politics of Child Abuse,* Macmillan Education, London, 1985.

quitting smoking, then it would be a straight-forward reporting of epidemiological findings and there would be little in it to which one could object, even if one did not find all facets of the evidence to be equally compelling. The need for such a message was the thrust of the seminal Lalonde doctrine[1] that public health measures should be initiated to curb smoking and to warn the public of its perceived dangers, without waiting for science to establish them beyond the possibility of doubt. However the adoption of that policy has done more than impress upon both the public and the medical mind that there is now no room for doubt; based on the belief that the end justifies the means it has fostered a policy that blatantly delivers its message in ways that deliberately provoke shock and horror in order to produce an emotional response that is conducive to accepting it. This is done, not by actually lying, but by presenting selected facts in isolation, without the balancing restraint of other relevant facts, particularly those that are not likely to be known to the public at large.

For example one can emphasise that during 1992 there were as many as 18,920 deaths in Australia that were due to smoking and that this works out at roughly 50 such deaths every day, or about 1 every 30 minutes. That smoking kills as many as 50 people every day is likely to surprise and shock those unfamiliar with just how many people do die each day and its shock value is enhanced by deliberately withholding information about daily mortality from other causes. In point of fact in Australia in 1992 ever-smokers accounted for about 50 percent of the adult population and there were in all an estimated 123,651 deaths, of which the 18,920 deaths attributed to cigarette smoking accounted for a little over 15 percent. While it is true that a daily 50 deaths were attributed to smoking, there were, in addition more than five and a half times as many daily deaths that were attributed to causes other than smoking; viz. 287 deaths each day, of which almost 150 though due to smoking-related conditions were attributed to something other than smoking. In round terms, deaths attributed to cigarette smoking occurred about once every 30 minutes, deaths attributed to something other than smoking occurred about once every 5 minutes and of those about every other one was due to a tobacco-related illness not caused by smoking. These additional facts, though in no way falsifying the claim that smoking is the attributed cause of 50 deaths per day, give it an additional perspective that enables one to view it in a more balanced way. But even so it is a fair assumption that most people do not know that the 18,920 figure is itself the higher of two estimates, that the suppressed lower estimate is about 30 percent smaller than it, and that if the lower estimate were used, then there would be a corresponding decrease in the daily death rate said to be due to smoking together with a balancing increase in the daily death rate due to causes other than smoking.

Another common ploy of the anti-smoking movement, and some might argue a dishonest one to boot, is to cite a particularly striking instance of illness in a smoker, suggesting by implication that because it did occur in a smoker it was smoking that was to blame for it, but failing to give any justification for believing that this was indeed the case; while, at the same time, withholding the fact that such instances, though striking, are exceedingly rare, thereby suggesting by default that they are, on the contrary, commonly occurring consequences of smoking. A case in point is a

recent anti-smoking advertisement on television which portrayed damage to the aorta of one who is said to be a 34 year old male smoker. It is a moot point whether a commercial undertaking would be permitted the self-indulgence of such a deceptive and misleading advertisement. We are not competent to assess the medical facts of this case, but it is surely relevant that at that age a smoker death that is due to smoking rather than to something else is an extremely rare event. As Table 6 shows, each year at that age only about 1 in every 8,000 male current smokers, and about 1 in every 20,000 female current smokers, die because of their smoking. In addition, according to Table 7, both male and female current smokers of that age are, in a given year, over 10 times more likely to die from causes other than smoking than they are to die because of their smoking. Moreover Table 15 suggests that even when death or morbidity from a tobacco-related condition does occur in a male current smoker of that age, the odds are only about 3 to 2 that smoking was to blame for it whereas, for a female current smoker of that age the odds go the other way, viz. about 3 to 2 in favour of something other than smoking being the culprit.

The fact that the anti-smoking movement continually emphasises the enormity of aggregate effects, and that nobody seems to question their relevance, suggests that it is not well understood that adding up small numbers very many times inevitably produces a large result and that to interpret it one needs to take account of just how many additions did lead to it. As we noted in the introduction, the enormous 88,266 potential person-years of life before 70 years of age claimed to be lost each year because of smoking arises from an annual loss of less than $5\frac{1}{2}$ days per ever-smoker. Similarly the 459,618 hospital bed-days said to be caused by smoking in 1992 arose from an average 2 hours 14 minutes per male ever-smoker and an average 1 hour 24 minutes per female ever-smoker. Those who see the Lalonde doctrine not so much as the anticipation of the findings of science as the use of science to further a political agenda might well argue that the fact that the per person effects of smoking are not large does not matter, because even one life lost due to smoking would be one death too many. But that is not the issue here. We are not arguing that people should smoke and we concede that there is, perhaps, a sense in which it might be better for smokers if they did not knowingly risk damage to their health. The issue here is simply what the current scenario for the harm smoking causes actually says about the risks smoking poses to smokers. Whether those risks should be seen by smokers as large enough to persuade them to stop smoking is up to smokers to decide for themselves. We have no choice but to leave the decision as to whether or not they are large enough to justify the constraints on smoking advocated by the anti-smoking movement to those who see it as their mission to regulate the way in which other people should be allowed to behave.

There is nothing new in missionaries telling people how they should behave. There is nothing new in the suppression of relevant information and the use of propaganda to persuade people to believe what you want them to believe. Nor is there anything new in large sections of the scientific establishment putting aside the uncertainties of pure science to support dominant sectarian views on how science should be put to use in practical affairs. Early in the 17th century Sir Francis Bacon drew attention to the

conflict between pure and applied science. In his "Wisdom of the Ancients", Bacon likened pure science to the Muses, but its application to practical life he likened to the Sphinx who, he recalled, *"was a monster combining many shapes in one",* and who, he went on, *"proposes to men a variety of hard questions and riddles which she received from the Muses"*. Of these questions and riddles he said:

"...while they remain with the Muses, there is probably no cruelty; for so long as the object of meditation and inquiry is merely to know, the understanding is not oppressed or straitened by it, but is free to wander and expatiate, and finds in the very uncertainty of conclusion and variety of choice a certain pleasure and delight; but when they pass from the Muses to the Sphinx, that is from contemplation to practice, whereby there is necessity for present action, choice and decision, then they begin to be painful and cruel; and unless they be solved and disposed of they strangely torment and worry the mind, pulling it first this way and then that, and fairly tearing it to pieces".

In the diagnosis and treatment of disease, medical practitioners have to deal repeatedly with situations that call for immediate action, choice and decision, and to that extent Medicine, perhaps more than any other profession, occupies a middle ground between the Muses and the Sphinx; looking forwards to the Sphinx as it sees the need for action and glancing backwards to the Muses for guidance and understanding. The Lalonde doctrine to ignore the 'yes, buts' of science has severed preventive medicine's backward links to the Muses and opened it to prejudice and unfounded conviction. For what is most surprising about the results presented here is not the fact that the anti-smoking movement's own figures provide so little support for some of its claims, and most of its innuendoes, but the fact that anti-smoking advocates have been so anxious to give voice to their convictions as scientific truths, without even bothering to perform the calculations that would have shown them to be largely unfounded.

It is perhaps an oblique comment on the interface between present-day scientific enquiry and public policy that we feel obliged to emphasise that the findings reported here have been pursued in the Baconian spirit of merely wanting to know just what it is that the Muses are telling us when they give us the anti-smoking movement's own figures. The enquiry has been neither prompted by, nor supported by, the patronage of tobacco companies, pro-smoking groups or any part of the anti-smoking movement itself.

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APPENDIX

For the purposes of this paper, the basic demographic facts about a one-sex age group are how many of the people in it have never smoked, how many of them are ex-smokers and how many of them are current smokers. The sum of the last two numbers is the number of ever-smokers in the age group and adding this to the number of never-smokers we get the total number of people in the age group. In practice this information can be presented by giving first an estimate of the size of the age group and then estimates of what percentage of the people in it are ex-smokers and what percentage of them are current smokers. Adding those two percentages gives the percentage of ever-smokers in the age group and subtracting that from 100 we obtain the corresponding percentage of never-smokers. To recover the sizes of the various smoking categories each percentage is applied to the size of the age group. The percentages themselves are usually called prevalences. Table A1 gives the relevant information for Australia in 1992. The age group sizes are taken from the official population statistics for that year[20] and the smoking prevalences are those given in Table 4-3 and 4-4 of QDM[5].

The basic facts about annual mortality in a one-sex age group are the total number of deaths that occurred in it during the designated year and how many of them were due to the tobacco-related conditions listed in QDM[5]. Similarly the basic facts about annual morbidity in the age group are first the total number of hospital episodes and hospital bed-days that occurred during the year in question and then how many of them were due to tobacco-related conditions. Table A2 gives the basic annual mortality and morbidity for males in Australia for 1992 and Table A3 gives the corresponding data for females. The information in those Tables were extracted from various Tables in QDM[5], viz. Tables 4-9, 4-10, 4-11, 4-12, 4-13, 4-14.

It should be noted that all the figures presented in Tables A1, A2 and A3 are estimates calculated in various ways from census data, survey data and medical records. Their estimation errors are usually seen as small enough to be relatively unimportant for the issues discussed here and the figures themselves are conventionally accorded the status of undisputed facts. This is not so true of the way one apportions mortality and morbidity from tobacco-related conditions between smokers and non-smokers. To do so one has to know how much of that mortality and morbidity is due to smoking and how much of it is due to causes other than smoking. The quantity that tells us this is what QDM[5] calls the population aetiological fraction. For brevity we simply call it the aetiological fraction. For the age group under consideration, it gives the proportion of annual deaths from tobacco-related conditions that are claimed to be due to smoking. QDM[5] gives the aetiological fractions for the combination of all tobacco-related conditions by age, sex and smoking category. These are reproduced in Table A4.

[20] ABS, *Australian Demographic Statistics, 1992*. Catalogue No. 3101.0, Australian Bureau of Statistics, CGPS, Canberra, 1993.

Aetiological fractions are used in the following way. If the total number of deaths from tobacco-related conditions in a given one-sex age group of Tables A2 and A3 is denoted by d and the aetiological fraction for its smoking category c from Table A4 is denoted by F_c, then the number of deaths in that category that are attributed to smoking is the number dF_c obtained by multiplying d by F_c. The corresponding death rate due to smoking is obtained by dividing that number of deaths by the number of people in the category in question. After the deaths due to smoking have been calculated for each smoking category, the remaining deaths from tobacco-related conditions are apportioned between the various smoking categories, including the never-smokers, in direct proportion to the numbers of people in them, so that the death rate from tobacco-related conditions due to causes other than smoking is the same for each smoking category. The details of these calculations can be set out very simply in symbolic shorthand and they are presented in that way in Table A5.

Various other quantities of interest can be calculated from the entries in Table A5. The relative risk R_c to a smoker in category c is the overall death rate from tobacco-related conditions in that category divided by the corresponding death rate for never-smokers. In symbols

$$R_c = (\overline{d_0} + \overline{d_c}) \Big/ \overline{d_0} = 1 + \left\{ \frac{F_c}{(1 - F_1) p_c} \right\}. \qquad (1A)$$

This expression shows that R_c depends only on the overall aetiological fraction F_1 the aetiological fraction F_c for the smoking category c and p_c the prevalence of smoking in that category. Again there are in all d_c deaths from tobacco-related conditions in the smoking category c and dF_c of them are attributed to smoking. To determine what proportion of the annual deaths from tobacco-related conditions in the smoking category c is attributed to smoking, we need only divide dF_c by d_c. This proportion, viz.

$$\frac{dF_c}{d_c} = 1 - \frac{1}{R_c} = \left[1 + \frac{(1 - F_1) p_c}{F_c} \right]^{-1} \qquad (2A)$$

is the quantity tabulated in section 10. It can be interpreted as the probability that, for the year in question, a given death from a tobacco-related condition in the smoking category c was due to smoking rather than to something other than smoking. We call it the age group's smoking mortality index for smoking category c.

If the symbolic expression (1A) is rewritten in the form

$$R_c - 1 = \frac{F_c}{(1 - F_c) p_c}, \qquad (3A)$$

then reference to Table A5 shows that for each smoker-death from the tobacco-related conditions in question that is due to causes other than smoking the quantity R_c-*1* is the corresponding excess number of smoker deaths in that category from those conditions that are due to smoking. This is the property of relative risks that underpins our examination in section 9 of the effects of aging and duration of smoking.

In Table A5 the total annual deaths *d*, their division between the smoking categories, and the various aetiological fractions for them, refer to the combination of all tobacco-related conditions. Calculations done in that way are referred to in QDM[5] as an "All-Cause Mortality Analysis". However one can draw a separate such table for each tobacco-related condition individually and perform what QDM[5] calls a "Condition-specific Analysis". In that analysis the aetiological fractions in each Table are specific to the condition then in question and *d* is then the total number of deaths from that particular condition in the age group under consideration. In that way one can calculate, for each age group, the number of deaths due to smoking for each tobacco-related condition in turn and then add them over all the conditions in question. As Table A6 shows this gives a total number of deaths from all tobacco-related conditions that is due to smoking which is different from that given by the all-cause mortality analysis. It is that difference which leads to the disparity between the estimated death rates and relative risks of sections 6 and 7.

Condition-specific aetiological fractions and deaths are given in QDM [5] by age and sex. We do not reproduce them here. Instead we give the associated numbers of deaths attributed to smoking that are obtained from them by means of the condition-specific analysis. Those figures are given by age and sex in Table A7, together with the corresponding figures for hospital episodes and hospital bed-days. They were extracted from various Tables in QDM[5].

For both all-cause and condition-specific analyses, morbidity due to tobacco-related conditions is apportioned between smoking categories in exactly the same way as that adopted for mortality. In the all-cause morbidity analogue of Table A5 the number *d* for deaths from tobacco-related conditions is replaced by the number *m* which specifies how much morbidity arises from those conditions, viz. the number of hospital episodes or the number of hospital bed-days that are given in Table A2 or A3 as due to tobacco-related conditions in the age group under consideration. In the condition-specific analysis the number *m* is the corresponding amount of morbidity associated with the particular disease in question, and the aetiological fractions are those that are specific to that disease.

Strictly speaking there are three distinct aetiological fractions in any smoking category of a one-sex age group. A mortality aetiological fraction which gives the proportion of its deaths from tobacco-related conditions that are due to smoking, an episode aetiological fraction which gives the proportion of the hospital episodes associated with those conditions that are due to smoking and finally a bed-days aetiological fraction which gives the proportion of its tobacco-related hospital bed-days that are to be attributed to smoking. These proportions might well be different from each other. For some diseases, smoking might seldom kill at some ages and yet

be responsible for much morbidity. At other ages it might kill rapidly with relatively little morbidity. Again smoking might sometimes cause many hospital episodes of short duration or alternatively be responsible for few hospital episodes, but each of them leading to many hospital bed-days. Nevertheless the calculations in QDM[5] use the same aetiological fractions in its analysis of hospital episodes and hospital bed-days as it does in its analysis of mortality. As that report itself points out, its aetiological fractions are a non-uniform mix of mortality data, prevalence data and incidence data. They cannot be regarded as anything more than useful guidelines. Yet the reliability of the calculations portrayed in Table A5, which determine how much blame should be attributed to smoking, is clearly related to how accurately one can estimate the aetiological fractions in question. A substantial part of the QDM[5] report is devoted to explaining how those fractions were estimated. It is the uncritical acceptance of those estimates that we had in mind when we said in the introduction that we would not question the validity of the figures on which the claims of the anti-smoking movement are based. This does not mean that there can be no doubts about the accuracy of those estimates, the assumptions on which they are based and the way in which they are used. It means only that such questions are not at issue here. For the same reason, we adopt the procedure of QDM[5] and use its aetiological fractions for the analysis of both mortality and morbidity. In all fairness it should be stressed that, whatever misgivings one might have about the estimation procedures in QDM[5], no one has developed alternatives that are clearly superior to them.

Particular diseases are analysed in the way described above for the combination of all tobacco-related conditions. To carry out the corresponding age group analysis displayed in Table A5, one needs the relevant disease-specific aetiological fractions and the mortality and morbidity during the year in question that was attributed to the disease under study. Tables A8,9,10 and 11 provide the relevant 1992 figures for Lung Cancer, Chronic Obstructive Pulmonary Disease, Ischaemic Heart Disease and Stroke, the four leading tobacco-related causes of death. These are the figures given in QDM[5].

A smoking morbidity index is the analogue of the mortality index of equation (2A) above. It is the proportion of the morbidity from tobacco-related conditions in a smoking category of a one-sex age group that is attributed to smoking. It is the quantity obtained by dividing mF_c, the morbidity attributed to smoking in category c by m_c, the corresponding total morbidity from tobacco-related conditions in that category. Because the same aetiological fractions are used for both mortality and morbidity analyses of a one-sex age group, a smoking morbidity index is numerically the same as its corresponding mortality index. While this numerical equivalence of the two sorts of index holds for both the all-cause analyses for the combination of all tobacco-related conditions and for the condition-specific analysis of particular diseases, it does not hold in the condition-specific analysis for the combination of all the tobacco-related conditions.

The reason for this discrepancy is that in the overall condition-specific analysis the smoking mortality index is the proportion of all deaths from tobacco-related

conditions in the smoking category under consideration that are due to smoking. To calculate it one has first to work out the total number of deaths that are attributable to smoking by adding the condition-specific dF_c over all the conditions and then divide that total by the corresponding sum of the condition-specified d_c, viz. the total number of deaths in question from tobacco-related conditions. Similarly an overall condition-specific smoking morbidity index is the sum of the mF_c over all conditions divided by the corresponding sum of the m_c. While each disease-specific smoking morbidity index $mF_c \div m_c$ is numerically the same as its corresponding mortality index $dF_c \div d_c$, this will not be true, in general, of the two overall indices obtained by summing corresponding numerators and denominators over all the tobacco-related conditions and dividing the numerator sum by the denominator sum. A similar discrepancy arises when one combines age groups of the same sex for the same conditions. The two types of index for the combined age group arise from summing corresponding numerators and denominators separately, viz. the dF_c and then the d_c or the mF_c and then the m_c, as the case may be, over all the age groups being, combined, and then dividing the numerator sum by its corresponding denominator sum. Although the two indices are numerically the same in each age group, in general they will not be numerically the same in the combined age group.

All the results given in this paper, with the exception of those involving alcohol and illicit drugs, can be reproduced by simple arithmetic with a pocket calculator, using the procedure outlined in Table A5 and the information provided in the other Tables of this appendix.

Table A1

Population Size in Australia, 1992
& Percentage Prevalence of Cigarette Smoking Patterns
in Australia, 1989-1990, by Age and Sex

AGE GROUP	MALES			FEMALES		
	Population Size	Smoking Category		Population Size	Smoking Category	
		Current	Ex		Current	Ex
20-24	726,476	39.2	10.3	706,416	36.8	13.5
25-29	692,546	39.9	16.1	688,676	32.8	19.3
30-34	725,568	36.8	22.2	724,750	29.9	20.4
35-39	673,702	36.8	25.6	675,653	26.1	18.1
40-44	654,565	31.3	29.4	642,605	23.8	17.5
45-49	561,608	33.3	31.9	538,595	24.4	20.6
50-54	447,166	30.5	33.7	424,543	22.1	16.6
55-59	373,830	29.5	41.2	365,621	20.7	17.9
60-64	362,272	26.9	45.8	365,165	17.9	18.4
65-69	325,240	22.2	53.4	352,908	14.0	21.7
70-74	239,249	16.3	54.1	292,925	13.5	21.0
75-79	162,310	11.7	55.9	229,500	9.8	18.6
80 plus	135,457	10.2	54.6	266,342	2.8	14.6

Table A2

Annual Mortality and Morbidity for Males in Australia for 1992 by Age

Age Group	DEATHS		HOSPITAL EPISODES		HOSPITAL BED-DAYS	
	Total	Due to tobacco-related conditions	Total	Due to tobacco-related conditions	Total	Due to tobacco-related conditions
20-24	865	26	64,192	1,437	253,664	6,713
25-29	889	33	63,341	1,891	299,653	8,251
30-34	982	87	64,452	2,557	325,001	12,998
35-39	990	171	63,394	3,611	306,621	20,508
40-44	1,310	396	69,398	6,137	311,105	31,302
45-49	1,673	688	70,139	9,158	351,044	49,991
50-54	2,268	1,139	70,101	12,037	375,135	73,770
55-59	3,236	1,860	76,652	17,066	421,706	119,354
60-64	5,511	3,451	96,096	24,306	628,509	183,208
65-69	8,138	5,295	104,548	29,328	741,216	243,872
70-74	9,509	6,400	92,383	26,838	740,966	246,464
75-79	10,780	7,335	78,128	22,890	708,236	252,641
80 plus	17,862	12,014	76,540	21,163	858,130	256,182
Total	64,013	38,895	989,364	178,419	6,320,986	1,505,254

Table A3

Annual Mortality and Morbidity for Females in Australia for 1992 by Age

Age Group	DEATHS		HOSPITAL EPISODES		HOSPITAL BED-DAYS	
	Total	Due to tobacco-related conditions	Total	Due to tobacco-related conditions	Total	Due to tobacco-related conditions
20-24	302	23	143,800	10,801	499,829	39,548
25-29	294	31	179,900	14,642	709,673	56,165
30-34	406	60	163,657	12,951	706,344	53,458
35-39	496	89	112,645	7,682	478,663	32,285
40-44	725	177	94,589	5,076	406,408	25,678
45-49	980	282	83,983	4,716	389,072	24,947
50-54	1,320	455	73,132	5,896	362,004	36,585
55-59	1,807	762	66,352	7,948	390,799	53,304
60-64	2,840	1,409	77,716	12,142	498,654	91,347
65-69	4,471	2,410	88,682	17,056	670,981	154,224
70-74	6,353	3,732	88,194	18,802	756,723	179,014
75-79	8,710	5,479	87,531	19,608	928,400	240,134
80 plus	27,497	18,504	117,814	27,181	1,623,559	445,388
Total	56,201	33,413	1,377,995	164,501	8,421,109	1,432,077

Table A4

Aetiological Fractions for the combination of all tobacco-related conditions by Age, Sex and Smoking Category[a]

AGE GROUP	MALES		FEMALES	
	Smoking Category		Smoking Category	
	Ex	Current	Ex	Current
20-24	0.01	0.40	0.02	0.21
25-29	0.02	0.40	0.04	0.19
30-34	0.03	0.38	0.04	0.18
35-39	0.04	0.38	0.04	0.16
40-44	0.05	0.34	0.03	0.15
45-49	0.05	0.35	0.04	0.15
50-54	0.05	0.33	0.03	0.14
55-59	0.06	0.32	0.04	0.13
60-64	0.07	0.30	0.04	0.11
65-69	0.05	0.03	0.01	0.08
70-74	0.05	0.02	0.01	0.08
75-79	0.05	0.02	0.01	0.06
80 plus	0.05	0.02	0.00	0.02

[a]Taken from section 4.6.57 of QDM[5]

Table A5

Apportioning a total of *d* deaths from tobacco-related conditions between the smoking categories of an age group of size *n*

	Smoking Categories				Total
	Never	Ex	Current	Ever	Smokers and non-smokers
Prevalence	p_0	p_{01}	p_{11}	$p_1=p_{01}+p_{11}$	1
Size	np_0	np_{01}	np_{11}	np_1	n
Aetiological Fraction	$F_0=0$	F_{01}	F_{11}	$F_1=F_{01}+F_{11}$	F_1
Deaths due to smoking	$dF_0=0$	dF_{01}	dF_{11}	dF_1	dF_1
Deaths due to other causes	$p_0(d-dF_1)$	$p_{01}(d-dF_1)$	$p_{11}(d-dF_1)$	$p_1(d-dF_1)$	$d-dF_1$
Deaths due to all causes	$d_0 = p_0(d-dF_1)$	$d_{01}= p_{01}(d-dF_1)+ dF_{01}$	$d_{11} = p_{11}(d-dF_1) + dF_{11}$	$d_1 = p_1(d-dF_1) + dF_1$	d
Death rate due to smoking	0	$\overline{d_{01}} = \frac{dF_{01}}{np_{01}}$	$\overline{d_{11}} = \frac{dF_{11}}{np_{11}}$	$\overline{d_1} = \frac{dF_1}{np_1}$	$\frac{dF_1}{n}$
Death rate due to other causes	$\frac{d-dF_1}{n}$	$\frac{d-dF_1}{n}$	$\frac{d-dF_1}{n}$	$\frac{d-dF_1}{n}$	$\frac{d-dF_1}{n}$
Death rate due to all causes	$\overline{d_0} = \frac{d-dF_1}{n}$	$\overline{d_0}+\overline{d_{01}}$	$\overline{d_0}+\overline{d_{11}}$	$\overline{d_0}+\overline{d_1}$	$\overline{d} = \frac{d}{n}$

Table A6

Estimated numbers of deaths caused by cigarette smoking in Australia 1992 by age, sex and method of analysis[a]

Age Group	Males		Females	
	Condition-Specific Analysis	All-Cause Mortality Analysis	Condition-Specific Analysis	All-Cause Mortality Analysis
40-44	183	510	65	130
45-49	342	669	111	186
50-54	590	861	190	224
55-59	997	1,229	307	307
60-64	1,847	2,039	551	426
65-69	2,121	651	650	402
70-74	2,247	665	852	571
75-79	2,245	754	925	609
80 plus	3,145	1,250	1,298	549
Total	13,717	8,628	4,949	3,404

[a]Taken from Table 4-20 of QDM[5]

Table A7

Deaths, Hospital Episodes and Bed-days by Age and Sex attributed to smoking obtained by means of the "condition-specific" analysis[a]

Age Group	DEATHS		HOSPITAL EPISODES		HOSPITAL BED-DAYS	
	Males	Females	Males	Females	Males	Females
20-24	10	9	414	1,440	1,947	5,097
25-29	14	11	626	1,920	2,557	6,843
30-34	38	22	897	1,874	4,622	7,775
35-39	78	31	1,441	1,363	7,610	5,980
40-44	183	65	2,525	1,309	12,945	7,217
45-49	342	111	4,087	1,622	22,713	9,027
50-54	590	190	5,444	2,027	33,847	13,066
55-59	997	307	8,065	2,816	56,650	19,876
60-64	1,847	551	11,710	4,110	89,713	31,718
65-69	2,121	650	9,879	3,831	84,994	35,421
70-74	2,247	852	8,681	3,841	81,622	37,382
75-79	2,245	925	7,006	3,317	77,258	38,960
80 plus	3,145	1,298	6,062	2,459	70,636	35,604
Total	13,857	5,022	66,837	31,929	547,114	253,966

[a]Taken from Tables 4-15, 4-17 & 4-18 of QDM[5]

Table A8

Aetiological Fractions, Mortality and Morbidity attributed to Lung Cancer by Age and Sex for Australia, 1992

Age Group	Aetiological Fraction		Total Deaths	Total Hospital Episodes	Total Hospital Bed-days
	Current	Ex			
20-24	0.75	0.09	1	0	0
25-29	0.71	0.14	3	2	39
30-34	0.66	0.19	5	14	175
35-39	0.64	0.21	13	53	480
40-44	0.58	0.26	42	102	859
45-49	0.59	0.27	102	282	2,356
50-54	0.55	0.29	219	466	4,802
55-59	0.51	0.34	390	845	7,949
60-64	0.47	0.38	669	1,478	12,054
65-69	0.40	0.46	960	1,638	19,029
70-74	0.32	0.51	910	1,415	16,054
75-79	0.25	0.57	709	1,011	11,238
80 plus	0.23	0.58	643	691	9,828
Total			4,666	7,997	84,863
	FEMALES				
Age Group	Aetiological Fraction		Total Deaths	Total Hospital Episodes	Total Hospital Bed-days
	Current	Ex			
20-24	0.71	0.10	1	0	0
25-29	0.66	0.15	0	2	23
30-34	0.63	0.17	4	19	135
35-39	0.61	0.17	6	33	218
40-44	0.59	0.17	25	93	672
45-49	0.58	0.19	49	147	1,292
50-54	0.58	0.17	89	220	1,829
55-59	0.55	0.19	126	344	3,312
60-64	0.52	0.21	219	501	4,877
65-69	0.44	0.26	307	610	7,387
70-74	0.43	0.26	308	478	5,118
75-79	0.37	0.27	312	402	5,047
80 plus	0.15	0.31	288	239	4,277
Total			1,734	3,088	34,187

Table A9

Aetiological Fractions, Mortality and Morbidity attributed to Chronic Obstructive Pulmonary Disease by Age and Sex for Australia, 1992

Age Group	MALES				
	Aetiological Fraction		Total Deaths	Total Hospital Episodes	Total Hospital Bed-days
	Current	Ex			
20-24	0.69	0.12	0	44	102
25-29	0.65	0.17	0	68	212
30-34	0.59	0.23	0	55	188
35-39	0.57	0.26	2	87	411
40-44	0.51	0.31	4	148	808
45-49	0.51	0.32	9	251	1,620
50-54	0.48	0.34	35	472	3,048
55-59	0.44	0.40	84	1,000	7,318
60-64	0.40	0.44	260	2,112	21,140
65-69	0.33	0.51	526	2,879	25,427
70-74	0.26	0.56	715	3,274	33,790
75-79	0.20	0.61	908	3,036	37,539
80 plus	0.18	0.62	1,374	2,827	33,401
Total			3,917	16,253	165,004
Age Group	FEMALES				
	Aetiological Fraction		Total Deaths	Total Hospital Episodes	Total Hospital Bed-days
	Current	Ex			
20-24	0.65	0.15	0	91	250
25-29	0.58	0.22	0	84	271
30-34	0.55	0.24	2	126	531
35-39	0.53	0.24	0	126	543
40-44	0.51	0.24	1	167	813
45-49	0.50	0.27	5	245	1,504
50-54	0.50	0.24	34	437	3,211
55-59	0.47	0.27	68	701	6,483
60-64	0.44	0.29	135	1,111	9,676
65-69	0.36	0.36	274	1,712	16,644
70-74	0.35	0.35	370	1,681	18,707
75-79	0.29	0.36	414	1,648	18,686
80 plus	0.12	0.40	663	1,702	25,514
Total			1,966	9,831	102,833

Table A10

Aetiological Fractions, Mortality and Morbidity attributed to Ischaemic Heart Disease by Age and Sex for Australia, 1992

Age Group	MALES				
	Aetiological Fraction		Total Deaths	Total Hospital Episodes	Total Hospital Bed-days
	Current	Ex			
20-24	0.44	0.02	5	28	131
25-29	0.44	0.04	9	78	311
30-34	0.41	0.05	41	322	1,563
35-39	0.41	0.06	84	1,104	5,090
40-44	0.37	0.07	205	2,764	13,407
45-49	0.38	0.08	369	4,734	23,256
50-54	0.36	0.08	571	6,180	32,894
55-59	0.34	0.10	848	7,935	42,972
60-64	0.32	0.12	1,533	10,112	59,096
65-69	0.12	0.05	2,275	10,797	71,579
70-74	0.09	0.06	2,831	8,308	53,638
75-79	0.07	0.06	3,220	5,841	42,679
80 plus	0.06	0.06	5,069	4,330	37,562
Total			17,060	62,533	384,178
Age Group	FEMALES				
	Aetiological Fraction		Total Deaths	Total Hospital Episodes	Total Hospital Bed-days
	Current	Ex			
20-24	0.42	0.03	0	8	58
25-29	0.39	0.05	2	37	240
30-34	0.37	0.05	10	88	368
35-39	0.34	0.05	18	246	1,159
40-44	0.32	0.05	45	608	2,677
45-49	0.32	0.06	67	1,106	5,722
50-54	0.30	0.05	129	1,677	8,775
55-59	0.29	0.05	272	2,506	13,498
60-64	0.26	0.06	504	4,052	24,147
65-69	0.08	0.02	947	5,627	35,540
70-74	0.08	0.02	1,640	5,866	41,568
75-79	0.06	0.02	2,550	5,512	46,351
80 plus	0.02	0.02	8,232	6,583	100,172
Total			14,416	33,916	280,275

Table A11

Aetiological Fractions, Mortality and Morbidity attributed to Stroke by Age and Sex for Australia, 1992

Age Group	MALES				
	Aetiological Fraction		Total Deaths	Total Hospital Episodes	Total Hospital Bed-days
	Current	Ex			
20-24	0.45	0.02	5	62	949
25-29	0.45	0.03	5	83	735
30-34	0.42	0.04	15	129	2,267
35-39	0.42	0.04	24	169	2,410
40-44	0.38	0.05	43	305	3,756
45-49	0.39	0.05	60	516	5,925
50-54	0.37	0.06	74	732	8,790
55-59	0.36	0.07	133	1,231	20,589
60-64	0.33	0.08	236	1,910	24,292
65-69	0.12	0.07	476	2,858	41,994
70-74	0.09	0.07	681	3,127	48,575
75-79	0.07	0.07	1,044	3,140	59,692
80 plus	0.06	0.07	2,054	3,535	64,598
Total			4,850	17,797	284,572
Age Group	FEMALES				
	Aetiological Fraction		Total Deaths	Total Hospital Episodes	Total Hospital Bed-days
	Current	Ex			
20-24	0.43	0.02	7	49	581
25-29	0.40	0.03	6	56	509
30-34	0.37	0.04	14	148	1,602
35-39	0.34	0.03	19	153	1,948
40-44	0.32	0.03	31	280	5,636
45-49	0.33	0.04	56	350	3,725
50-54	0.31	0.03	75	511	7,861
55-59	0.29	0.04	89	689	9,480
60-64	0.26	0.04	178	1,127	16,735
65-69	0.08	0.03	327	1,798	30,593
70-74	0.08	0.03	548	2,673	45,106
75-79	0.06	0.03	1,081	3,496	67,320
80 plus	0.02	0.02	4,690	6,107	147,472
Total			7,121	17,437	338,568