



<b>Title</b>	<b>The cost of tobacco-related disease</b>
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## The cost of tobacco-related disease

### Background

There is growing epidemiological evidence of the harm caused to health by tobacco smoking. The data can be used to calculate the economic impact of tobacco use. In Hong Kong, information is available on the impact of tobacco use on mortality and also on the impact of passive smoking on health care utilisation and on time taken off work by those exposed to second-hand smoke (SHS). Using this and other data we calculated the annual health-related cost of tobacco smoking, with 1998 as the example year.

### Aim

This study aimed to estimate the costs of tobacco-related disease in 1998 using local data.

### Methods

This study was conducted from May 2000 to May 2003.

### Data

Data were used to estimate the cost of in-patient and out-patient use of health care, in both public and private sectors, which could be related to tobacco use. This covered the effects of both active and passive smoking.

The datasets used included: the lifestyle and mortality study (LIMOR), which provided relative risks of active and passive smoking on mortality from a variety of causes<sup>1</sup>; the Harvard Household Survey (HHS), which provided population data on active and passive smoking and on health care utilisation<sup>2</sup>; the Police Health Survey (PHS), which provided data on the association between passive smoking and health care utilisation and time off work<sup>3</sup>; and the Hospital Authority (HA) in-patient database, which covers all episodes of hospital care in public hospitals.

### Mortality due to active smoking

Analysis of the LIMOR dataset indicated the risks of excess mortality from specific causes for smokers.<sup>4</sup> The dataset was reanalysed to calculate the fraction of deaths attributed to active smoking. Applying these attributable fractions to all deaths, we estimated the number of lives lost, premature lives lost (ie those <75 years), and lives lost during productive years (ie those <65 years). Using the age at death, we calculated life years lost before age 75 and productive years lost. Life years were discounted at 3% per annum. The losses were monetised by valuing a premature life lost at HK\$10 million and a working year lost at the median wage in 1998 for male or female, as appropriate.

### Morbidity due to active smoking

We applied the disease-specific attributable fractions for mortality to hospital admissions, assuming that the proportion of all those who died of a specific disease was similar to the proportion of all those admitted for that disease. Specialist out-patient visits were analysed in a similar manner. The HA provided data on the unit cost of a bed-day in acute and long-stay hospitals and unit costs of a specialist out-patient visit. For private hospitals, we used data on the number of admissions. BUPA (Asia) Ltd supplied an estimate of charges for admissions that gave a conservative estimate of the cost of private hospital care.

### Key Messages

1. Tobacco use costs Hong Kong more than \$5.3 billion (bn) per year (estimated from 1998 data).
2. Two thirds of the cost (\$3.6 bn) was for health care and the remainder (\$1.8 bn) was for productivity losses due to ill health or death during working life. The proportion of the morbidity costs which fell on the public sector was 70% for active smoking and 50% for passive smoking.
3. Much of the enormous annual cost from tobacco use is avoidable.
4. Legislation preventing smoking in public places would reduce much of the expenditure on passive and some of that on active smoking effects.

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Less severe morbidity could be treated by general out-patient clinics (GOPCs), Accident and Emergency (A&E) units, or by private general practitioners (GPs). For GOPCs, we applied the attributable risks calculated from LIMOR to the total number of GOPC visits and multiplied the value obtained by the unit cost of a visit. For private GP visits, we included only visits for respiratory disease and used an estimate of relative risk for a smoker from a local study.<sup>5</sup> This relative risk was applied to an estimate of all visits for respiratory problems and the average cost of these visits taken from the HHS.

The relative risk of taking extra time off work due to active smoking was estimated using the PHS data. An attributable fraction was then applied to a conservative estimate of the days taken off work by the working population and the days lost were valued at the median wage. Similarly, the days spent in hospital as an in-patient by those of working age was adjusted to reflect the non-working population and multiplied by the median wage.

Those who suffer from tobacco-related diseases may use other services such as long-term care, that is residential care including nursing homes or may be looked after at home by a domestic helper or family members. We estimated these costs based on the number of smoking attributable cases of disease identified. The number of persons enrolled in the four types of residential care home was obtained from routine data (personal communication). The unit monthly cost for each kind of residential care home (personal communication) was multiplied by the attributable number of cases to get the annual smoking attributable nursing home cost. We used the amount of time over which persons required home-based care from the LIMOR dataset and applied it to the costs of local and foreign domestic helpers<sup>6</sup> to calculate the attributable cost for decedents in their last year of life. We did not attribute any cost to those looked after by family members due to the lack of suitable cost data.

### ***Mortality due to passive smoking***

Passive smoking has been associated with lung cancer, chronic obstructive pulmonary disease (COPD), ischaemic heart disease (IHD), and stroke in both local and international studies. We used the locally derived relative risks for lung cancer, COPD, and stroke and the overseas pooled results for IHD, which were very similar to the local findings. We estimated attributable fractions of mortality from these causes and valued them in dollars in the same way as for active smoking. In the main estimate of cost, we included the impact of passive smoking at home and at work. The costs were calculated for all non-smokers.

### ***Morbidity due to passive smoking***

Local data on the costs in the first year of life due to pre- and post-natal passive smoke exposure are available.<sup>7</sup> From another local study on 8- to 12-year-old children,<sup>8</sup> we extrapolated the excess doctor visits caused by passive

smoking and their costs to children between 1 to 15 years old. Local data on the levels of the nicotine metabolite cotinine in catering workers has been used to model the likely mortality from lung cancer and heart disease in this occupational group.<sup>9</sup> For the remainder of the population, we applied the attributable fractions for mortality to admissions for lung cancer, COPD, IHD, and stroke. We did not include the cost of private hospitals due to lack of data.

For more minor morbidity, we used local data on self-reported use of GP services and their costs for those exposed to SHS at work.<sup>10</sup> We could not include the impact of SHS at home due to insufficient data.

We estimated time lost due to passive smoking from a published paper<sup>11</sup> using the PHS dataset, but recalculated it to give sex-specific estimates. We also included an estimate of the time lost due to the attributable inpatient admissions for the working population.

All reported costs are in Hong Kong dollars (HK\$7.8=US\$1.0) and are for 1 year (1998).

## **Results**

The Table shows the costs of active and passive smoking.

We estimate that 5596 deaths (aged  $\geq 35$  years) in Hong Kong in 1998 were attributable to active smoking and 3398 (61%) of these are premature deaths (<75 years). The number of deaths occurring while smokers or ex-smokers were in their productive years (<65 years) was 1529 (27% of all attributable deaths).

The smoking-attributable years of potential life lost for all premature deaths was 28 668 years with a 3% discount rate. This is 8.4 years for each smoking-attributable premature death. Assuming that the production of a person not in the work force is zero, the attributable productive years lost was 8669 person years with a 3% discount rate.

### ***Value of mortality attributable to active smoking***

Applying the value of \$10 million to each premature life lost, we obtain a value of \$33 980 million. The monetary value of the lost productive years was \$1244 million, valued at the median wage.

### ***Morbidity due to active smoking***

The smoking-attributable cost of public acute and long-stay hospital care was \$1314 million. This was about 5% of the HA's total expenditure in 1998.

The estimated annual cost of private hospital utilisation attributable to active smoking was \$124 million.

Smoking-attributable visits to an HA specialist out-patient clinic (SOPC) numbered 256 823 with a cost of \$148

**Table. Summary of the annual costs (1998) of mortality and morbidity due to diseases caused by tobacco**

Component of cost	No. of smoking attributable units		Unit cost (HK\$)		Value (million HK\$)	
	Active smoking	Passive smoking	Active smoking	Passive smoking	Active smoking	Passive smoking
<b>Mortality</b>						
Total lives lost	5596	1324	-	-	-	-
Premature deaths (<75 years)	3398	529	10 million	10 million	33 980	5290
Productive lives lost (<65 years)	1529	178	-	-	-	-
Life years lost (<75 years)	28 668	3719	-	-	-	-
Productive years lost (<65 years)	8669	815	male: 144 000, female: 108 000	male: 144 000, female: 108 000	1244	109
<b>Morbidity</b>						
Admissions and outpatient use in children					-	33
Public hospital days						
Acute	270 038	88 916	3744	3744	1011	333
Long stay	152 888	69 588	1985	1985	303	138
Private hospital episodes	6370	NE*	19 500 on average	NE	124	-
Specialist out-patient clinics (visits)	256 823	NE	578	NE	148	-
General out-patient clinics (visits)	714 585	NE	DH: 218, HA†: 265	NE	160	-
Accident & emergency (visits)	105 661	NE	572	NE	60	-
Private general practitioner (visits)	519 962	approx 1 500 000	181	181	94	248
Days off work (private sector)	170 893	942 409	male: 395, female: 296	male: 395, female: 296	66	319
Days off work (public sector)	21 610	102 390			8	35
Nursing home care					913	-
Home-based care					5	2
<b>Sub-total component of cost</b>		<b>Active smoking</b>		<b>Passive smoking</b>		
Health care		HK\$1 900 000 000		HK\$752 000 000		
Residential and informal care		HK\$918 000 000		HK\$2 000 000		
Lost working time		HK\$1 310 000 000		HK\$463 000 000		
Deaths (all ages)		5596		1324		
Deaths (<75 years)		3398		529		
<b>Sub-total annual costs</b>		<b>HK\$4.1 billion plus the value of lives lost</b>		<b>HK\$1.2 billion plus the value of lives lost</b>		
<b>Total annual costs</b>		<b>HK\$5.3 billion plus the value of lives lost of 6920 (3927 of them premature) deaths</b>				

\* NE denotes not estimated

† DH denotes Department of Health, and HA Hospital Authority

million, representing 5.2% of all visits to non-paediatric SOPCs.

The cost of the 714 585 attributable attendances at GOPCs was estimated to be \$160 million; this was 11.7% of the total cost for GOPC visits in 1998. If we assume that the average public sector doctor sees 30 patients a day 5 days a week for 48 weeks per year, then the smoking-attributable visits represent the workload of 99 full-time doctors in GOPCs.

There were 105 661 smoking-attributable visits to A&E units costing \$60 million. This amounts to 4.6% of the total A&E visits in 1998.

The cost of the 519 962 attributable GP consultations for respiratory disease in 1998 was \$94 million. The attributable visits were 2.9% of total doctor consultations for respiratory disease in 1998. If we assume each GP sees 30 patients per day 5 days a week for 48 weeks per year, these consultations are equivalent to the workload of 72 full-time GPs.

Absence for illness or injury due to active smoking

number was estimated to be 192 503 days. Of these, 116 590 days may be due to admissions into public hospitals. Valued at the median monthly wage, this was \$74 million. This did not include the cost of time off for doctor consultations or a period of suboptimal productivity on return to work.

The attributable cost of nursing home care due to active smoking was \$913 million while the cost of home-based care was \$5 million.

**Morbidity due to passive smoking**

Extra hospitalisations and out-patient consultations due to SHS exposure in utero and post-natally at home resulted in an annual cost of \$27.1 million.<sup>7</sup> Extrapolating this number to all children aged 1 to 15 in Hong Kong gave an estimate of \$6.2 million for extra doctor visits for children.

Public hospital use for lung cancer, COPD, IHD, and stroke attributable to passive smoking costed a total of \$471 million for home or work exposure.

For the three million full-time workers, there were

around 1.5 million extra visits to a doctor for cold, flu, or fever, which were attributable to SHS exposure at work. The cost was \$248 million with \$21 million (8.5%) attributed to the public sector, \$71 million (28.6%) paid for by the employer, and \$156 million (62.9%) paid by the employees themselves. We do not have data for home exposure effects on GP visits.

After applying the population attributable fraction to the total number of days off, we estimate an attributable loss of 1 044 799 days per year. Applying the median salary, exposure to SHS at work for the labour force in 1998 cost \$354 million. The value of attributable work days lost due to hospital admissions amounted to \$7.2 million for SHS exposure at home or at work.

The attributable cost of home-based care due to passive smoking was \$2 million but we could not estimate the cost of nursing home care for conditions caused by passive smoking.

## Conclusions

A conservative estimate of the cost of smoking in Hong Kong in 1998 is \$3.6 billion for health care and \$1.8 billion for productivity losses. About 3927 people died prematurely in that year. Of the morbidity costs, 70% and 50% for active and passive smoking respectively were incurred in the public sector. About 23% of the total annual costs is due to passive, rather than active, smoking. Of the productivity losses, 26% was due to passive smoking with most of this effect likely to be due to passive smoking at work. This costing has not included the cost of intensive care or coronary care, or pain and suffering due to illness.

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