

The social costs of smoking in Western Australia in 2004/05 and the social benefits of public policy measures to reduce smoking prevalence

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Executive summary

This report provides new estimates of the social costs of tobacco use in Western Australia for the financial year 2004/05. It also presents estimates of the value of the social benefits which would accrue from a possible reduction in Western Australian smoking prevalence from its 2004 level of 15.5 per cent to five per cent over periods of ten years or 15 years.

The main conclusions concerning the estimates of the social costs of smoking in Western Australia in 2004/05 can be summarised as follows:

- The total social costs of smoking were about \$2.4 billion;
- Of these costs, 31.3 per cent were tangible costs and 68.7 per cent were intangible costs;
- Western Australia bore 7.6 per cent of the total Australian social costs of smoking in 2004/05. To put this figure in context, the Western Australian population in 2004/05 represented ten per cent of the total Australian population;
- Individuals bore 54 per cent of the total *tangible* costs, businesses bore 41 per cent and governments about five per cent. Individuals bear 100 per cent of *intangible* costs;
- The change to tobacco tax arrangements resulting from the introduction in 2000 of the GST meant that Western Australia effectively lost more than two thirds of its tobacco tax revenue (although, from the perspective of total State revenue, this loss was more than compensated for by the increased GST revenues accruing to the State from other consumer expenditures). In 2004/05, Western Australian tax revenues from tobacco abuse exceeded smoking-attributable expenditures in that State by \$94 million.
- The financial impact on the Federal budget of Western Australian smoking was very favourable, with tobacco tax revenues from Western Australian smokers exceeding federal smoking-attributable expenditures in that State by over \$330 million.

The table below presents a summary of the aggregate social cost estimates.

Social costs of tobacco abuse in Western Australia in 2004/05

	\$m	%
Tangible	748.5	31.3
Intangible (loss of life)	1,641.5	68.7
Total	2,390.0	100.0

The next table compares the Western Australian social cost estimates for 1998/99 and 2004/05 in constant price terms.

Comparison of constant price estimates of the social costs of tobacco in Western Australia, 1998/99 and 2004/05, at 2004/05 prices

	1998/99 \$m	2004/05 \$m	Per cent change
Tangible costs	521.4	748.5	43.5%
Intangible costs	1,387.4	1,641.5	18.3%
Total costs	1,908.8	2,390.0	25.2%

The *real* social costs of tobacco abuse are estimated to have risen during the period 1998/99 to 2004/05 by 25.2 per cent (consisting of a 43.5 per cent increase in tangible costs and an 18.3 per cent increase in intangible costs). Although smoking prevalence has been falling steadily and smoking-attributable mortality has also fallen very significantly in Western Australia, the lagged effects of past smoking both on health care and on the workforce have meant that the overall social costs of smoking continue to rise. However, as the lagged effects of past smoking work their way through the system, and assuming that smoking prevalence continues to decline, real smoking costs (adjusted for the effects of inflation) in Western Australia should eventually fall very significantly.

The following table presents estimates of the social benefits (in terms of the reduction in the social costs of smoking) which would result from reductions in smoking prevalence in Western Australia from 15.5 per cent to five per cent over ten and 15 year periods. It presents estimates calculated on the “most conservative” and “most plausible” bases.

The present value in 2004/05 of the social benefits of a reduction in Western Australian smoking prevalence to five per cent

Assumption Set	Prevalence reduced over 10 years		Prevalence reduced over 15 years	
	Present value \$m	Present value per smoker \$	Present value \$m	Present value per smoker \$
Most conservative	1,406.6	8,398	937.7	5,599
Most plausible	4,368.6	26,083	3,340.8	19,947

Under the most conservative method of estimation, and assuming that the prevalence reduction would take 15 years to achieve, the present value in the year 2004/05 of the social benefits of the reduction in smoking prevalence would be \$938 million. This represents \$5,600 for each person prevented from smoking by the anti-smoking interventions. These figures are the present value in 2004/05 of the benefits accruing over the whole of an assumed twenty year period of analysis, not the benefits which would accrue in the year 2004/05. The estimated benefits would be much higher if the most plausible basis for calculation was adopted.

The benefits calculated on the most conservative basis would justify the expenditure of up to \$110 million per annum on smoking interventions, assuming these interventions to be effective.

These figures represent the maximum justified expenditures. It is probable that the lower prevalence rate could be achieved by the application of much lower expenditures than these maxima, particularly if the Federal Government cooperated by raising the rate of excise tax on tobacco. Clearly, there is strong economic justification for effective annual public anti-smoking expenditure programs much higher than the actual 2004/05 Western Australian expenditures of \$7.7m.

These calculations in themselves do not indicate whether public expenditure programs of this magnitude would lead to the targeted decline in prevalence, nor do they indicate the form which successful anti-smoking interventions should take. However, the magnitude of the potential cost savings available to successful interventions would suggest that high social rates of return would be available to effective policies and programs.

A wide range of cost estimates can be produced under the various possible sets of underlying assumptions for the calculations. Under these circumstances, it is the view of the authors that, to avoid any possibility of overstatement of the "true" costs, the estimates calculated on the most conservative basis should be adopted for the purposes of policy discussion. There were various categories of smoking-attributable social costs which were not able to be valued and this strengthens the belief that these estimates are in fact underestimates.

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- Associate Professor James Codde of the University of Western Australia, who provided us with invaluable epidemiological assistance.

We continue to draw on the epidemiological work of Holman, Armstrong *et al*, English, Holman *et al*, Ridolfo and Stevenson, and now Begg *et al*, without all of whose painstaking calculation of aetiological fractions it would not be possible to undertake this study.

We are greatly indebted to all who assisted us. If errors and omissions remain, despite all the information and assistance provided, they are entirely our responsibility.

1. Introduction

This study estimates the social costs of tobacco use which were borne in Western Australia in the financial year 2004/05. It updates two previous studies of the social costs of tobacco in Western Australia (Collins and Lapsley, 2001 and 2004). The 2004/05 State estimates have been developed from the latest social cost estimates for Australia as a whole. These Australian estimates are presented in Collins and Lapsley (2008a) and are summarised in Collins and Lapsley (2008b). The present report also provides estimates of the value of the benefits which would result from future reductions in the prevalence of smoking in Western Australia.

In the main, both methodology and data sources are largely unchanged from those in the previous Western Australian study. This has the advantage that, for the first time, we are able to compare cost estimates in two different years (1998/99 and 2004/05), in order to indicate the trend of the social costs of tobacco over time.

The research methodology of this work has been extensively explained in the four earlier Australian studies by the present authors. For readers unfamiliar with this methodology, Appendix A presents a broad summary, particularly in relation to the estimation of State costs. Appendix B discusses methodological issues involved in estimating the benefits likely to arise from a reduction in the prevalence of smoking in Western Australia and Appendix C explains the derivation of the demographic estimates which underlie much of the calculations. Section 2 of this report explains briefly the estimation of cost categories for which new data sources are available or new institutional arrangements are in place. Thus, Section 2, together with Appendices A, B and C, should be sufficient to provide the reader with a general understanding of the research process and with the ability to interpret the cost results. Readers seeking more detailed elucidation should consult the most recent national study (Collins and Lapsley, 2008a).

In the remainder of this report, Section 3 explains the general interpretation of the social cost estimates. Section 4 presents estimates of some of the individual social costs of smoking in Western Australia, with the aggregate results appearing in Section 5. Section 6 provides a comparison of the real social costs of smoking in Western Australia between 1998/99 and 2004/05. Section 7 presents estimates of the cost impact of future reductions in Western Australian smoking prevalence. Section 8 draws together some conclusions from this research.

2. Changes affecting the calculation of the social costs of tobacco

In general the calculation methodology used in this study is consistent with that adopted for the previous estimates of the social costs of smoking in Western Australia in 1998/99. However, the arrangements by which tobacco is taxed have changed very significantly, and improved data have become available for the calculation of tobacco-attributable ambulance usage and pharmaceuticals consumption. These three areas of change are discussed in this section.

The impact of the GST on the taxation of tobacco

This study, like previous studies by the present authors in this series, estimates the impact of tobacco abuse by Western Australian smokers on the budgets of the Commonwealth and Western Australian governments. This involves a comparison of drug-attributable expenditures, for example on health care and justice, with the relevant tax revenues. Since the previous Western Australian study (Collins and Lapsley, 2004) there have been significant changes in the way in which tobacco is taxed.

Prior to 1997, tobacco was taxed through Federal customs and excise duties and State franchise fees. In August 1997, in response to a challenge to NSW franchise fees on tobacco, a High Court decision in the *Ha and Lim vs. The State of New South Wales* struck down these fees. This decision clearly also had applicability to tobacco franchise fees imposed by other States and, incidentally, to liquor franchise fees across all States and, as a result, all franchise fees were suspended.

As a consequence, the Commonwealth Government negotiated a safety net agreement with the States under which the Commonwealth would increase its tax rates on tobacco and alcohol to cover the revenue which would have been raised by the now-suspended franchise fees. The safety net revenue was returned to the States as Revenue Replacement Payments (RRPs). This situation was reflected in the 1998/99 tax revenue data in Collins and Lapsley (2004).

In July 2000, the Commonwealth Government introduced the Goods and Services Tax (GST) and abolished the wholesale sales tax, as part of a complicated package of changes resulting from the 1999 Intergovernmental Agreement (IGA) negotiated between the Commonwealth and the States. The IGA changed the method of taxing tobacco, and the distribution of that revenue between the Commonwealth and the States. Under the IGA, all GST revenue was earmarked for the States (though much of this revenue was clawed back by the Commonwealth through the simultaneous abolition of Financial Assistance Grants to the States).

It was intended that the GST should be applied to tobacco at the standard rate of 10 per cent, but that the overall rates of tax on tobacco should be largely unchanged. Thus, as a compensatory change to adjust for the application of the GST, the tobacco excise rate was reduced.

At the same time, to improve the effectiveness of the tobacco excise tax, its basis was changed from taxation purely by weight of tobacco to a combination of "per stick" taxation and taxation by tobacco weight. This latter reform was estimated at the time by Federal Treasury to yield an increase in tobacco tax revenue Australia-wide of \$440m. in a full year.

Apart from the "per stick" tobacco tax change, the above reform was designed to leave tobacco tax revenue broadly unchanged. However, it resulted in a major reallocation of tobacco tax revenue from the States to the Commonwealth. The States lost the Revenue Replacement Payments and, in compensation, received only the 10 per cent GST on tobacco. The result is shown in Table 1, which compares the situations in the financial years 1998/99 (the year of the previous tobacco costs study) and 2004/05.

Table 1 Tobacco tax revenues raised from Western Australian smokers, 1998/99 and 2004/05

	1998/99			2004/05		
	Federal \$m	Western Australia (RRPs) \$m	Total \$m	Federal \$m	Western Australia (GST) \$m	Total \$m
Excise tax	151.9	346.3	498.2	495.9	0.0	495.9
Customs duties	23.7	0.0	23.7	49.2	0.0	49.2
GST	n.a.	n.a.	n.a.	0.0	100.2	0.0
Total revenue	175.6	346.3	521.9	545.1	100.2	645.3
Percentage	33.6%	66.4%	100.0%	84.5%	15.5%	100.0%

Sources: Australian Bureau of Statistics, *Taxation Revenue* (5506.0), various years.

Australian Taxation Office, *Taxation Statistics* (various years).

Authors' calculations of GST revenue.

Note: n.a. means not applicable.

The above table shows how the taxation of tobacco is now almost entirely a Commonwealth prerogative. In 2004/05, the Commonwealth received 84.5 per cent of total tobacco tax revenue from Western Australian smokers (up from 33.6 per cent in 1998/99). Western Australia, on the other hand, received 66.4 per cent of tobacco tax revenue from smokers in that State in 1998/99, but only 15.5 per cent in 2004/05. In practice, the States now have no ability to control the GST tax rate, their single remaining source of tax revenue from tobacco.

Ambulances

It has, for the first time, proved possible to estimate ambulance costs attributable to smoking in Western Australia. The Western Australian Department of Health collects data on separations arriving at hospital by ambulance at a level of disaggregation which permits linking to tobacco-attributable medical conditions. The relevant attributable fractions are applied to these data to yield estimates of attributable ambulance services. Ambulance service costs are estimated by application of Western Australian ambulance usage and the relevant cost data in the *Report on Government Services 2006* (Attachment 8A).

Pharmaceuticals

The pharmaceutical cost estimates presented below relate to selected pharmaceuticals prescribed for the treatment of tobacco-attributable conditions identified in the risk-related fractions, and for which hospital and medical services are provided. This is necessarily only a partial calculation since it does not include costs of non-prescribed (across-the-counter) drugs consumed in relation to tobacco-attributable conditions. The present study costs those included in the one hundred highest cost Pharmaceutical Benefits Scheme (PBS) drugs.

An increasing component of treatment and care is provided on a non-inpatient basis. It is, therefore, important to identify these costs wherever possible. The cost estimates presented below apply only to prescription pharmaceuticals provided outside the hospital sector. In-patient pharmaceutical costs are incorporated in Diagnosis Related Groups (DRG) hospital costs.

3. Interpreting the social cost estimates

The definition of the costs of tobacco use adopted for the purposes of this study is:

The value of the net resources which in a given year are unavailable to the community for consumption or investment purposes as a result of the effects of past and present tobacco consumption, plus the intangible costs imposed by this consumption.

This definition reflects a distinction between tangible and intangible costs. Tangible costs are costs such as hospital costs which, when reduced, release resources for other uses. When intangible costs, such as pain and suffering, are reduced there is no release of resources. The beneficiaries cannot pass on these benefits to anyone else.

The costs calculated in this study are the costs of smoking which, it is estimated, were actually borne in the financial year 2004/05. The basis for this calculation is a comparison between the various costs (for example for health care or in terms of reduced labour productivity) which were borne in that year and the level of costs which would have been borne in the same year had there been no previous or current smoking in Western Australia. Thus the actual smoking situation is compared with the hypothetical counterfactual situation of no smoking.

The estimation methodology is described in much greater detail in Appendix A.

4. Some disaggregated costs

This section provides detailed estimates of the smoking-attributable costs of health care, production losses and fires. The next section provides an overall summary of the social costs of tobacco. This form of presentation is adopted to provide more comprehensive information on these areas of costs than is practicable in the aggregate tables. In the case of the smoking-attributable costs of fires, it is also a means of avoiding a problem of the double counting of some costs. Fire costs include both health costs and productivity losses, for which separate aggregate smoking cost estimates are made. Productivity and health costs cannot be included in both areas without double counting, and yet to exclude them from fire costs would give the impression that the total costs of smoking-attributable fires were lower than they in fact are. This problem is overcome by presenting the overall costs as well as costs "n.e.i." (not elsewhere included) which are the values carried over to the aggregate tables. In this way all double counting is avoided.

Health

Drug-attributable morbidity imposes health care costs for medical services, hospitals, nursing homes, pharmaceuticals and ambulances. However, the premature deaths caused by drug abuse can relieve the community of some health care cost burdens. Had the prematurely deceased been still alive they would have been placing demands on health care resources, demands which have been avoided as a result of the premature deaths. This paper estimates these health care savings as well as the health care costs.

Table 2 shows the health care costs due to smoking, and the savings in health care costs due to the premature deaths of smokers. The pharmaceutical costs identified here apply to prescribed pharmaceuticals outside the hospital system.

Table 2 Health care costs and savings attributable to smoking, Western Australia, 2004/05

	Medical \$m	Hospitals \$m	Nursing homes \$m	Pharma- ceuticals \$m	Ambulances \$m	Total \$m
Gross costs	36.9	59.8	34.2	17.8	4.4	153.0
Savings from premature deaths	28.2	45.2	51.4	10.4	1.7	136.9
Net costs	8.7	14.6	(17.2)	7.4	2.7	16.2

Note: Figure in brackets is negative.

Great care should be taken to interpret correctly this type of information. In no way could it be claimed that, even if the health care savings resulting from the premature deaths exceeded the gross health care costs, these deaths would be in the community's interest. The community bears other costs as a result of premature deaths, as is clearly illustrated by later information presented on the other tangible and intangible social costs of smoking.

Table 3 presents estimates of tobacco-attributable deaths caused and prevented by smoking. In fact, a very small number of deaths and hospital bed-days are prevented through tobacco consumption. The protective effects of tobacco are extremely small relative to the harmful effects.

Table 3 Tobacco-attributable deaths, hospital bed days and hospital costs, caused and prevented, Western Australia, 2004/05

	Deaths (number)	Hospital bed days (number)	Hospital costs (\$m)
Caused	1,268	68,135	60.3
Prevented	13	765	0.5
Caused less prevented	1,256	67,370	59.8

The following two tables reflect the deaths, bed-days and hospital costs of voluntary and involuntary smoking. Table 4 shows the absolute numbers and Table 5 the relative proportions. These estimates show that the costs of involuntary smoking result largely from involuntary smoking by children and the unborn, the most fragile and blameless in the population.

Table 4 Tobacco-attributable deaths, hospital bed days and hospital costs, by age and smoking status, Western Australia, 2004/05

	Voluntary	Involuntary	Total
Deaths (number)			
0-14	0	2	2
15+	1,244	9	1,253
Total	1,244	11	1,256
Hospital bed days (number)			
0-14	0	6,570	6,570
15+	60,620	180	60,800
Total	60,620	6,750	67,370
Hospital costs (\$m)			
0-14	0.0	5.7	5.7
15+	53.9	0.2	54.1
Total	53.9	5.9	59.8

Table 5 Proportions of tobacco-attributable deaths, hospital bed days and hospital costs, by age and smoking status, Western Australia, 2004/05

	Voluntary	Involuntary	Total
Deaths			
0-14	0.0%	20.2%	0.2%
15+	100.0%	79.8%	99.8%
Total	100.0%	100.0%	100.0%
Hospital bed days			
0-14	0.0%	97.3%	9.8%
15+	100.0%	2.7%	90.2%
Total	100.0%	100.0%	100.0%
Hospital costs			
0-14	0.0%	96.1%	9.6%
15+	100.0%	3.9%	90.4%
Total	100.0%	100.0%	100.0%

Over 97 per cent of all hospital costs arising from involuntary smoking are attributable to patients in the 0-14 age group.

Productivity

Table 6 presents estimates of the loss of productivity in Western Australia which is caused by smoking. These losses are estimated for the paid workforce and also within the household sector. As with the preceding cost estimates, these are net estimates, and show the amount of resources which would have been available if there had been no tobacco-attributable productivity losses.

Table 6 Paid and unpaid production costs of smoking, Western Australia, 2004/05

	Male \$m	Female \$m	Total \$m
Labour in the workforce			
Reduction in the workforce	178.1	89.4	267.4
Absenteeism	76.9	12.8	89.7
Total paid production costs	254.9	102.2	357.1
Labour in the household			
Premature death	458.6	301.4	760.0
Sickness	46.9	24.5	71.4
Total unpaid production costs	505.5	325.9	831.4
Total paid and unpaid production costs	760.5	428.0	1,188.5
Consumption resources saved	546.8	243.6	790.4
Total net production costs	213.6	184.4	398.1

The value of the total productivity loss in Western Australia in 2004/05, in both the workforce and the household sector, is estimated to be almost \$400m.

Fires

Table 7 provides estimates of the costs of smoking-attributable fires in Western Australia. Total costs are estimated to be \$16.0m., with tangible costs representing about three quarters of total costs.

Table 7 Costs of smoking-attributable fires, Western Australia, 2004/05

	\$m	Total \$m
Health		
Medical	0.6	
Hospital	1.1	
Total health		1.7
Labour		
In the workforce	4.2	
In the household	2.3	
Total labour		6.5
Fire services		3.1
Property damage		1.2
Total tangible costs		12.5
Value of loss of life	3.5	
Total intangible costs		3.5
Total costs		16.0
Total tangible n.e.i.		4.3
Relevant costs as per cent of Gross State Product		0.01%

Note: "n.e.i." indicates not elsewhere included.

5. Aggregate results

This section presents a series of tables providing a range of aggregate tobacco-attributable cost estimates, including tangible and intangible costs, the incidence of total costs, their budgetary impact at both Federal and State levels, and a comparison of selected attributable costs in Western Australia with Western Australian state output, as measured by gross state product.

Tangible costs

The tangible social costs of smoking presented in Table 8 are estimated at \$748m., the largest component of which reflects the reduction in production due to premature deaths.

Table 8 Tangible social costs of smoking, Western Australia, 2004/05

	\$m	Total \$m
Labour in the workforce		
Reduction in workforce	267.4	
Absenteeism	89.7	
Total workforce labour		357.1
Labour in the household		
Premature death	760.0	
Sickness	71.4	
Total household labour		831.4
Total labour		1,188.5
Less consumption resources saved		790.4
Total net labour costs		398.1
Health care (net)		
Medical	8.7	
Hospital	14.6	
Nursing homes	(17.2)	
Pharmaceuticals	7.4	
Ambulances	2.7	
Total health care		16.2
Fires n.e.i.		4.3
Resources used in tobacco consumption		329.9
Total		748.5

Notes: "n.e.i." indicates not elsewhere included.
Figure in brackets is negative.

Intangible costs

Intangible costs arise from loss of life and from pain and suffering. The only intangible cost which it proved possible to estimate in this study was loss of life. This cost is estimated to have been \$1,641.5m.

Total costs

Table 9 combines estimates of tangible and intangible costs, showing that valuation of loss of life is the largest component of total costs. Since it has not been possible to calculate intangible costs associated with morbidity, this estimate is considered to be very conservative.

Table 9 Total social costs of smoking, Western Australia, 2004/05

	\$m	%
Tangible	748.5	31.3
Intangible (loss of life)	1,641.5	68.7
Total	2,390.0	100.0

Table 10 compares estimates of smoking-attributable costs in 2004/05 in Western Australia and at the national level. Western Australian costs represented 7.6 per cent of aggregate Australian costs. To put this figure in context, the Western Australian population in 2004/05 represented 10.0 per cent of the total Australian population.

Table 10 Comparison of smoking-attributable social costs in Western Australia and Australia, 2004/05

	Western Australia \$m	Australia \$m	Western Australia as percentage of Australia %
Tangible	748.5	12,026.2	6.2%
Intangible	1,641.5	19,459.7	8.4%
Total	2,390.0	31,485.9	7.6%

Source of Australian data: Collins and Lapsley (2008a, Table 35).

Who bears the social costs of tobacco?

Table 11 illustrates the distribution of tangible tobacco costs showing that in Western Australia in 2004/05 individuals bore about 54 per cent of total tangible costs. In that year, businesses bore about 41 per cent and governments approximately 5 per cent. It is not widely recognised that such a large proportion of the social costs of smoking are labour costs, most of which are borne by business. By their nature, all intangible costs are borne by individuals.

Table 11 Incidence of the tangible social costs of smoking, Western Australia, 2004/05

	Individuals \$m	Business \$m	Government \$m	Total \$m
Workforce labour	0.0	294.3	62.8	357.1
Household labour	831.4	0.0	0.0	831.4
Hospitals	0.8	2.4	11.4	14.6
Medical	1.0	0.8	6.9	8.7
Nursing homes	(3.3)	0.0	(13.9)	(17.2)
Pharmaceuticals	1.2	0.0	6.2	7.4
Ambulances	0.4	0.4	1.9	2.7
Fires n.e.i.	1.9	1.9	0.4	4.3
Resources used in tobacco consumption	0.0	329.9	0.0	329.9
Total quantified tangible costs	833.4	629.9	75.6	1,538.9
Percentage of total quantified costs	54.2%	40.9%	4.9%	100.0%

Notes: "n.e.i." indicates not elsewhere indicated.

Figures in brackets are negative.

This table does not allocate "consumption resources saved" to the three categories.

Budgetary impact

The following three tables indicate the impact of smoking in Western Australia on Federal Government and Western Australian Government budgets.

Table 12 Impact of Western Australian smoking on the Federal budget, 2004/05

Outlays	\$m	Total \$m	Receipts	\$m	Total \$m
Health			Excise tax	495.9	
Hospitals	5.9		Customs duty	49.2	
Medical	6.9		Total tobacco revenue		545.1
Nursing homes	(12.7)		Less		
Pharmaceuticals	6.2		Revenue forgone		
Ambulances	0.5		Income tax	55.6	
Total health		6.7	Indirect taxes	148.9	
			Total revenue forgone		204.5
Total outlays		6.8	Total net revenue		340.6
Net revenue minus outlays		333.8			

Note: Figure in brackets is negative.

Table 13 Impact of Western Australian smoking on the Western Australian State budget, 2004/05

Outlays	\$m	Total \$m	Receipts	\$m
Health			GST	100.2
Hospitals	5.5			
Medical	0.0			
Nursing homes	(1.1)			
Pharmaceuticals	0.0			
Ambulances	1.4			
Total health		5.7		
Fires n.e.i.		0.4		
Total outlays		6.1	Total revenue	100.2
Net revenue minus outlays		94.1		

Note: Figure in brackets is negative

Table 14 Total budgetary impact of Western Australian smoking, 2004/05

Outlays	\$m	Total \$m	Receipts	\$m	Total \$m
Health			Excise tax	495.9	
Hospitals	11.4		Customs duty	49.2	
Medical	6.9		GST	100.2	
Nursing homes	(13.9)		Total tobacco revenue		645.3
Pharmaceuticals	6.2		Less		
Ambulances	1.9		Revenue forgone		
Total health		12.5	Income tax	55.6	
Fires n.e.i.		0.4	Indirect taxes	148.9	
			Total revenue forgone		204.5
Total outlays		12.9	Total net revenue		440.8
Net revenue minus outlays		427.9			

Note: Figure in brackets is negative

The expenditure figures in the above three tables relate to government expenditure only. As Table 11 shows, further tobacco-attributable costs are also borne by individuals and by the business sector.

The July 2000 change in the tobacco tax arrangements detailed in Section 2 above has meant that the Federal Government is now by far the main budgetary beneficiary of revenues from smoking. In relation to Western Australia, Federal tobacco-attributable expenditures were in 2004/05 exceeded by tobacco tax revenue to the tune of nearly \$334m. The Western Australian budget benefited to the extent of an excess of revenue over expenditure of \$94m.

The above tables exclude State and federal expenditures on tobacco control activities. It has been argued that these types of expenditures, for example on anti-smoking campaigns and smoking-related research, are the discretionary effects of public decisions to reduce smoking rather than the direct effects of cigarette consumption, and as such should be excluded from smoking cost estimates. This point has been accepted here for the estimation of smoking-attributable social costs but it is still useful to identify the extent of these types of expenditures. Details of Western Australian expenditure on tobacco control activities, by both State government and non-government organisations, are presented in Table 15 below.

Table 15 Expenditure on tobacco control activities in Western Australia, 2004/05

Agency	Funding source			
	Healthway	Dept of Health	Other	Total
	\$	\$	\$	\$
The Asthma Foundation of Western Australia	165,434			165,434
Australian Council on Smoking and Health (ACOSH)	172,000			172,000
The Cancer Council Western Australia	487,003	307,499	308,062	1,102,564
Department of Health Western Australia	301,000	1,725,689		2,026,689
Healthway	3,580,379			3,580,379
National Heart Foundation (Western Australia)	637,735		15,000	652,735
Total	5,343,551	2,033,188	323,062	7,699,801

Source: Information supplied by agencies listed. These data relate only to directly identified tobacco control expenditures, not to expenditures by other government departments or non-government agencies for which tobacco control is not identified as part of their core business and from which disaggregated tobacco-related data are not available.

Notes:

- Asthma Foundation expenditure covers *Newborns Asthma and Parental Smoking* Project (including end of funding for Phase 3 and beginning of funding for Phase 4 including the commencement of an Indigenous Women's Pilot Project). Expenditure was estimated using an average of expenditure for the years 2004 and 2005, due to use of a calendar year accounting system during that period.
- The Cancer Council Western Australia expenditure covers the *Make Smoking History* and *Fresh Start* programs.
- Total Department of Health expenditure includes Healthway funded expenditure of \$301,000 for tobacco control support sponsorships, and Department of Health expenditure of \$1,725,689 covering salaries, tobacco control policy and legislation activity, and public education.

- Healthway grant monies expended in 2004/05 financial year for major tobacco control projects and support sponsorships appear as expenditure against relevant agencies. Remaining Healthway expenditure appears against Healthway and includes funds dispersed to NGOs for tobacco control projects which were not expended in the 2004/05 financial year (total \$147,631) by the contracted organisation, sponsorship funding for sport, arts and racing organisations (where anti-tobacco messages were assigned to the organisation), other tobacco control projects and funding to WA universities for 3 major tobacco control research development grants. Total Healthway expenditure on tobacco control for the 2004/05 financial year was \$5,343,551 across all Healthway program areas. Note that this is an under-estimate as the figure does not include service level agreements with health agencies to cover the staffing costs associated with Healthway sponsorships promoting a tobacco control message.
- National Heart Foundation expenditure covers the *Smarter Than Smoking* Project and Healthway support of sponsorships promoting anti-tobacco messages.

Tobacco-attributable costs and gross state product

Estimates of aggregate drug-attributable social costs tend to produce numbers which are very large in absolute terms. Commentators often attempt to put these numbers in context by expressing them as a percentage of gross domestic product (GDP), which is a measure of the total value of national production or national income. Similarly, attempts to make international comparisons of the relative sizes of aggregate drug abuse costs in economies of very different sizes (for example, Australia and the USA) tend to be made by comparing aggregate costs expressed as a percentage of GDP.

A problem with this approach is that estimates of drug abuse costs contain certain (sometimes very large) components that are not measured in conventional national account measurements of GDP. In the present study these unmeasured components consist of all intangibles (loss of life) and production losses in the household (unpaid) sector. Thus, when total drug-attributable costs are compared with GDP, like is not being compared with like.

In order to overcome this problem, Table 16 below compares Western Australian gross state product (GSP) at factor cost (that is, excluding taxes and subsidies) with only those components of drug abuse costs which are conventionally measured in national accounts data. GSP is the state equivalent of GDP.

Table 16 Comparison of some smoking-attributable cost categories with Western Australian Gross State Product, 2004/05

	\$m	Per cent of GSP
Labour in the workforce	357.1	0.38
Net health care	16.2	0.02
Fires n.e.i.	10.2	0.01
Resources used in tobacco consumption	329.9	0.35
Total	713.4	0.76

The relevant components of tobacco-attributable costs represented in total 0.76 per cent of Western Australian GSP in 2004/05.

6. Comparison with previous Western Australian social cost estimates

The present authors have now produced estimates of the social costs of smoking in Western Australia for four years - 1988, 1992, 1998/99 and 2004/05. However, for a range of reasons, which are explained in Collins and Lapsley (2008a), some previous estimates have not been directly comparable. Accordingly it has not been possible to draw meaningful conclusions about the direction and rate of change of the social costs of smoking. This is no longer the case for comparison between this study and the previous Western Australian tobacco costs study.

Factors which can render cost estimates non-comparable over time include changes in information on relative risk, in the scope of the cost estimates and in information availability. However, none of these factors have changed significantly between the 1998/98 and 2004/05 studies. Once adjustment is made for changes in the general level of prices, the estimates for the two periods can be directly compared.

Table 17 below presents a comparison of the two sets of estimates, expressed in constant 2004/05 terms.

Table 17 Comparison of constant price estimates of the social costs of tobacco in Western Australia, 1998/99 and 2004/05, at 2004/05 prices

	1998/99 \$m	2004/05 \$m	Per cent change
Tangible costs	521.4	748.5	43.5%
Intangible costs	1,387.4	1,641.5	18.3%
Total costs	1,908.8	2,390.0	25.2%

The *real* social costs of tobacco abuse are estimated to have risen during the period 1998/99 to 2004/05 by 25.2 per cent (consisting of a 43.5 per cent increase in tangible costs and an 18.3 per cent increase in intangible costs). Smoking prevalence has been falling steadily (the percentage of the Western Australian population aged 14 years and over who are daily smokers falling from around 22 per cent in 1998 to 15.5 per cent in 2004) and smoking-attributable mortality has also fallen very significantly (from 1,618 deaths in 1998/99 to 1,256 deaths in 2004/05). Nevertheless, the lagged effects of past smoking both on the population structure and on the workforce have meant that the overall social costs of smoking continue to rise.

However, as the lagged effects of past smoking work their way through the system, and assuming that smoking prevalence continues to decline, real smoking costs (adjusting for the effects of inflation) in Western Australia should eventually fall very significantly.

7. The economic benefits of reduced smoking prevalence in Western Australia

This section presents estimates of the social benefits which would arise as a result of a reduction in the smoking prevalence rate in Western Australia of 15.5 per cent in 2004 (see Australian Institute of Health and Welfare, 2005b, Table S1) to a rate of five per cent, over periods of ten years or 15 years. These benefits are expressed in terms of the reduction of the social costs of smoking. This study makes no judgment as to whether the assumed prevalence reduction is feasible or what mix of public policies would be necessary to achieve such a reduction. The results can be used to indicate the extent of public resources which could justifiably be employed on anti-smoking programs, if these programs led to the reduction in the Western Australian smoking prevalence rate considered in this paper.

Appendix B discusses the various methodological issues and problems involved in an economic evaluation of a reduction in smoking prevalence. Given the paucity of relevant research information it is necessary to undertake the evaluation on the basis of the adoption of certain sets of assumptions. Table 18 indicates, for each of the issues identified in Appendix B, what we judge to be the “most conservative” approach (in terms of having the effect of minimising the present value of the social benefits of the reduction in smoking prevalence), the “least conservative” approach (in terms of having the effect of maximising the present value of the social benefits of the reduction in smoking prevalence) and the “most plausible” approach (in terms of its approximation, in our judgment, to reality). Thus, in this context, the term “conservative” is used to denote “yielding a comparatively low present value of the benefits of prevalence reduction”. “Least conservative” indicates “yielding a comparatively high present value of the benefits of prevalence reduction”.

Table 18 Assumptions underlying the evaluation of reduced smoking prevalence

	Pattern of reduction in smoking prevalence	Lag between reduction in prevalence and reduction in social costs (years)	Period of analysis (years)	Discount rate (per cent)
Most conservative	Linear	10	20	10
Least conservative	Geometric	6	30	4
Most plausible	Geometric	8	20	6

Table 19 presents estimates of the present value in the financial year 2004/05 of the simulated smoking prevalence reduction, according to the most conservative, least conservative and most plausible sets of underlying analytical assumptions. It also presents estimates of the average benefits per smoker.

An assumption of this analysis is that, in the absence of effective interventions to reduce the rate of smoking prevalence in Western Australia, the rate would remain at the 2004/05 level of 15.5 per cent. The benefits accruing to smoking reduction interventions would result from a reduction of prevalence below the 2004/05 rate.

When estimating the average benefits per smoker, the term “smoker” includes both never-smokers (those who, as a result of the intervention, do not take up smoking) and ex-smokers (those who, as a result of the intervention, quit smoking). Therefore there can be two components in any reduction in prevalence rates:

- Some existing smokers quit smoking; and
- Some smokers who die are not replaced by new smokers.

Table 19 The present value in 2004/5 of the social benefits of a reduction in Western Australian smoking prevalence to five per cent

Assumption Set	Prevalence reduced over 10 years		Prevalence reduced over 15 years	
	Present value \$m	Present value per smoker \$	Present value \$m	Present value per smoker \$
Most conservative	1,406.6	8,398	937.7	5,599
Least conservative	13,054.3	77,942	11,515.6	68,755
Most plausible	4,368.6	26,083	3,340.8	19,947

These estimates range from \$1,407m. to \$13,054m. for the reduction in the prevalence rate over ten years, and from \$938m. to \$11,516m. for the reduction over 15 years. The present values per smoker, as defined above, range from \$5,599 to \$77,942. Appendix B presents a testing of the sensitivity of these results to the adoption of a range of estimation assumptions indicated in Table 18 above. In general, we would tend to favour the most conservative analytical basis, and so the most conservative estimates.

These results are more meaningful if they are placed into a policy context. For example, it could be assumed that public expenditures were required to yield a real social rate of return of at least ten per cent per annum and that these public expenditures were successful in producing the reduction in Western Australian smoking prevalence to five per cent. On this basis, and on the most conservative set of assumptions, the achievement of the lower prevalence over 15 years would justify annual real expenditures of up to \$110m. for a 20 year period. Reducing the prevalence rate to five per cent over 10 years would justify annual expenditures of up to \$165m.

These figures represent the maximum justified expenditures. It is probable that the lower prevalence rate could be achieved by the application of much lower expenditures than these maxima, particularly if the Federal Government cooperated by raising the rate of excise tax on tobacco. Clearly, however, there would be strong justification for effective annual public anti-smoking expenditure programs much higher than the actual 2004/05 Western Australian public expenditures of \$7.7m. detailed in Table 15.

These calculations in themselves do not indicate whether public expenditure programs of this magnitude would lead to the targeted decline in prevalence, nor do they indicate the form which successful anti-smoking interventions should take. However, the magnitude of the potential cost savings available to successful interventions (as indicated by the avoidable cost estimates) would suggest that high social rates of return are available to effective policies and programs.

8. Conclusions

Some important conclusions can be drawn from this research concerning both the costs which smoking imposes on the Western Australian community and the implications of these costs for public policies at both the Western Australian and Federal levels.

Smoking imposes high costs on the whole Western Australian community, on the business community, on individuals, and on the Western Australian Government budget. The real social costs of smoking (after adjusting for the general rate of inflation) rose between 1998/99 and 2004/05 as a result of the lagged effects of past smoking, in spite of declining smoking prevalence and a reduction in tobacco-attributable deaths over that period. However, these lagged effects will increasingly wash through the system and, as long as anti-smoking efforts are at the very least maintained, the real social costs of smoking in Western Australia will eventually decline very significantly.

The calculations presented in this paper indicate that the benefits of further reductions in Western Australian smoking prevalence will, over time, be very high. Accordingly, there is strong justification for devoting a substantially higher level of public resources to efforts to reduce smoking prevalence.

A major problem for the States in implementing anti-tobacco policies is that the most effective, and certainly the most cost-effective, instrument for reducing smoking is tobacco taxation, which is now in practice under the exclusive control of the Federal Government. In recent years the Commonwealth has declined to increase the real rate of tobacco taxation, confining excise tax increases to rises in the consumer price index. While the States bear high smoking costs, the Commonwealth is by far the major beneficiary of tobacco tax revenue.

Indeed, it could be argued that the Federal Government policy to allow returning Australian tourists generous duty-free allowances on tobacco is, by eliminating the tax on significant quantities of imported tobacco, at odds with the goal of reducing the social costs of smoking. The consequent costs represent significant burdens on the States (for a review of the issues of tobacco duty-free allowances see Collins and Lapsley, 1994).

The ability for travellers to purchase duty-free tobacco must be considered a public health anomaly. The significant subsidy to purchasers of tobacco at duty-free concessions has to be compared with the public health consequences of increased consumption, and the high social costs associated with tobacco consumption. The lower price of duty-free tobacco due to lack of tax has the dual effect of encouraging consumption and increasing the total costs of tobacco use to the Australian community.

It has been shown that the States, in this case Western Australia, bear a large proportion of the tangible costs of tobacco consumption, while the forgone revenue, if the same quantity of cigarettes had been purchased in Australia, would have accrued to the Federal Government. On the other hand, if the removal of duty-free concessions for tobacco were to result in reduced consumption of tobacco, the health status of those people who then smoked less would improve, thus reducing the health care costs borne by both State and Federal governments.

To summarise the conclusions to be drawn from these research results, the estimated social costs of smoking in Western Australia are very high, as are the potential benefits of policies to reduce smoking prevalence. There is ample justification for increasing the levels of public expenditure devoted to the reduction of smoking prevalence in Western Australia.

A wide range of cost estimates can be produced under the various possible sets of underlying assumptions for the calculations. Under these circumstances, it is the view of the authors that, to avoid any possibility of overstatement of the “true” costs, the estimates calculated on the most conservative basis should be adopted for the purposes of policy discussion. The fact that there were various categories of smoking-attributable social costs which were not able to be valued supports the belief that these estimates are in fact underestimates.

Appendix A Estimating the Western Australian costs of tobacco use

This section provides a summary of the issues involved in estimating the social costs of tobacco consumption. It reproduces in large part the methodological discussion of the previous Western Australian paper. For a more comprehensive treatment of the issues see Collins and Lapsley (2008a, sections 2-4).

The study estimates the social costs of smoking which are *borne by Western Australia*. This is not the same as the costs of *smoking in Western Australia* since some of the costs borne by Western Australia may result from smoking undertaken elsewhere. For example, people living in other States may smoke for many years before moving to Western Australia, whose health system will then bear the smoking-related illness costs. The reverse process is equally true, for example as a result of smokers, having lived their working life in Western Australia, moving to other States as their health-related smoking costs rise.

In order to be able to produce estimates of the social costs of smoking it is necessary to identify two types of information, relating to:

- causality; and
- costs.

Causality

Information on causality is in large part epidemiological- identifying and quantifying the causal relationships between tobacco consumption, on the one hand, and mortality and morbidity, on the other. This causal information is, however, not confined to epidemiology. For example, the relationship between tobacco use and workplace productivity is a matter for several related disciplines, including industrial relations.

The quantification of tobacco costs relies upon the prior quantification of the causal relationships discussed above. Where causal relationships can be identified and quantified, the costs of smoking can almost always be estimated (although with varying degrees of accuracy).

A very considerable amount of information exists about the effects on mortality and morbidity of smoking and Western Australia has a proud record in this area of epidemiological research. The pioneering Australian work on the estimation of attributable fractions for tobacco was undertaken by Holman, Armstrong *et al* (1990) at the University of Western Australia. They estimated smoking attribution factors for all conditions for which it was possible to identify quantifiable causal relationships with smoking. The University of Western Australia also provided a team which produced a second comprehensive study on this topic (English, Holman *et al*, 1995). Their work was subsequently updated by researchers at the Australian Institute of Health and Welfare (Ricardo and Stevenson, 2001). The most recent Australian research in this area is in the Australian Burden of Disease study undertaken by epidemiologists from the School of Population Health at the University of Queensland (see Begg *et al*, 2007).

Table 20 below presents a listing of all the causes of mortality and morbidity which these studies identify as being causally associated with the consumption of tobacco.

Table 20 Tobacco-caused conditions and defining ICD-10 codes

Diseases and conditions	ICD-10 codes
Oropharyngeal cancer	C00-14
Oesophageal cancer	C15
Stomach cancer	C16
Pancreatic cancer	C25
Laryngeal cancer	C32
Lung cancer	C33-34
Cervical cancer	C53, D06
Endometrial cancer	C54
Bladder cancer	C67
Kidney cancer	C64-66, C68
Ischaemic heart disease	I20-25
Chronic obstructive pulmonary disease	J40-44
Tobacco abuse	F17, T65.2, Z72.0
Parkinson's disease	G20-21
Pulmonary circulation disease	I26.0, I27-28
Cardiac dysrhythmias	I46-49
Heart failure	I50-51, I97.1
Stroke	I60-69, G45
Peripheral vascular disease	I70.0-I70.8, I72-74
Lower respiratory tract infection	J10-13, J15-18, J20.0, J20.2-20.9, J21-22
Crohn's disease	K50
Ulcerative colitis	K51
Antepartum haemorrhage	O20, O44.1, O45-46, P02.0-02.1
Low birthweight	P05-07, P22
SIDS	R95
Fire injuries	X00-19
Asthma (under 15 years)	J45-46
Macular degeneration	H35.3-52.4
Otitis media	H65-66

Source: Collins and Lapsley (2008a, Table 59).

The attributable fractions in relation to tobacco consumption are almost all positive. In other words, there are only very minor protective effects of tobacco consumption. The consumption of tobacco, even at low levels, is damaging to health.

Costs

Once the causal relationships have been established and quantified, the allocation of tangible costs is relatively straightforward. The major types of information used here are:

- National accounts data on consumption, output and income;
- Medical, hospital and nursing home costs and usage data;
- Data on pharmaceuticals usage and costs;
- Data on workforce, wage rates and earnings; and
- Budgetary data on tax revenues and public expenditures.

We consider that the approach adopted by this study confronts more directly than do most other studies the issue of the exact nature of social costs. It can also be argued that the methodology of this study leads to a much more comprehensible concept of cost.

The definition of the costs of tobacco use is very closely related to the definition of the costs of drug abuse used in Collins and Lapsley (2008a). It is:

The value of the net resources which in a given year are unavailable to the community for consumption or investment purposes as a result of the effects of past and present tobacco consumption, plus the intangible costs imposed by this consumption.

This definition reflects a distinction between tangible and intangible costs. Tangible costs are costs such as hospital costs which, when reduced, release resources for other uses. When intangible costs, such as pain and suffering, are reduced there is no release of resources. The beneficiaries cannot pass on these benefits to anyone else. Intangible costs are generally much more difficult to value than tangibles because there is no market in intangibles. Labour and capital resources are bought and sold, so that a market price exists. On the other hand, there is no market in pain, suffering and loss of life, with the result that it is more difficult to place a value on them. Intangibles are, however, important costs of tobacco use and they cannot sensibly be ignored by researchers and policymakers.

The above definition of tangible costs relates to the resources *which would have been available* had there been no smoking. This removes the need to consider the alternative uses to which these resources would, or would not, have been put. For example, if the alternative uses were to be specifically considered, the costs of smoking would vary according to the rate of unemployment. If unemployment were high, it could be argued, the costs of smoking would be lower because dead workers would have been either unemployed or replaced by the unemployed and little or no output would have been lost. This approach treats unemployment as a target of public policy rather than simply as a given. Governments and society can make their own decisions about the way they wish to react to the release of productive resources which would result from reduced tobacco consumption.

The total costs of abuse to the community consist of private costs and social costs (the latter are often referred to in the economic literature as “external” costs). If the costs of smoking are knowingly and freely borne by rational smokers, they constitute private costs. If these conditions are not satisfied, smoking costs become social costs. In the conventional terminology, the total costs of smoking to the community as a whole (both smokers and non-smokers) consist of the costs borne by informed and rational smokers (private costs) and the costs borne by the rest of the community (social costs). Thus:

$$\text{Total costs} = \text{private costs} + \text{social costs}$$

From the point of view of public policy it is social costs, not private costs, which are relevant. The costs which smokers impose on the rest of the community are important in determining the appropriate levels of tobacco consumption and in deciding appropriate public policies, for example tobacco tax rates and the resources devoted to smoking education programs. This study estimates the *social* costs of smoking in Western Australia.

Two broad approaches have been adopted to the estimation of the costs of substance use in general, and of tobacco use in particular - the widely adopted "human capital" approach and the more recent "demographic" approach. Both approaches are accepted and supported in the WHO's *International Guidelines for Estimating the Costs of Substance Abuse* (Single et al, 2003). Both relate to the valuation of the loss of production arising from the tobacco-related deaths of otherwise productive members of society. Both approaches compare production and abuse costs in the actual situation with those in a hypothetical alternative situation which would have existed had there been no past or present tobacco use. The difference between the two approaches relates to the way in which the production costs of premature mortality are treated.

The human capital approach is to estimate the value of the worker's future production stream, brought back to present day values by the use of an appropriate discount rate. A thousand dollars received this year is worth more than a thousand dollars received next year (even if there is no inflation) because this year's resources become available for investment purposes a year earlier and so produce interest receipts or profits a year earlier. The use of a discount rate acknowledges this fact and adjusts for the difference between present and future values. Two major issues arise in the human capital approach - how to forecast future production levels and how to choose the appropriate discount rate.

The demographic approach compares the actual population size and structure with the size and structure of a hypothetical alternative non-smoking population. From this comparison the actual and hypothetical outputs are compared to yield the production costs in *that year* of past and present tobacco use. The major problem in this approach is the estimation of the alternative population structure, which is a demographic exercise. One major advantage of the demographic approach is that the need for arbitrary selection of a discount rate is avoided.

The present study adopts the demographic approach for two reasons:

- It avoids the very serious problem of determining an appropriate discount rate; and
- The results of this approach are much easier and more sensible to interpret.

Smoking, through its effects on mortality and morbidity, reduces both the number of people in the paid work force and the productivity of some people remaining in the work force. It also affects the output of people who are not in the paid work force but who are, nevertheless, contributing to real national output. This unpaid work includes domestic activities, childcare, and volunteer and community work. This study estimates the value of the loss of unpaid work resulting from smoking.

It is not, with the currently available information, possible to assign values to all of the types of social costs which smoking imposes. The major types of costs which are not estimated in this study are:

- Some prescribed pharmaceuticals consumed outside hospitals and non-prescribed pharmaceutical consumption;
- Domiciliary care and allied health professional services;
- Reduced on-the-job productivity;
- Litter; and
- Pain and suffering experienced by smokers and others.

This study estimates the social costs of smoking to Western Australia. It must be emphasised that it would not be possible to implement public policies which would eventually reduce all these social costs to zero. Public policies may be very successful in further reducing the prevalence of smoking but it is not within the current realms of possibility that smoking will disappear completely. Thus, of these total social costs of smoking, a component is avoidable with the remainder being unavoidable. Avoidable costs can be interpreted as being those costs which are susceptible to reduction as a result of the implementation of the appropriate public policies. They indicate the benefits potentially available to public policy initiatives.

Collins and Lapsley (2008a) discuss the problems of identifying which sections of the community bear the social costs imposed by tobacco use (individuals, government or business). It is, in practice, only possible to estimate the impact incidence of tangible tobacco costs. For example, businesses which face higher production costs as a result of a smoking-attributable decline in productivity might pass on some or all of these cost increases to their customers by charging higher prices. This type of reaction is referred to as cost-shifting. No attempt has been made to estimate any shifting behaviour adopted in response to the initial impact of these costs. By their nature, all intangible costs are borne by individuals.

In addition to the imposition which tobacco use places on real resources (such as the labour and capital used in supplying health care services) it also puts pressure on government budgets, as a result of the need to fund public expenditures on these types of services. However, the consumption of tobacco also produces government revenue, at the Federal level through customs and excises and the GST, whose revenue is fully earmarked for the States. The impact of recent changes to the taxation of tobacco is explained in section 3 above.

On the outlay side of the government budget, there will clearly be increased expenditures attributable to tobacco use but there will also be some attributable reductions. In particular, the premature mortality resulting from tobacco consumption will lead to some reduction in health expenditures. These “benefits”, as well as the costs, are estimated in this study.

On the revenue side, in addition to the evident gains there will also be losses in revenue. For example, premature mortality will lead to reduced output, incomes and consumption and so there will be reductions in revenue from income tax and indirect taxes. This analysis does not, however, include the relatively minor effects on revenues from corporate taxes such as company income tax, fringe benefits tax and payroll tax, for the reasons explained in Collins and Lapsley (1996).

The estimation of the budgetary impact of smoking is an exercise subsidiary to that of estimating the tangible and intangible costs of smoking. The latter represent the impact of smoking on the community as a whole. The budgetary impact is largely an indication of the funding impact of smoking on government.

Estimation of the social costs of smoking borne in an individual State establishes substantial additional data requirements. In summary, disaggregated State data are needed for:

- Mortality;
- Morbidity;
- Hospital occupancy and costs;
- Nursing home occupancy and costs;
- Medicare services;
- Health expenditure and sources of funding;
- Diagnosis related groups (DRG) costs;
- Consumption expenditures;
- Award rates of pay;
- Employee earnings and hours of work;
- Household incomes and wages, salaries and supplements;
- Gross State Product,
- Population size and structure;
- Demographic impact of smoking;
- Income tax and indirect tax revenues;
- Workforce;
- Prices; and
- Smoking program costs.

Appendix B Issues in the economic evaluation of reductions in smoking prevalence

Methodological issues

This study estimates the social benefits (expressed in terms of the reduction of the social costs of smoking) which would arise as a result of a reduction in the smoking prevalence rate in Western Australia (as indicated by the percentage of the population aged 14 years and over who smoked on a daily basis) from 15.5 per cent in 2004/05 to five per cent over periods of ten years and 15 years.

Declines in smoking prevalence will lead to reductions in social costs, but the lags involved in this process are difficult to identify. A decline in smoking prevalence may lead to a virtually instant decline in some costs, for example those arising from fire-related deaths, injuries and damage. On the other hand, other types of costs may only be responsive to declines in smoking prevalence with a considerable lag. For example, reduced smoking prevalence may lead to a decline in lung cancer-related costs only after a period of many years. It appears impossible, on the basis of currently available research, to estimate the relevant average lag period. This study adopts the approach, therefore, of making an educated guess as to the range of values in which the actual lag may lie and testing the sensitivity of the results to the adoption of different lags. All other things being equal, the longer the assumed lag the lower will be the calculated social benefits. Total benefits will be lower and, since they will accrue later in the life of the program, their discounted present value will be less.

The present study, therefore, assumes that a given proportionate reduction in prevalence rates will lead to the same proportionate reduction in social costs after a relevant period. Results are calculated on assumed average lags of six, eight and ten years.

A further complication is that the effects of past tobacco-attributable mortality on the structure of the Western Australian population will take many years to disappear completely. Thus, the longer the period of study the greater is the proportion of the social costs of tobacco which are potentially avoidable. In this study it is assumed that the population effects of past smoking will only have fully disappeared at the end of a thirty year period.

Estimates of the future benefits of public policy programs could simply be calculated as a time series presenting, on a year-by-year basis, benefits expressed in the values of the relevant years. Such results would have limited significance since it would be virtually impossible to make any comparison between projects which were competing (in the sense that they were alternative ways of achieving the same objective) when the time patterns of benefits differed between the two projects. All other things being equal, the program which yielded its benefits earlier would be the preferable program. This is because program benefits could be reinvested in other projects to yield a further rate of return and the earlier that the benefits accrued the greater would be the reinvestment benefits. If Project A yields comparatively low benefits comparatively early while Project B yields comparatively high benefits comparatively late, simple inspection of the two time series of benefits at current values may not conclusively indicate which project is to be preferred. This type of decision can only be properly made using the technique of discounting.

Discounting reduces the future flow of values to a single figure, the present value expressed in the prices of the chosen year. Present value is calculated by the application of a discount rate to the future value stream. The higher is the discount rate, the lower will be the present value of a given stream of future values. Since there are serious theoretical problems in the choice of an appropriate social discount rate, this study estimates results according to a range of discount rates.

Over what period should the evaluation of reduced smoking prevalence be undertaken? In investment analysis it is usually possible to define the life of the project. However, anti-smoking programs often have no pre-defined lives and it is difficult to predict future public policies towards smoking. Given that the benefits of anti-smoking programs may accrue over many years and that they would certainly continue to accrue for at least some period of time after the program had ended, the adoption of too short a period of analysis would lead to underestimation of the program benefits. On the other hand, it is extremely difficult to predict future developments in medical technology, and therefore health care costs. Technological improvements may lead to cost reductions, for example as a result of the development of new vaccines, or they may lead to cost increases, for example as a result of the development of more effective but more expensive medical treatments.

The higher is the discount rate, the lower will be the present value of social benefits accruing into the future. For example, one dollar's benefits to be received in thirty years time will have a current value of seventeen cents at a discount rate of six per cent, but only six cents at a discount rate of ten per cent. Given the major uncertainties in forecasting over long periods of time, which have to be balanced against the understatement of benefits implied by the adoption of too short a period of analysis, this paper analyses benefits accruing over twenty and thirty year periods.

In estimating the social benefits of reduced smoking prevalence, comparison must be made with some alternative level of prevalence which is based on the assumption that the maintenance of current policies would lead to the maintenance of current prevalence rates. For the purposes of this study a comparison is made between one situation in which current year 2004/05 prevalence rates are maintained into the future and another in which prevalence is reduced.

An issue arises as to the path which the assumed reduction in the smoking prevalence rate would take in the 10 and 15 year periods under analysis. One possibility is that the prevalence rate would fall by an equal absolute amount each year (a linear progression). An alternative assumption would be that suggested by experience in many public health campaigns that is that the absolute impact on prevalence declines over the life of the campaign. It therefore becomes progressively more difficult to reduce the prevalence rate as a result of delays in reaction by the more resistant sections of the smoking population. This scenario can be represented by a geometric progression. Both scenarios are analysed in this paper, as indicated in the Table 21.

Table 21 Assumed reductions in smoking prevalence rates

Initial prevalence rate	15.5 per cent	15.5 per cent	15.5 per cent	15.5 per cent
Target prevalence rate	5.0 per cent	5.0 per cent	5.0 per cent	5.0 per cent
Assumed number of years to achieve target rate	10	10	15	15
Assumed reduction path	Geometric	Linear	Geometric	Linear
	Prevalence rate	Prevalence rate	Prevalence rate	Prevalence rate
2004/5	15.5%	15.5%	15.5%	15.5%
2005/6	13.8%	14.5%	14.4%	14.8%
2006/7	12.4%	13.4%	13.3%	14.1%
2007/8	11.0%	12.4%	12.4%	13.4%
2008/9	9.9%	11.3%	11.5%	12.7%
2009/10	8.8%	10.3%	10.6%	12.0%
2010/11	7.9%	9.2%	9.9%	11.3%
2011/12	7.0%	8.2%	9.1%	10.6%
2012/13	6.3%	7.1%	8.5%	9.9%
2013/14	5.6%	6.1%	7.9%	9.2%
2014/15	5.0%	5.0%	7.3%	8.5%
2015/16			6.8%	7.8%
2016/17			6.3%	7.1%
2017/18			5.8%	6.4%
2018/19			5.4%	5.7%
2019/20			5.0%	5.0%

In summary the approach adopted to calculating the benefits of reduced smoking prevalence is as follows:

- Assume that in the absence of anti-smoking campaigns the annual real (that is, adjusted for inflation) social costs of tobacco in Western Australia in the periods of analysis (2004/05 to 2014/15, and 2004/05 to 2019/20) would remain the same as in 2004/05, the last year for which actual estimates are available;
- Estimate the proportions of these total costs which are avoidable and unavoidable for each year of the period being analysed on the basis of the target rate of smoking prevalence;
- Assume that avoidable social costs decline by the same percentage as the percentage decline in smoking prevalence, with assumed lags of six, eight and ten years before the reduction in social costs commences;
- Test the sensitivity of the results to a range of discount rates, assumed lags, periods of analysis and prevalence rate declines.

The sensitivity of the estimates of the benefits of prevalence reduction to the assumptions adopted

The tables below indicate the sensitivity of the results to the assumptions adopted. The alternative assumptions relate to:

- The pattern of the reduction in smoking prevalence (linear or geometric);
- The period over which the simulated reduction in smoking prevalence takes place (ten years or 15 years);
- The lag between the reduction in smoking prevalence and the reduction in the social costs of smoking (six, eight or ten years);
- The period of analysis (twenty or thirty years); and
- The social rate of discount adopted (four per cent, six per cent, eight per cent or ten per cent).

The results presented in Section 7 as the “most conservative”, “least conservative” and “most plausible” for the ten year period are highlighted in various tables below.

Linear prevalence reduction to 5 per cent by 2014/15

Table 22 Present values (year 2004/05 prices), linear prevalence reduction to 5 per cent, twenty year analysis

Discount rate	Lag (in years)		
	6	8	10
4 %	6,850.9	5,279.4	3,787.4
6 %	5,060.9	3,827.1	2,699.5
8 %	3,775.9	2,799.9	1,940.6
10%	2,844.1	2,066.6	1,406.6

Table 23 Present values (year 2004/05 prices), linear prevalence reduction to 5 per cent, thirty year analysis

Discount rate	Lag (in years)		
	6	8	10
4 %	12,314.7	10,743.1	9,251.2
6 %	8,378.5	7,144.6	6,017.0
8 %	5,815.0	4,839.0	3,979.7
10%	4,112.2	3,334.6	2,674.7

Linear prevalence reduction to 5 per cent by 2019/20**Table 24 Present values (year 2004/05 prices), linear prevalence reduction to 5 per cent, twenty year analysis**

Discount rate	Lag (in years)		
	6	8	10
4 %	5,001.7	3,647.5	2,525.0
6 %	3,671.0	2,637.7	1,799.6
8 %	2,721.9	1,925.3	1,293.7
10%	2,038.0	1,417.9	937.7

Table 25 Present values (year 2004/05 prices), linear prevalence reduction to 5 per cent, thirty year analysis

Discount rate	Lag (in years)		
	6	8	10
4 %	10,465.5	8,989.0	7,588.4
6 %	6,988.5	5,875.3	4,858.7
8 %	4,761.0	3,911.7	3,164.5
10%	3,306.1	2,651.0	2,095.2

Geometric prevalence reduction to 5 per cent by 2014/15**Table 26 Present values (year 2004/05 prices), geometric prevalence reduction to 5 per cent, twenty year analysis**

Discount rate	Lag (in years)		
	6	8	10
4 %	7,590.5	5,981.7	4,454.0
6 %	5,653.3	4,368.6	3,194.2
8 %	4,253.1	3,220.1	2,310.4
10%	3,230.7	2,394.8	1,685.1

Table 27 Present values (year 2004/05 prices), geometric prevalence reduction to 5 per cent, thirty year analysis

Discount rate	Lag (in years)		
	6	8	10
4 %	13,054.3	11,445.5	9,917.7
6 %	8,970.9	7,686.2	6,511.7
8 %	6,292.2	5,259.3	4,349.6
10%	4,498.8	3,662.8	2,953.1

Geometric prevalence reduction to 5 per cent by 2019/20**Table 28 Present values (year 2004/05 prices), geometric prevalence reduction to 5 per cent, twenty year analysis**

Discount rate	Lag (in years)		
	6	8	10
4 %	6,051.9	4,592.0	3,312.2
6 %	4,477.9	3,340.8	2,370.8
8 %	3,347.2	2,453.3	1,711.6
10%	2,526.8	1,817.7	1,245.9

Table 29 Present values (year 2004/05 prices), geometric prevalence reduction to 5 per cent, thirty year analysis

Discount rate	Lag (in years)		
	6	8	10
4 %	11,515.6	9,985.5	8,533.4
6 %	7,795.4	6,612.5	5,531.6
8 %	5,386.4	4,462.1	3,648.5
10%	3,794.9	3,065.6	2,446.8

Appendix C Demographic estimates

This appendix describes the research's demographic methodology, using aetiological fractions and demographic data to estimate the additional numbers of Western Australian males and females who would have been alive and enumerated in the Western Australian population in June 2005 had there been no use of tobacco. The appendix was written by J.H. Pollard, Emeritus Professor of Actuarial Studies, Macquarie University, who undertook the demographic calculations for this study.

The data

The aetiological fractions used in this report are those presented in English, Holman *et al* (1995), Ridolfo and Stevenson (2001), and Collins and Lapsley (2008a). For the purposes of this projection, the first set of aetiological fractions are assumed to apply prior to 1988 (but without illicit drug deaths prior to 1962) and those of Ridolfo and Stevenson in 1998, with intermediate fractions for the period 1989-1997. Those of Collins and Lapsley are assumed to apply in 2005, with intermediate fractions between 1998 and 2005.

The other data used in the calculations are as follows:

- the population of Australia in 1947 by age (in individual years) and sex;
- the Australian life tables 1953-55, 1965-67, 1975-77, 1985-87 and 1995-97;
- ABS Life Tables Australia 2003-2005;
- the numbers of births in Australia for each calendar year 1947-2005;
- the numbers of net migrants by age (in broad age groups) and sex for representative years in each decade (1950s, 1960s, 1970s, 1980s, 1990s) and 2000-2003;
- estimates of the Australian and Western Australian populations in 2005 by age and sex.

These demographic data were all available from Australian Bureau of Statistics (ABS) publications.

Method

Using the base 1947 population, the history of births, the above-mentioned life tables and the representative migration numbers, it was possible to project forward the Australian population from 1947 to 2005. The resultant estimates for 2005 were close to those provided by ABS.

The projection program was then re-run with modifications to the assumed rates of mortality to reflect the situation which would have existed had there been (a) no illicit drug use, (b) no illicit drug use nor alcohol use, and (c) no illicit drug use, nor alcohol use nor tobacco use. The resultant Australian figures were then scaled on a pro-rata basis for the various age-groups using the Western Australian and Australian 2005 ABS population estimates in five-year age groups to obtain the Western Australian figures shown in the tables.

All calculations apart from the final scaling were performed using single years of age. The reported results are in five-year age groups.

The scaling approach was adopted to obtain the Western Australian estimates because it was believed that the direct application of the national method to an individual state would produce spurious accuracy due to

- the uncertainties inherent in the age-specific migration numbers into the state from overseas,
- the uncertainties relating to age-specific net interstate migration numbers and their drug usage histories, and
- the possibility that the aetiological fractions, applicable nationally, might not be exactly the same for each individual state.

As in previous reports, no attempt was made to quantify the births that did not take place because of lives lost through drug usage.

Adjustment of the Australian mortality rates

Using the aetiological fractions described above and applying them to the relevant causes of death identified by the same authors, it is possible to estimate the proportions of deaths at each age attributable to illicit drug use, to alcohol use and to tobacco use. These proportions were then applied to the mortality rates in earlier epochs to determine the modified mortality rates for use in the various computer program runs described above. Normal multiple-decrement table formulae were used to calculate the modified rates.

This approach can be criticised on several counts. First, it is doubtful whether exactly the same fractions applied in earlier years, since usage of these drugs has changed over time, and other factors have had major impacts on the numbers dying from the various causes (road accident deaths, for example, have halved in the last decade, as a result of various measures, and circulatory system disease mortality has declined remarkably, presumably as a result of a number of lifestyle and medical changes). Second, the aetiological fractions ought to be applied to the deaths by cause in earlier epochs to derive mortality proportions relevant to those times. This second objection can be addressed, but any improvement in accuracy is likely to be spurious, because of the serious nature of the first limitation.

It is important to note that the current Australian Burden of Disease (ABOD) study (Begg *et al*, 2007) reports a substantially lower health benefit due to alcohol compared with the previous study, with only an estimated 2,346 deaths being saved by alcohol in 2003, compared with 7,157 deaths saved in 1996. According to the authors of the current ABOD report, the previous study incorrectly estimated the number of people who abstain from alcohol or drink less than 0.25 drinks per day. In the absence of corrected aetiological fractions for the mid 1990s, the original fractions were incorporated in the projection as described above, and as a result the net numbers of alcohol-related deaths are believed to be underestimated.

In the absence of equivalent aetiological fractions for all earlier epochs, the above approach was considered the most reliable.

Results

Table 30 presents the resulting estimates of the additional Western Australian population in the absence of past and present smoking.

Table 30 Estimated additional Western Australian population in the absence of smoking, June 2005, classified by age and sex

	Male	Female	Total
0-4	14	8	23
5-9	34	22	56
10-14	48	33	81
15-19	94	57	151
20-24	167	80	246
25-29	302	121	422
30-34	527	176	702
35-39	776	251	1,027
40-44	1,045	347	1,392
45-49	1,262	435	1,697
50-54	1,482	516	1,998
55-59	1,787	609	2,397
60-64	1,835	614	2,449
65-69	2,294	782	3,077
70-74	2,800	966	3,766
75-79	3,526	1,262	4,788
80-84	3,270	1,317	4,588
85 plus	3,353	1,350	4,703
Total	24,616	8,947	33,563

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