PREVENTABLE MORTALITY: THE PRICE OF NEGLECT

E. S. O. Smith

Alberta Department of Social Services and Community Health,
Edmonton, Alberta, Canada

Résumé—Il s'agit ici d'un examen de l'expérience en mortalité de la province de l'Alberta sur le plan de l'évitabilité. Certaines causes spécifiques ont été choisies à cause d'un facteur préventif. En se fondant sur les études épidémiologiques qui ont mesuré le risque des influences contrôlables, on a estimé la proportion des décès évitables pour chaque cause spécifique.

Utilisant les tables de mortalité, les années de vie et les années de travail perdues ont été calculées pour une personne mourant dans n'importe quel groupe d'âges précis. En suite on a appliqué ces chiffres au nombre de décès par sexe et âge spécifiques évitables afin de donner une estimation des années de vie et des années de travail perdues en rapport avec chaque cause de décès.

Finalement, le nombre d'années de travail perdues pour chaque sexe et la cause de décès ont été multipliés par le revenu moyen estimé afin de produire un chiffre pour le coût des décès évitables. On offre ceci comme une approximation de la somme qui aurait pu être gagnée en 1974 par les gens qui moururent des causes évitables avant 1974, et dont l'âge, s'ils avaient vécu, aurait été entre 20 et 65.

En guise de conclusion, nous suggérons un ordre économique d'importance des causes de décès comme guide aux efforts préventifs.

Abstract—The mortality experience of Alberta during 1970-72 was examined from the viewpoint of preventability. Certain specific causes were selected because of a preventable factor. On the basis of epidemiological studies which have measured the risk from controllable influences, the proportion of preventable deaths was estimated for each specific cause.

By the use of life tables, the lost years of life and the lost working years were calculated for a person dying in any particular age group. These figures were then applied to the number of sex-and age-specific preventable deaths to give an estimate of the lost person-years of life and the lost working person-years associated with each cause of death. Finally, the number of lost working person-years for each sex and cause of death was multiplied by the estimated average income to produce a figure for the cost of preventable deaths. This is offered as an approximation for the amount which might have been earned in 1974 by people who died from preventable causes prior to 1974, and whose age if they had lived would have been between 20 and 65.

The presentation concludes by suggesting an economic order of importance of causes of mortality for the guidance of preventive efforts.

Introduction

Several Canadians in recent months, including Wallace (1974), Colborn and Baker (1974), and Lalonde (1974), have drawn attention to the unneccessary loss of life among young people and those in their prime, and to the feasibility of preventing these tragedies by modifying human behaviour or lifestyle. The object of this paper is to estimate, for one province of Canada, the extent of the preventable loss from selected causes of mortality, not only in terms of the number of deaths, but also in terms of lost years of life, lost working years and lost earning power.

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Method

An examination has been made of the deaths from certain causes in the intermediate list of the ICD (International Classification of Diseases) which occurred among Alberta residents during the period 1970-72. A three-year period was used in order to eliminate the effects of year-to-year fluctuation associated with smaller numbers; the fact that the middle year of this period was a census year facilitated the calculation of rates.

Each cause was selected because of a preventable factor, but deaths due to communicable diseases were excluded because these were regarded as the hard core of unpreventable deaths which defied the efforts of an active control programme. The causes selected were eight kinds of cancer, four kinds of other chronic disease and two kinds of trauma.

For each selected cause of death an estimate of percentage preventability was made, usually on the basis of epidemiological studies reported in the literature, allowing, where necessary, for sex and age differences in the feasibility of prevention. As a preliminary to the computation of preventability, however, it is necessary to refer to the concept of risk.

There are two kinds of risk, namely, relative and attributable. In the following typical 2×2 table

| | Exposure Status | | |
Clinical Category	Exposed	Unexposed	Total
Disease present (index cases)	a	b	$a + b$
Disease absent (controls)	c	d	$c + d$
Total	$a + c$	$b + d$	$a + b + c + d$

the relative risk, which we shall call r, is given by the equation

$$r = \frac{a}{a + c} \bigg/ \frac{b}{b + d}.$$

However, if a and b are small in relation to c and d, we can approximate with

$$r = \frac{a}{c} \bigg/ \frac{b}{d} = \frac{ad}{bc}.$$

Attributable risk, which we shall call r', is given by the equation

$$r' = \frac{a}{a + c} - \frac{b}{b + d} = \frac{a(b + d) - b(a + c)}{(a + c)(b + d)} = \frac{ad - bc}{(a + c)(b + d)}.$$

Again, it may be permissible to approximate with

$$r' = \frac{a}{c} - \frac{b}{d} = \frac{ad - bc}{cd}.$$

For the estimation of preventability we need to know the relative risk rather than the attributable; many epidemiological studies have in fact arrived at the relative risk (for a particular hazard such as smoking) by comparing the mortality rate of persons exposed with that of persons not exposed and expressing the comparison as a ratio, in the manner described above.

To estimate the possible mortality reduction, it is necessary to know the proportion of the population which is exposed to the particular hazard and the proportion which is not so exposed. If we call these proportions p and q, it follows that $p + q = 1$. If we then call the unpreventable deaths C and observed deaths D, we can apply the relative risk r to the proportion of the population which is exposed and a relative risk of unity to the proportion of the population which is not exposed, arriving at the equation

$$D = C \, (pr + q).$$

The preventable mortality can then be expressed as

$$\frac{D-C}{D} = \frac{pr+q-1}{pr+q} = \frac{p(r-1)}{pr+q} \; .$$

From a set of abridged life tables based on Alberta's mortality experience during the same three-year period 1970-72 were calculated the lost years of life and the lost working years for a person dying in any particular age group. Lost years of life are given by

$$\overset{o}{e}_{x+\frac{n}{2}} = \frac{T_x}{{}_nL_x/n} - \frac{n}{2}$$

and lost working years, depending upon the age at death, are given by

(a) $we_{x+\frac{n}{2}} = \dfrac{T_{20}-T_{65}}{{}_nL_x/n}$ if death occurs before age 20, or

(b) $we_{x+\frac{n}{2}} = \dfrac{T_x-T_{65}}{{}_nL_x/n} - \dfrac{n}{2}$ if death occurs at or after age 20,

where n is the age group interval, T_x is the number of persons out of a theoretical 100,000 who would be in the age group x to $x+n-1$ and all subsequent age groups, and ${}_nL_x$ the number of persons out of a theoretical 100,000 who would be in the age group x to $x+n-1$. These figures were then applied to the number of sex- and age-specific preventable deaths to give an estimate of the lost person-years of life and the lost working person-years associated with the preventable deaths from each selected cause.

Finally, the number of lost working person-years for each sex and cause of death was multiplied by the sex-specific average income for Alberta, as derived from 1971 census data, to produce a figure for the cost of preventable deaths. This figure was converted from 1970 to 1974 dollars by the application of an inflation factor.

Observed Deaths from Selected Causes

The deaths from each of the fourteen selected causes which occurred among Alberta residents of each sex during 1970-72 are summarized in Table 1. These represent 52.5 per cent of the deaths from all causes, or 56.2 per cent in the case of male and 46.4 per cent in the case of female deaths. For the purpose of this study it was necessary to know their age distribution, which is summarized for all selected causes by sex in Table 2.

Estimation of Preventability

An estimate of percentage preventability of deaths from each selected cause, qualified where necessary by sex and age criteria, is shown in Table 3. The basis for each of these estimates was as follows:

1) Cancer of buccal cavity and pharynx

The most important aetiological factor in oral and pharyngeal cancer is the smoking of tobacco, and the second most important is alcohol which is believed to aid the absorption of carcinogens in tobacco and in this way to enhance their carcinogenic effect. A study by Wynder et al. (1957) showed that the incidence of oral cancer was about 3.6 times as great among smokers as among non-smokers. Since a study of the smoking habits of Canadians (Canada, 1967) showed that in the Prairie provinces about 51.4 per cent of males and 31.6 per cent of females 15 years of age and over were smokers, and allowing a ten-year incubation period, we can estimate the potential preventability of oral and pharyngeal cancer from age 25 as 57.2 per cent for males and 45.1 per cent for females.

TABLE 1. DEATHS FROM SELECTED CAUSES BY SEX AND CAUSE,
ALBERTA, 1970-72

Intermediate List Rubric	Cause of Death	Number of Deaths		
		Male	Female	Total
A 45	Cancer of buccal cavity and pharynx	73	23	96
A 46	Cancer of oesophagus	64	21	85
A 47	Cancer of stomach	347	162	509
A 50	Cancer of larynx	34	2	36
A 51	Cancer of trachea, bronchus, and lung	770	164	934
A 55	Cancer of cervix uteri	–	98	98
A 58G	Cancer of bladder	107	29	136
A 59	Leukaemia	171	114	285
A 83	Ischaemic heart disease	5582	2704	8286
A 85	Cerebrovascular disease	1566	1492	3058
A 93	Bronchitis, emphysema, and asthma	552	127	679
A 102	Cirrhosis of liver	216	120	336
AE 138A	Traffic accidents	956	337	1293
AE 147	Suicide	477	132	609
	All selected causes	10915	5525	16440

2) Cancer of oesophagus

The two principal factors associated with cancer of the mouth and pharynx are also associated with cancer of the oesophagus. Carcinogens present in tobacco smoke are presumably able to reach the oesophagus in swallowed saliva. It is significant, as pointed out by Wynder, et al., (1959), that Seventh Day Adventists, who neither smoke nor drink, have a very low incidence of oesophageal cancer. Doll (1967a) has stated that the risk associated with smoking is about the same for oesophageal as for oral and pharyngeal cancer.

3) Cancer of stomach

Again, carcinogens present in tobacco smoke are presumably able to reach the stomach in swallowed saliva. Lilienfeld, et al., (1956) showed the mortality from stomach cancer among smokers to be about 1.86 times that among non-smokers. Applying this risk factor to the prevalence rates for smoking, we can estimate the potential preventability of stomach cancer from age 25 as 30.7 per cent for males and 21.4 per cent for females.

4) Cancer of larynx

Athough cancer of the larynx can occasionally occur as an occupational hazard, or as the result of exposure to radiation, the most important aetiological factor is cigarette smoking, and

TABLE 2. DEATHS FROM SELECTED CAUSES BY SEX AND AGE GROUP,
ALBERTA, 1970-72

Age Group	Number of Deaths		
	Male	Female	Total
<1	11	4	15
1 – 4	46	25	71
5 – 9	45	18	63
10 – 14	50	24	74
15 – 19	266	88	354
20 – 24	262	67	329
25 – 29	131	53	184
30 – 34	118	64	182
35 – 39	158	58	216
40 – 44	278	98	376
45 – 49	414	138	552
50 – 54	553	173	726
55 – 59	819	247	1066
60 – 64	965	333	1298
65 – 69	1253	446	1699
70 – 74	1359	629	1988
75 – 79	1329	809	2138
80 – 84	1379	946	2325
85+	1479	1305	2784
All ages	10915	5525	16440

alcohol is believed to be a contributing factor. Doll (1967b) has suggested that the share of responsibility attributable to smoking is about the same for cancer of the larynx as for cancer of the buccal cavity and pharynx or of the oesophagus.

5) Cancer of trachea, bronchus, and lung

The relationship of lung cancer to cigarette smoking was first demonstrated by Doll and Hill (1952), and has been confirmed by many other studies. The Canadian Study of Smoking and Health (Canada, 1966) indicated that lung cancer mortality risk for smokers was about 14.9 times that for non-smokers. Applying this risk factor to the prevalence rates for smoking, we can estimate the potential preventability of lung cancer from age 25 as 87.7 per cent for males and 81.5 per cent for females.

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TABLE 3. ESTIMATED PERCENTAGE PREVENTABILITY OF DEATHS
FROM SELECTED CAUSES

Intermediate List Rubric	Cause of Death	Estimated Percentage Preventability	
		Male	Female
A 45	Cancer of buccal cavity and pharynx	57.2 from age 25	45.1 from age 25
A 46	Cancer of oesophagus	57.2 from age 25	45.1 from age 25
A 47	Cancer of stomach	30.7 from age 25	21.4 from age 25
A 50	Cancer of larynx	57.2 from age 25	45.1 from age 25
A 51	Cancer of trachea, bronchus, and lung	87.7 from age 25	81.5 from age 25
A 55	Cancer of cervix uteri	—	62.6
A 58G	Cancer of bladder	32.3 from age 25	22.7 from age 25
A 59	Leukaemia	←——— 7.0 for age <10 ———→	
A 83	Ischaemic heart disease	23.6	15.9
A 85	Cerebrovascular disease	14.0	13.1
A 93	Bronchitis, emphysema, and asthma	79.9	70.9
A 102	Cirrhosis of liver	58.1 from age 20	20.0 from age 20
AE 138A	Traffic accidents	←——— 46.3 ———→	
AE 147	Suicide	←——— 21.4 ———→	

6) Cancer of cervix uteri

By means of cytological screening it is possible to detect carcinoma in situ of the cervix up to ten years before the lesion becomes invasive. The accuracy of detection in screening has been claimed by Graham (1958) to be as high as 97 per cent, but by Freidal, et al., (1960) to be no more than 70 per cent. In this study we have taken the mid-range level of 83.5 per cent. However, Dunn (1958) has pointed out that 25 per cent of all invasive cancers, lesions such as the spray cancers of Schiller, do not progress through the in situ phase. We have, therefore, estimated preventability at three-quarters of the reliability level, or 62.2 per cent.

7) Cancer of bladder

It would appear that some of the carcinogens in tobacco smoke are absorbed into the bloodstream and subsequently excreted in the urine, for Lilienfeld, et al., (1956) showed the mortality from bladder cancer among smokers to be 1.93 times the mortality among non-smokers. Applying this risk factor to the prevalence rates for smoking, we can estimate the potential preventability of bladder cancer from age 25 as 32.3 per cent for males and 22.7 per cent for females.

8) Leukaemia

The exposure of a mother to radiation during pregnancy increases the chance that her offspring will develop leukaemia in childhood. However, Doll (1967b) has estimated that only about seven per cent of leukaemia mortality under the age of 10 years can be blamed on maternal exposure to radiation.

9) Ischaemic heart disease

The term ischaemic heart disease covers the many forms of acute, subacute and chronic disease which lead to occlusion of the coronary arteries. The well known Framingham study, as reported by Dawber, et al., (1964), showed that high serum cholesterol, high blood pressure and excessive cigarette smoking contribute to the development of coronary disease in an additive manner. In the meantime, the Canadian Study of Smoking and Health (Canada, 1966) indicated that the mortality risk from ischaemic heart disease for smokers was 1.60 times that for non-smokers. Applying this risk factor to the prevalence rates for smoking, we can say that, by virtue of the smoking factor alone, the preventability of death from ischaemic heart disease is 23.6 per cent for males and 15.9 per cent for females.

10) Cerebrovascular disease

In cerebrovascular disease or stroke the most important aetiological factor is hypertension. A survey published by the Metropolitan Life Insurance Company (1961), based on the experience of 26 companies over a twenty-year period, showed that persons with a systolic pressure greater than 150 mm. Hg. or a diastolic pressure greater than 95 mm. Hg. had three times the mortality risk of normotensive persons from cerebrovascular disease. Since a recent survey by Silverberg, et al., (1974) showed the prevalence of hypertension in Edmonton to be 9.18 per cent among males and 8.48 per cent among females, considerably lower than the prevalence rates observed in several other surveys, we can say that the proportion of deaths from stroke attributable to high blood pressure is about 15.5 per cent for males and 14.5 per cent for females. However, Stamler (1967) has indicated that 10 per cent of hypertensives have secondary hypertension, due to some other cause, and that only 90 per cent have essential hypertension, the kind which can usually be controlled by drugs. We can, therefore, estimate the potential preventability of death from cerebrovascular disease as 14.0 per cent for males and 13.1 per cent for females.

TABLE 4. ESTIMATED PREVENTABLE DEATHS FROM SELECTED CAUSES
BY SEX AND CAUSE, ALBERTA, 1970-72

Intermediate List Rubric	Cause of Death	Estimated Preventable Deaths		
		Male	Female	Total
A 45	Cancer of buccal cavity and pharynx	41.7	10.6	52.3
A 46	Cancer of oesophagus	36.6	9.7	46.3
A 47	Cancer of stomach	106.5	34.5	141.0
A 50	Cancer of larynx	19.6	1.0	20.6
A 51	Cancer of trachea, bronchus, and lung	675.4	133.5	808.9
A 55	Cancer of cervix uteri	–	61.3	61.3
A 58G	Cancer of bladder	34.3	6.6	40.9
A 59	Leukaemia	6.9	3.6	10.5
A 83	Ischaemic heart disease	1317.4	430.1	1747.5
A 85	Cerebrovascular disease	219.1	195.3	414.4
A 93	Bronchitis, emphysema, and asthma	441.1	89.9	531.0
A 102	Cirrhosis of liver	122.4	23.6	146.0
AE 138A	Traffic accidents	442.8	156.1	598.9
AE 147	Suicide	102.2	28.0	130.2
	All selected causes	3566.0	1183.8	4749.8

11) Bronchitis, emphysema, and asthma

Chronic bronchitis and emphysema have a significant relationship to cigarette smoking. Since deaths from asthma account for only a very small proportion of the total, their inclusion in this category makes very little difference. The Canadian Study of Smoking and Health (Canada, 1966) showed that the risk of death from bronchitis and emphysema is 8.71 times as high for smokers as for non-smokers. Applying this risk factor to the prevalence rates for smoking, we can estimate the preventability of death from this group of diseases as 79.9 per cent for males and 70.9 per cent for females.

12) Cirrhosis of the liver

Jellinek, as reported by Popham (1956), demonstrated that the proportion of reported deaths from liver cirrhosis attributable to alcoholism after the age of 20 was about 40 per cent in the United States and 37 per cent in Canada. The sex-specific proportions in the United States were 62.8 per cent for males and 21.6 per cent for females. The corresponding proportions for Canada would be 58.1 and 20, and it is at these levels that we estimate preventability.

13) Traffic accidents

If we consider motor vehicle accidents as the result of an interaction between host, agent and environment, it is evident that all age groups are exposed to essentially the same environment. The automobile, as agent, may sometimes be unsafe, and for economic reasons it is more likely to be unsafe when owned by a teenager or young adult than when owned by a more mature adult. Seat-belts reduce the risk of serious injury, but they are useless unless they are worn, and we do not know the prevalence of this behavioural pattern. It is obvious, however, that host factors of one kind or another are primarily responsible for the tremendous excess of deaths affecting the 15-24 age group, in which males outnumber females by more than four to one. In particular, we know from accident records of the Department of Highways

TABLE 5. ESTIMATED PREVENTABLE DEATHS FROM SELECTED CAUSES BY SEX AND AGE GROUP, ALBERTA, 1970-72

| Age Group | Estimated Preventable Deaths | | |
	Male	Female	Total
<1	4.5	1.4	5.9
1 – 4	21.2	9.6	30.8
5 – 9	19.1	7.2	26.3
10 – 14	18.5	8.1	26.6
15 – 19	101.3	36.0	137.3
20 – 24	100.3	24.1	124.4
25 – 29	46.2	18.2	64.4
30 – 34	41.6	19.9	61.5
35 – 39	56.0	16.1	72.1
40 – 44	98.3	30.9	129.2
45 – 49	140.6	46.8	187.4
50 – 54	197.4	53.5	250.9
55 – 59	288.9	69.6	358.5
60 – 64	342.4	78.6	421.0
65 – 69	443.3	102.3	545.6
70 – 74	471.6	132.6	604.2
75 – 79	422.4	153.0	575.4
80 – 84	380.9	162.2	543.1
85+	371.5	213.7	585.2
All ages	3566.0	1183.8	4749.8

(Alberta, 1971, 1972 and 1973) that drinking or impaired drivers accounted for 46.3 per cent of the fatal traffic accidents which occurred in Alberta during 1970-72, and this is suggested as the level of preventability.

14) Suicide

In an attempt to evaluate the effectiveness of suicide prevention centres in England, Bagley (1968) showed that in fifteen cities with prevention centres the average suicide rate fell by 5.84 per cent between one four-year period and the next, while in fifteen control cities of comparable size without prevention centres the average rate rose by 19.84 per cent. The difference of 25.68 expressed as a percentage of 119.84 comes to 21.4 per cent, which is suggested as the level of potential preventability.

Preventable Deaths

Based on the foregoing estimates, the number of preventable deaths from each selected cause during 1970-72 was calculated for each sex and age group, and the results are summarized in Table 4. The age distribution of preventable deaths for all selected causes by sex is shown in Table 5.

TABLE 6.   LOST PERSON-YEARS OF LIFE PER YEAR ASSOCIATED WITH PREVENTABLE DEATHS FROM SELECTED CAUSES BY SEX AND CAUSE, ALBERTA, 1970-72

Intermediate List Rubric	Cause of Death	Lost Person-Years of Life per Year Associated with Preventable Deaths		
		Male	Female	Total
A 45	Cancer of buccal cavity and pharynx	206.3	68.2	274.5
A 46	Cancer of oesophagus	154.8	53.9	208.7
A 47	Cancer of stomach	421.5	171.2	592.7
A 50	Cancer of larynx	87.5	3.7	91.2
A 51	Cancer of trachea, bronchus, and lung	3055.5	818.2	3873.7
A 55	Cancer of cervix uteri	–	433.5	433.5
A 58G	Cancer of bladder	119.4	29.0	148.4
A 59	Leukaemia	152.8	88.6	241.4
A 83	Ischaemic heart disease	4979.4	1491.4	6470.8
A 85	Cerebrovascular disease	662.8	663.6	1326.4
A 93	Bronchitis, emphysema, and asthma	1672.3	539.7	2212.0
A 102	Cirrhosis of liver	872.9	193.4	1066.3
AE 138A	Traffic Accidents	6056.4	2399.5	8455.9
AE 147	Suicide	1173.1	388.7	1561.8
	All selected causes	19614.7	7342.6	26957.3

Lost Years of Life and Lost Working Years

The number of preventable deaths in each sex and age group was multiplied by the lost years of life and the lost working years appropriate to that group to produce, for each selected cause of death, an estimate of the lost person-years of life and the lost working person-years which might have been prevented during the period 1970-72.

The totals for each sex and cause of death, and for each sex and age group, were divided by three to produce the annual loss of person-years of life associated with preventable deaths (Table 6 and 7), and the annual loss of working person-years associated with preventable deaths (Tables 8 and 9).

TABLE 7. LOST PERSON-YEARS OF LIFE PER YEAR ASSOCIATED WITH PREVENTABLE DEATHS FROM SELECTED CAUSES BY SEX AND AGE GROUP, ALBERTA, 1970-72

Age Group	Lost Person-Years of Life per Year Associated with Preventable Deaths		
	Male	Female	Total
<1	105.1	36.1	141.2
1 - 4	481.6	242.8	724.4
5 - 9	406.6	170.3	576.9
10 - 14	363.9	178.4	542.3
15 - 19	1834.9	734.5	2569.4
20 - 24	1667.0	453.1	2120.1
25 - 29	697.6	313.0	1010.6
30 - 34	563.7	310.4	874.1
35 - 39	672.4	225.7	898.1
40 - 44	1031.8	385.0	1416.8
45 - 49	1272.0	511.5	1783.5
50 - 54	1512.1	505.2	2017.3
55 - 59	1836.4	557.7	2394.1
60 - 64	1766.8	522.4	2289.2
65 - 69	1814.6	548.0	2362.6
70 - 74	1501.2	557.4	2058.6
75 - 79	1032.1	496.7	1528.8
80 - 84	745.3	416.3	1161.6
85+	309.6	178.1	487.7
All ages	19614.7	7342.6	26957.3

TABLE 8. LOST WORKING PERSON-YEARS PER YEAR ASSOCIATED WITH
PREVENTABLE DEATHS FROM SELECTED CAUSES BY SEX AND CAUSE, ALBERTA,
1970-72

Intermediate List Rubric	Cause of Death	Lost Working Person-Years per Year Associated with Preventable Deaths		
		Male	Female	Total
A 45	Cancer of buccal cavity and pharynx	68.4	19.6	88.0
A 46	Cancer of oesophagus	38.6	13.5	52.1
A 47	Cancer of stomach	99.5	33.9	133.4
A 50	Cancer of larynx	25.4	-	25.4
A 51	Cancer of trachea, bronchus, and lung	733.9	207.8	941.7
A 55	Cancer of cervix uteri	-	151.3	151.3
A 58G	Cancer of bladder	24.0	6.0	30.0
A 59	Leukaemia	94.7	51.7	146.4
A 83	Ischaemic heart disease	1182.9	156.0	1338.9
A 85	Cerebrovascular disease	124.0	107.8	231.8
A 93	Bronchitis, emphysema, and asthma	334.6	166.1	500.7
A 102	Cirrhosis of liver	423.9	77.2	501.1
AE 138A	Traffic accidents	4252.1	1495.2	5747.3
AE 147	Suicide	797.9	240.2	1038.1
	All selected causes	8199.9	2726.3	10926.2

Economic Loss from Preventable Mortality

From 1971 census data it was ascertained that in Alberta during 1970 the average income for males was $6,474 and that for females was $2,759. Applying an inflation factor of 1.2084, the corresponding figures in terms of 1974 dollars would be $7,823.18 for males and $3,333.98 for females.

In Tables 10 and 11 these average income figures have been applied to the annual loss of working person-years associated with the preventable deaths for each sex by cause and age group respectively. The total of $73,238,636 is offered as an approximation for the amount which might have been earned in 1974 by people who died from certain preventable causes prior to 1974, and whose ages if they had lived would have been between 20 and 65.

Discussion

The present study begins by reviewing the literature on preventable mortality with particular emphasis on certain selected diseases. Estimates of preventability are arrived at by carefully evaluating the literature as well as by applying simple epidemiological techniques to calculate relative risk. Life tables are used to calculate lost years of life and lost working years

TABLE 9. LOST WORKING PERSON-YEARS PER YEAR ASSOCIATED WITH
PREVENTABLE DEATHS FROM SELECTED CAUSES BY SEX AND AGE GROUP, ALBERTA,
1970-72

Age Group	Lost Working Person-Years per Yeat Associated with Preventable Deaths		
	Male	Female	Total
<1	61.2	19.9	81.1
1 - 4	290.9	137.6	428.5
5 - 9	262.9	103.5	366.4
10 - 14	255.3	116.6	371.9
15 - 19	1405.7	519.4	1925.1
20 - 24	1322.3	328.7	1651.0
25 - 29	537.3	218.7	756.0
30 - 34	418.2	207.0	625.2
35 - 39	474.7	141.5	616.2
40 - 44	679.9	222.1	902.0
45 - 59	756.9	261.8	1018.7
50 - 54	764.6	214.7	979.3
55 - 59	684.7	169.3	854.0
60 - 64	285.3	65.5	350.8
0 - 64	8199.9	2726.3	10926.2

due to the occurrence of preventable deaths for each selected cause. The study then
demonstrates the cost of preventable deaths by computing the average income which victims
might have earned if their death had been prevented.

Since most, if not all of the conditions considered in this study have a multifactorial
aetiology, and since the estimate of preventability for each has usually been based on only one
aetiological factor, the calculation of potential preventability has obviously been over-
simplified. A consequence of taking only one factor into account for each condition is that
potential preventability has undoubtedly been underestimated.

There are many other causes of death which could have been included in this study,
including some kinds of accident which are obviously preventable. Although some of these,
such as accidental poisoning, have been the subject of epidemiological studies, it is not always
possible to infer from such studies a quantitative level of preventability. The study does not
include deaths due to communicable diseases. These deaths were excluded because there were
less than 10 per year for every cause except tuberculosis, the preventability of which is difficult

TABLE 10. ANNUAL VALUE (IN 1974 DOLLARS) OF LOST WORKING PERSON-YEARS
ASSOCIATED WITH PREVENTABLE DEATHS BY SEX AND SELECTED CAUSE, ALBERTA,
1970-72

Intermediate List Rubric	Cause of Death	Annual Value of Lost Working Person-Years Associated with Preventable Deaths		
		Male	Female	Total
A 45	Cancer of buccal cavity and pharynx	534,959	65,213	600,172
A 46	Cancer of oesophagus	301,896	45,109	347,005
A 47	Cancer of stomach	778,250	113,155	891,405
A 50	Cancer of larynx	198,943	-	198,943
A 51	Cancer of trachea, bronchus, and lung	5,741,510	692,768	6,434,278
A 55	Cancer of cervix uteri	-	504,464	504,464
A 58G	Cancer of bladder	187,522	19,870	207,392
A 59	Leukaemia	741,090	172,267	913,357
A 83	Ischaemic heart disease	9,254,353	520,201	9,774,554
A 85	Cerebrovascular disease	970,153	359,536	1,329,689
A 93	Bronchitis, emphysema, and asthma	2,617,558	553,641	3,171,199
A 102	Cirrhosis of liver	3,315,933	257,217	3,573,150
AE 138A	Traffic Accidents	33,265,022	4,984,967	38,249,989
AE 147	Suicide	6,242,194	800,855	7,043,049
	All selected causes	64,149,383	9,089,263	73,238,646

TABLE 11. ANNUAL VALUE (IN 1974 DOLLARS) OF LOST WORKING PERSON-YEARS ASSOCIATED WITH PREVENTABLE DEATHS FROM SELECTED CAUSES BY SEX AND AGE GROUP, ALBERTA, 1970-72

Age Group	Annual Value of Lost Working Person-Years Associated with Preventable Deaths		
	Male	Female	Total
<1	478,857	66,480	545,337
1 - 4	2,275,528	458,889	2,734,417
5 - 9	2,056,558	344,967	2,401,525
10 - 14	1,997,258	388,642	2,385,900
15 - 19	10,997,122	1,731,536	12,728,658
20 - 24	10,344,513	1,095,979	11,440,492
25 - 29	4,203,473	729,141	4,932,614
30 - 34	3,271,732	690,000	3,961,732
35 - 39	3,713,664	471,658	4,185,322
40 - 44	5,319,137	740,344	6,059,481
45 - 49	5,921,365	872,736	6,794,101
50 - 54	5,981,525	715,872	6,697,397
55 - 59	5,356,531	564,610	5,921,141
60 - 64	2,232,110	218,409	2,450,519
0 - 64	64,149,373	9,089,263	73,238,636

to assess in view of the fact that most of the mortality occurs in the older age-groups in situations where the use of B.C.G. is often precluded and where the proper use of chemoprophylaxis depends on the early identification of new tuberculin reactors and contacts of active infectious cases.

It happens that life expectancy in Alberta is one of the highest in Canada. Nevertheless, a further reduction in mortality is both possible and realistic, and there is a need to develop programmes aimed at the prevention of premature preventable deaths. For provinces with higher mortality levels than those of Alberta, the gain from such preventive programmes would be even greater.

One of the purposes of this study is to illustrate how epidemiological studies can point the way to prevention, and to indicate the economic advantages to be gained from preventive programmes in the area of chronic disease and trauma. From a purely economic viewpoint, the most important fields for preventive action are motor vehicle accidents, ischaemic heart disease, lung cancer and suicide, in about that order, and the best investment is in young people age 15-24. It is not within the scope of this paper to develop a design for preventive programmes, and no attempt has therefore been made to estimate the cost of such programmes or to attempt a cost-benefit analysis.

E. S. O. Smith

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