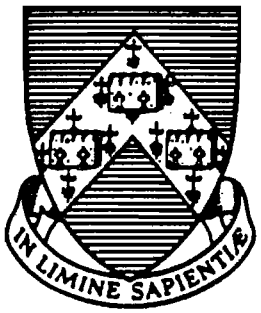

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Priorities for Health Promotion
An Economic Approach

by

Christine Godfrey, Geoffrey Hardman and Alan Maynard

A JOINT INITIATIVE OF THE HEALTH EDUCATION AUTHORITY AND THE CENTRE FOR HEALTH ECONOMICS

DISCUSSION PAPER 59

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Executive Summary

1. In this paper a framework is described in which the causes of ill health can be identified and the cost effectiveness of alternative means of reducing this ill health can be ranked.

2. Ranking health promotion involves comparisons of activities and therefore requires the identification and construction of common outcome measures. From an economic perspective this suggests the development of measures which reflect changes in both the quantity and quality of life.

3. Indices such as quality adjusted life years (QALYs) which combine measures of quality and quantity of life are still in an early stage of development and such indices are not available for a number of diseases. In this paper, we explore the use of 'avoidable years lost' for those dying before the age of 65 as a method of calculating the burden of illness and examining the priorities for health promotion, following a methodology adopted in an American Study (Amler and Dull, 1987). This approach involves the calculation of the number of life years lost from a range of diseases considered amenable to prevention. The second stage is to calculate the proportion of disease that can be attributed to risk factors such as smoking, alcohol abuse, raised blood pressure and diet. 'Avoidable life years' lost can be calculated by applying the risk factors to the estimates of life years lost for each disease. The methods and results from the Amler and Dull study are used to illustrate the potential use of this model in the UK.

4. Results are presented for the pattern of life years lost from different diseases in England and Wales in 1986 (see tables 2.3 and 2.4). As a whole, neoplasms, while causing fewer deaths among the under 65s than diseases of the circulatory system, account for more years lost. In terms of individual disease categories, heart disease is the major cause of lost life years for both men and women. There were differences in disease patterns between the sexes. Breast cancer was the second ranked disease in terms of life years lost for women. Cervical cancer also accounts for a large number of life years lost and is ranked 8th, but lung cancer causes twice as many life years lost for women. For men, motor vehicle accidents and suicide and self inflicted injury are major causes of life years lost.

5. Two areas of preventable disease not distinguished by using ICD codes for deaths in the analysis are infant mortality and AIDS. In terms of life years lost, infant and neonatal mortality are ranked high. In 1986, the year of the analyses, there had still been relatively few deaths from AIDS. Future forecasts of mortality rates are uncertain, but a young average age of death suggests that AIDS will be ranked as a major cause of premature death and life years lost in the future.

6. A number of extensions to this analysis could be made. Different disease groupings could be examined and more comprehensive indicators of the burden of disease including morbidity estimates could be compiled. Such work is likely to emphasise the importance of generally non life threatening disorders particularly those associated with mental handicap and illness.

7. It is not possible to consider the 'avoidable years lost' for all diseases but the use of the methodology is illustrated with some examples. Using the risk factors given in the Amler and Dull study, it is estimated that at least 26 per cent of all life years lost from cancer could be attributed to smoking, diet, occupation and alcohol risk factors.

8. In the American study, a number of main risk factors emerged from their examination of a wide range of diseases. These were tobacco, injury risks, alcohol, gaps in primary prevention, unintended pregnancy, high blood pressure and over nutrition (which is obesity, high serum cholesterol or both). Tobacco, alcohol injury risks and gaps in primary prevention accounted for 75 per cent of the years of avoidable life years lost before the age of 65. There are a number of reasons to expect a similar pattern to emerge from the UK, although the precise ranking of the different factors may vary.

9. It would be useful to extend this analysis for England and Wales to more diseases and to use the most up to date epidemiological literature to calculate attributable risk factors. These reviews, as in the American study, are likely to reveal a range of estimates for different single risk factors and the sum of individual risk factors may exceed the total. It would be useful to test the sensitivity of these analyses by using ranges of estimates and by making allowance for the interaction of risk factors to avoid double counting.

10. The available data on various lifestyles are also examined. There is information available on some risk factors such as

smoking, drinking and diet and analyses of such data could be useful in helping to identify potential benefits from health promotion. For other lifestyle factors, particularly sexual habits, there are few data available. Useful insights could be obtained by examining interactions of aspects of lifestyle behaviour. The results of analysis on existing data sets make it clear that accumulating data alone is not sufficient and theoretical frameworks which encompass economic and other social science behavioural models need to be developed and tested rigorously.

11. Analyses of the burdens of illness and the factors influencing lifestyle behaviour can indicate areas where health education programmes may be employed to change behaviour and ultimately reduce the burden of disease. There are, however, many health promotion policies which could be adopted to change behaviour, but there are limited resources to fund them. The information requirements for good economic evaluations which are necessary to identify the "best buys" are outlined. Existing evidence on the cost effectiveness of some prevention activities does suggest that some but not all health promotion activities give "good value for money".

12. An economic framework can provide a useful means of organising existing information and plays a role in assessing the priorities for health promotion activities. This process is on-going and providing cost-utility data for health promotion policies is likely to be powerful in influencing resource allocation.

Introduction

The objective of this paper is to describe a framework in which the causes of ill health (measured ultimately by reduced duration and quality of life) can be identified, and the cost-effectiveness of alternative means of reducing this ill health can be ranked.

In the first part of the paper, an economic perspective for determining the burden of illness is explored. A framework for calculating avoidable life years lost which can exploit available data is described. In the next two sections, the potential use of this approach is illustrated. Some calculations on the burden of different diseases are presented in the first of these sections. In the next part of the paper, some examples of calculating avoidable disease are discussed. The work needed to elaborate the initial framework is indicated.

Health promotion seeks to increase the duration and quality of life by changing health behaviour. In the fourth section of the paper, some of the available data which could be used to examine current levels of, and trends in different aspects of life styles are reviewed. The fifth section contains a brief review of some of the available literature about the most cost-effective means of reducing the burden of illness through health promotion. Finally, some concluding comments are made about the further work which could be undertaken to test the robustness and efficiency of this framework, and how it could be extended and refined.

1. An Economic Perspective on the Burden of Illness

Two types of questions arise from any consideration of the priorities for health promotion. The first question involves determining the level of resources devoted to health promotion activities, as opposed to the amount of resources allocated to health treatment or non-health related activities. The second question involves deciding the priorities between different types of health promotion activities within a given budget. Both types of question require information on the potential benefits and the potential costs of health promotion activities.

There are difficulties involved in calculating the benefits of health promotion. It is not clear how information of the form that one campaign reduced the level of smoking and another campaign resulted in a number of people seeking advice on diet could be used to compare the effectiveness of the two programmes. To rank different activities whether within health promotion or between health promotion and other activities, it is necessary to have a common outcome measure.

A number of indicators could be considered for evaluating the impact of diseases and ill health and potential benefits of health promotion activities, including rates of mortality, morbidity and costs to the NHS. These different measures all indicate some aspect of the burden of illness to society. Minimising NHS or health expenditure is not, however, the objective of the health care system. Rather the purpose is to maximise both the quantity and quality of life, given available

resources. Indeed, some research has indicated that if prevention policies such as reduced smoking result in a larger proportion of the population living longer, although health expenditures related to activities such as smoking would decline in the long run, total health care expenditures may rise (Leu and Schaub 1983). Overall health care costs may increase in the future because populations will be larger and there will be more older people who on average have higher medical expenditure than the young.

While health promotion may not lead to a large reduction of health care expenditure, it may improve both the quantity and quality of life. Ideally we would like an outcome measure not only combining the mortality and morbidity which results from different diseases, but how these diseases effected quality of life through for example pain and disability. Such measures as Quality Adjusted Life Years (QALYs) or Well Years are still in an early stage of development. The data required for compiling such indices are not always available and the methodologies involved in the calculation of QALYs are crude if explicit. In their absence, it may be necessary to use other indicators of the burden of illnesses and the potential benefits of health promotion.

In this paper we explore the use of the concept of 'avoidable years lost' as a method of both calculating the burden of illness and examining the priorities for health promotion.This approach involves the calculation of the number of life years lost from a range of diseases considered amenable to prevention.

The second stage is to calculate the proportion of disease that can be attributed to a number of risk factors or precursors, e.g. smoking, alcohol abuse, raised blood pressure etc. A number of 'avoidable life years' lost can be calculated by applying the risk factors to the estimates of life years lost for each disease.

This model was developed in a study by Amler and Dull (1987) about the burden of unnecessary illness in the United States. In this study the authors brought together a number of consultants from various medical specialties with the purpose of comparing adverse precursors associated with health problems and using a standard set of measures for comparison for all the health problems. Panels of experts were convened for each disease category to review available information and to undertake the tasks of defining health problems, calculating the health impact and social burden of the health problem, describing risk factors and known interventions, and estimating the potential benefit attributed to each intervention.

Such a comprehensive study has not been undertaken in the United Kingdom. The methods and results from Amler and Dull study are used in the next two sections to illustrate the potential use of such an approach in this country.

2. Measuring the Burden of Illness

As suggested in the earlier section, there are a number of indicators of the burden of illness. These burdens were categorised in the Amler and Dull study as mortality, morbidity,

Table 2.1

Number of Deaths In 1986

Diseases	Those Aged Less Than 65 (a)	Those Aged Over 65 (b)	Ratio (b)/(a)
Neoplasms	40,671	100,130	2.5:1
Diseases of the Circulatory System	42,955	235,794	5.5:1
Diseases of the Respiratory System	6,712	56,340	8.4:1
Diseases of the Digestive System	3,514	14,460	4.1:1
Injury & Poisonings	11,397	7,357	0.6:1
Mental Disorders	713	11,697	16.4:1
Diseases of the Nervous System	2,695	8,487	3.1:1
Infections and Parasitic	915	1,553	1.7:1
Other	6,834	25,468	3.7:1
Total	116,426	461,286	4.0:1

Source: OPCS (1988) Mortality Statistics - Cause 1986 Series DH2 No13, HMSO, London.

complications arising from disease, direct medical costs and effects on the quality of life of the individual, the family and society. The main indicator chosen for comparison was, however, avoidable, or potential life years lost for the chosen health problems for those under 65. The choice of the cut-off point of 65 years is abitary.

In Table 2.1 the numbers of deaths from the different diseases for England and Wales in 1986 are presented, broken down by those aged below 65 and those 65 and over. A crude ranking of different diseases for the different groups is given. Although circulatory disease and cancer account for the largest number of deaths for both age groups, other diseases are ranked differently. Injuries and poisonings is the third largest killer for the younger group but is one of the lowest causes of death for the elderly. Respiratory and mental disorders have a higher rank for the elderly than the young. In the last column of the data, ratios of the number of deaths in each group are calculated to indicate differences in the scales of the cause of mortality. Mental disorders and respiratory diseases are far more likely to be given as causes of death for the elderly than for the young. Injuries, poisoning and infectious diseases are far more likely to be cited as causes of death for those who died under the age of 65 than for the older group. Deaths from cancer, although higher in numbers for both groups, also accounted for a larger proportion of deaths of the younger group (35 per cent) than for the older group (22 per cent).

These figures give some idea of the different rankings of disease that may occur with different age cut-off points. As

general life expectancy increases, it may be argued that 65 is too low. Clearly the potential health gains in terms of enhanced length of life from healthier lifestyles are greater the younger the age. That is not to say, however, that considerable gains in the quality and quantity of life could not be achieved for the retired. Amler & Dull defended the use of the 65 cut-off because it preserved the option for worldwide comparisons. Using the same cut-off in this paper for our illustrative examples allows a comparison with the American study and is in line with some of the European targets for health for all, e.g. that mortality from cancer in people aged under 65 should be reduced by at least 15 per cent by the year 2000 (WHO, 1985).

Not all categories of disease are amenable to prevention. In Table 2.2 number of deaths and mortality rates are given broken down by sex and age for selected disease groups. These selected categories amount to 90 per cent of the deaths of those aged under 65 and those aged over 65. Figures given in Table 2.2 indicate the differences in the number of deaths and mortality rates between males and females. Female mortality rates from circulatory disorders and injury and poisonings for those under 65 were considerable lower than the rates for males. The ranking of disease by mortality rates, however, does not take account of differences in age of dying within the two broad age bands. It would be possible to present figures for narrower age bands, but a better summary measure of the quantity of life lost through these diseases is to calculate life years lost.

Table 2.2

Deaths and Death Rates for Selected Major ICD Groups, 1986

Disease Group	Deaths - Numbers			Deaths - Rates per million		
	All	<65	>65	All	<65	>65
All Neoplasms						
Male	73,717	20,877	52,840	2,926	979	17,212
Female	67,084	19,794	47,290	2,560	943	10,126
Diseases of the Circulatory System						
Male	136,414	31,306	105,109	5,332	1,468	34,237
Female	142,335	11,649	130,686	5,194	555	27,984
Diseases of the Respiratory System						
Male	32,999	4,133	28,866	1,255	194	9,403
Female	30,053	2,579	27,474	1,079	123	5,883
Diseases of the Digestive System						
Male	7,550	2,046	5,504	294	96	1,793
Female	10,424	1,468	8,956	382	70	1,918
Injuries and Poisoning						
Male	11,271	8,292	2,979	451	389	970
Female	7,483	3,105	4,378	280	148	937

Source: OPCS (1988) Mortality Statistics - Cause 1986. Series DH2, No 13, HMSO, London.

There are two ways such a figure would be calculated. The first method would be to calculate differences between 65 and the age of death. This is similar to the concept of working years lost especially if the cut-off point of 60 is used for women. The second method is to calculate the difference between age at death and the number of years of average life expectancy for a person of that age. For successive cohorts the expected length of life from birth to death has increased and the second method includes these trends. It is also more akin to a health objective of increasing quantity (and ultimately quality) of life of any age group, rather than a focus on so called 'productive' life. Obviously for some purposes of economic planning, working years lost is a useful concept, although population trends suggest there may be pressures to extend working life beyond 65 in the future. In general, however, the second measure will give greater weight to deaths of young people, although differences in rankings of life years lost between groups are unlikely to be large.

In Table 2.3 life years lost for those dying before the age of 65 using life expectancy data are presented for the same groups of diseases as in Table 2.2. Although the calculations of life years lost give a broadly similar picture for the major groupings of disease, there are some interesting features of the table. As a whole, neoplasms, while causing fewer deaths than diseases of the circulatory system, account for more years lost. It may be thought that calculating life years lost would give a

Table 2.3

Life Years Lost for those Dying Before Age 65

Major groupings by types of disease

Disease Group	Male	%	Female	%	Total	%
All neoplasms	440,748	28.5	535,272	50.2	976,020	37.4
Diseases of Circulatory System	635,400	41.1	284,070	26.7	919,470	35.2
Diseases of Respiratory System	97,591	6.3	73,646	6.9	171,237	6.6
Diseases of Digestive System	47,648	3.1	40,743	3.8	88,391	3.4
Injuries & Poisonings	325,050	21.0	131,002	11.9	456,052	17.4
	1,546,437	100.0	1,064,733	100.0	2,611,170	100.0

Sources: As Table 2.1. Life expectancy data for different ages were obtained from the Governments Actuary's Department.

greater prominence to injuries and poisonings which include accidents as a cause of loss of life.

In terms of deaths, injuries and poisonings account for only 1 death for every 5 from diseases of the circulatory system, but, in terms of life years lost, there are only two life years lost from diseases of the circulatory system for every one from injuries and poisoning. There is also a lower ratio of life years lost compared to numbers of deaths between neoplasms and injuries and poisonings (with a ratio of 3.6 deaths from neoplasms for every 1 from injuries and poisonings and a ratio of 2.1 : 1 for life years lost).

The figures in the table also illustrate the different burdens of illness between males and females. For example half of the life years lost for females calculated for these groups of diseases were attributable to neoplasms, whereas cancers accounted for less than a third of male life years lost. Injuries and poisonings accounted for 2.5 more life years lost for males than for females. Even for these broad categories of disease, these figures suggest that priorities for health promotion and disease prevention may differ substantially by sex.

The categories of disease reported in Table 2.2 are broad. Causes of disease for specific conditions vary, as does the potential for prevention. In Table 2.4, life years lost are calculated for a selected number of conditions. Overall the 19 conditions accounted for 73 per cent of the total life years lost given in Table 2.3. There was a

Table 2.4

Life Years Lost for Those Dying Before Age 65, Ranked by Specific Type of Disease

Disease Category (ICD Codes)	Total	Male	Rank	Female	Rank
Heart disease (390-429)	727,464	532,232	1	195,232	1
Lung Cancer (162)	204,337	133,992	2	70,345	4
Motor Vehicle (E810-E819) Traffic Accidents	166,416	122,517	3	43,889	5
Breast Cancer (174)	152,197	739	18	151,458	2
Cerebro vascular (430-438) disease	151,381	78,256	5	73,125	3
Suicide and self (E950- inflicted injury E959)	108,059	78,979	4	29,680	9
Chronic obstructive pulmonary disease and allied conditions (490-496)	97,296	54,684	6	42,612	7
Colorectal Cancer (153-154)	88,350	45,045	7	43,305	6
Cervical Cancer (180)	34,919	-	19	34,919	8
Pancreatic Cancer (157)	32,998	17,807	9	15,191	10
Due to Alcohol (100%) Note 1	30,029	19,442	8	10,587	12
Diabetes mellitus (250)	26,464	14,187	10	12,277	11
Bladder Cancer (188)	15,549	10,636	12	4,913	16
Diseases of the oesophagus stomach and duodenum (530-537)	15,404	9,215	13	6,189	13
Accidents caused by fire (E890-E899)	14,092	8,439	14	5,653	15
Homicide and assault (E960- E969)	13,430	7,549	15	5,881	14
Prostatic Cancer (185)	11,631	11,631	11	-	19
Accidental Poisonings (E850- E858)	10,196	5,657	16	4,539	17
Laryngeal Cancer (161)	5,254	4,228	17	1,026	18
	1,905,466	1,155,235		7,50,221	

Source: As Table 2.4
Note 1 : ICD Codes 291, 303, 305.0, 425.5, 571.0, 571.1, 571.2, 571.3, 980

between men and women, however, and only 68% of the life years lost reported for the 5 main ICD groupings in Table 2.3 for women could be accounted for by the 19 conditions in Table 2.4. It should be noted that any selection process can be criticised and the rankings given in Table 2.4 must be interpreted with some care. The striking feature of the figures in the table is the dominance of heart disease as a cause of lost life years for both men and women. Many of the conditions had similar rankings for both men and women, the exceptions being, in general, sex specific diseases. It is, however, important to note the dominance of breast cancer as a cause of lost life years for women. Cervical cancer also accounts for a large number of life years lost, but is ranked 8th, and lung cancer causes twice as many life years lost for women. For men, motor vehicle accidents and suicide and self inflicted injury are major causes of life years lost.

The analysis has concentrated on disease groups as defined by the ICD classification system. This is not the only way to look at the patterns of disease, however, and some categories of problems involve several different ICD categories. It would be possible for example to define alcohol related diseases in a much broader sense than in Table 2.4 where only those diseases related solely to alcohol are included. Two important areas of preventable disease are not separately distinguished from our analysis of mortality statistics, namely neonatal and infant mortality and AIDS, although calculations for life years lost already presented will include some deaths from these causes.

Mortality statistics do not include still births and no causes are given for other deaths before 28 days. Separate analysis of deaths before the age of a year are made by OPCS. In 1986 there were 3549 still births, 3449 neonatal deaths (babies younger than 28 days) and 2824 deaths of infants aged between 28 days and a year. It is possible to use such figures to calculate life years lost; neonatal mortality in 1986 accounted for 268,500 life years lost and infant deaths aged between 28 days and a year accounted for 201,424 life years lost. In Table 2.5 the causes of the infant mortality are examined in greater detail. It can be seen that the majority of life years lost (82.3%) occur outside the five main ICD categories that have been considered in the earlier part of the paper. At birth life expectancy is now calculated at 72.1 years for males and 77.8 years for females. Deaths of infants therefore rank highly in terms of life years lost.

Deaths from AIDS are subject to a separate monitoring system because of confidentiality and are not separately categorised within the mortality statistics. Up to 1986, the year chosen for our analysis, the number of deaths from AIDS was still quite small. The average age of death is low and therefore in any future analysis attention would need to be given to this health problem. So, for example, at age 27 life expectancy for males is 46.6 years and for females 51.9 years. In 1986 if 4,385 males had died from AIDS at age 27 the life years lost would be comparable to the total number from lung cancer. At the moment there are still insufficient data to accurately predict patterns of the disease. As the numbers of

Table 2.5

Life Years Lost From Mortality, By Cause, 1986

Disease	Life Years Lost	
Total Infant Mortality from All Causes (Under 1 but 28 days and over)	210,057	
By Cause:		
Neoplasms	1,421	37,285
Diseases of the Circulatory System	3,082	
Diseases of the Respiratory System	23,084	
Diseases of the Digestive System	1,937	
Injuries and Poisonings	7,761	
Congenital Abnormalities	36,625	
Certain Conditions Originating in the Perinatal Period	15,012	
Ill Defined/Unknown	96,923	
Total Neonatal Mortality From All Causes (Deaths under 28 days, excluding still births)	268,500	

deaths from AIDS increase, patterns of disease using ICD codes will also change and it will be necessary to carry out separate analyses for accurate comparisons of changing illness burdens.

Ideally, as part of the exercise of ranking health priorities, it would also be useful to compile information on morbidity, costs and other indicators of the burden of illness. As well as providing the information that would be needed to build improved indicators, the robustness of ranking priorities of life years lost could be tested. Unfortunately, there have not been many studies of the 'costs of illness' for different diseases as undertaken in the United States and other countries (Rice et al, 1986). Some calculations have been made for individual disease categories. So, for example, the costs to the NHS of coronary heart disease in England and Wales was estimated at £389.9m for 1985 (OHE 1987). Estimates of a similar nature have been made for smoking and alcohol related diseases, but little work has been done on the costs of specific conditions. A greater awareness of costs and development of better information systems within the health service may facilitate such studies in the future.

Data do exist on hospital in-patient cases by disease category. Such data are however partial and do not include GP consultations or outpatient referrals, nor sickness absence or the costs of prescriptions. Although a complete survey of available material is outside the scope of this paper, it is likely that such analyses would highlight the importance of generally non life threatening disorders, particularly those

associated with mental handicap and illness. For example, Goldberg & Huzler (1980) estimate the rates of mental illness identified by GPs at 140 per 1000 of the population with females in general having twice the rate of mental illness, however defined, than men.

A number of criticisms can be made of any one indicator. Not only is death only one dimension of health, but a number of different factors may be the cause of death and the eventual classification of deaths to different diseases may not accurately reflect the burden of diseases. All these factors indicate the importance of testing the sensitivity of any model or indicator using a number of different assumptions.

3. Calculating the Avoidable Burden of Illness

The disease categories in our analyses were chosen on the basis of association with prevention. The proportion of each disease which could be prevented will, however, vary considerably. To calculate avoidable life years lost in a systematic way, it is necessary to identify the generic precursors and then review the epidemiological literature to obtain attributable factors for each precursor.

In the Almer and Dull study, nine priority precursors were identified for the United States namely: tobacco; alcohol; over nutrition (i.e. obesity, high serum cholesterol or both); injury; unintended pregnancy/infant mortality; hand

guns; high blood pressure; violence and dental programmes. These nine factors were chosen from an initial list of eighteen by the panels of experts. This list was further ranked and amended to give the highest priority precursors as: tobacco; alcohol; injury; unintended pregnancy; gaps in primary prevention and violence; depression and substance abuse. A large number of conditions were explored in depth. Not all these health problems were mutually exclusive. Also within health problems, although a 'best estimate' approach was used to find a single attributable factor for each precursor, attempts were not made in the first instance to reconcile the overlaps between these factors. Hence in some cases the proportion of deaths or life years lost can add up to more than the actual total. It was necessary to carry out a separate analysis using the detailed studies to reconcile any double counting of conditions, decide on a mutually exclusive determination of risk factors and to combine the figures over all health problems. Only at this stage can the precursors be ranked in importance of the potential benefits that may accrue in the advent of prevention health policy.

Although it is not possible to replicate the Almer and Dull study in the UK, its use can be illustrated with some examples. Cancer, as seen in Table 2.3, is one of the two leading causes of life years lost for those who died before the age of 65 and figures for several specific cancers are given in Table 2.4. It has been suggested that about 85 per cent of cancer may be potentially avoidable (Doll and Peto, 1981) with cigarette smoking and diet being the most important risk factors. The importance of these factors varies,

however, between the different sites of the cancer. In Table 3.1 the attributable factors used in Almer and Dull are applied to the data for England and Wales. For this health problem, an international survey of epidemiological studies was undertaken which suggests the results will not be as biased towards American patterns of disease and lifestyles as the figures, for example, used for heart disease which were based on American data alone. For the seven types of cancer considered in the American study, there is some similarity in the pattern of life years lost between the US in 1980 and England and Wales in 1986. Lung cancer, pancreatic cancer and cancer of the larynx took up rather more of the total life years lost in the US compared to England and Wales, and breast cancer, cervical cancer and cancer of the bladder rather less.

From Table 3.1 it can be seen that causes of disease do vary between different cancers illustrating the usefulness of a more detailed approach. A single attributable risk factor was obtained by using exploratory data analysis to obtain the central tendency of relative risk factors. An alternative approach would be to explore a range of avoidable risk estimates. Risk factors were examined separately and were not mutually exclusive. Hence the sum of life years lost for the different risk factors for cervical cancer is greater than the total life years lost (34,919) attributable to the disease.

Another feature of this table is that not all risk factors are equally amenable to prevention policies. To help

Table 3.1

Attributable Life Years Lost due to Cancer (to 65 years old)
England and Wales 1986

Type		Total Life Years Lost	Factor	Attributable Life Years Lost
Cervical		34,919	Syphilis	2,514
			Onset of coitus < 17	10,196
			2 or more sex partners	17,390
			Herpes	11,523
			Smoking	9,184
			Oral contraceptives	6,879
Bladder	(M)	10,636	Smoking	4,954
	(F)	4,913	Coffee	3,927
			Occupation (high risk)	2,446
Pancreatic	(M)	17,807	Smoking	8,513
	(F)	15,191	High-fat diet	7,920
			Diabetes	2,126
			Coffee	7,227
Laryngeal	(M)	4,228	Smoking	5,153
	(F)	1,026	Alcohol	888
Lung	(M)	133,992	Smoking	154,683
	(F)	70,345	Occupation (high risk)	24,520
Breast		151,458	Weight (>60 kg)	45,437
			Age of 1st pregnancy <20	4,377
			Diet	30,292
Colorectal	(M)	45,045	Beer	3,711
	(F)	43,305	Diet	17,670

The attributable risk factors (ARFs) used in this table are from 'Closing the Gap. The Burden of Unnecessary Illness' edited by Robert W. Amler and H. Bruce Dull (1987).

reconcile some of the figures and indicate areas where risks may be reduced by primary prevention, the detailed data were reviewed and a conservative estimate of the main factors was obtained. This analysis, repeated on data for England and Wales, is presented in Table 3.2. The five risk factors applied to the selected examples identified in the table account for 26% of all the life years lost before the age of 65 identified with cancer. This is a similar figure to the 23% of all cancer life years lost recorded in the US for 1980. These risk factors applied to the specific cancer sites also accounted in the US for a similar proportion of all cancer deaths, number of hospital days and costs. In considering these figures, the consultants in the American study noted that more and more evidence is being accumulated on the importance of diet and that the estimates adopted in Table 3.1 give only a conservative estimate of the effects of diet. Also a number of other factors have been implicated as causes of cancer which may be amenable to life style changes. For example coffee consumption, and additional reductions in disease can be achieved through screening or self examination programmes, the take up of which may be influenced by health education.

It would be useful to test the validity of the results in Table 3.1 and 3.2 by more careful review of differences between American and English and Welsh cancer patterns, but the predominance of smoking and diet as risk factors is likely to remain.

Table 3.2

Conservative Estimates of the Proportion of 'Avoidable' Life Years Lost Amenable to Primary Prevention Selected Cancer Sites, 1986

		Attributable risk (%)	Life Years lost
Lung:	Smoking	75.9	154,683
	Occupation	12	24,520
Colorectal:	Diet	20	17,670
Breast:	Diet	20	30,292
Cervix:	Smoking	24.1	9,184
Pancreas:	Smoking	25.8	8,513
Bladder:	Smoking	39.0 (M) 16.4 (F)	4,954
	Occupation	23	2,446
Larynx:	Smoking	74	5,153
	Alcohol	16.9	888
			249,119

Percentage of life years lost from all cancers.

Even if all diseases could not be subjected to a detailed analysis, it would be useful to attempt to quantify the attributable life years lost from heart and cerebrovascular disease. A number of risk factors have been identified. These include smoking, raised serum total cholesterol levels; raised blood pressure; thrombogenic tendency, diabetes mellitus, obesity and a sedentary lifestyle. Many who suffer from coronary heart disease have more than one risk factor and there is some evidence that risks are multiplicative. It is not clear from existing studies whether some risk factors, such as obesity, have an independent causal effect or act mainly through other risk factors.

Trends in heart disease between the US and UK have varied and the type of analysis in the Amler and Dull study used a model which took account of the prevalence, for example, of smoking and over-nutrition within the US. Overall figures are given in Table 3.3 for cardiovascular disease. Other studies are used to give examples of risk factors for some of the other main diseases. The variations both in attributable risk factor and the prevalence of the disease illustrate how rankings could change between the comparison of life years lost and attributable life years lost. This highlights the need for careful analysis of all available data. One example is the health risks from smoking. In Table 3.2, over 75 per cent of lung cancers were attributable to smoking, yielding 154,683 life years lost. Smoking had a considerably smaller attributable risk factor for coronary heart disease ranging from 13 to 39 per cent for different age/sex groups, but resulted in a much larger number of life years lost (263,316).

Table 3.3

Attributable life-years lost for various diseases

	Total Life Years Lost	Attributable Life Years Lost	
Cardiovascular disease (ICD: 390-448)	907,751	Smoking[1]	263,316
		Blood Pressure[2]	176,876
		Cholesterol[3]	58,067
		Glucose intolerance[4]	84,323
Accidents			
		Smoking[5]	7,000
Caused by fire	14,092	Alcohol[5]	5,496
traffic	166,416	Alcohol[6]	58,246
Caused by drowning	10,294	Alcohol[5]	1,544
Homicide	13,430	Alcohol[5]	6,715
Suicide	108,059	Alcohol[5]	30,257
Chronic obstructive Pulmonary disease and allied conditions	97,296	Smoking[7]	66,580

Attributable Factors (%)

1. Amler & Dull

	M	F
<45	39	17
45-64	35	13

2. Amler & Dull

	M	F
<45	8	7
45-64	23	18

3. Amler & Dull

	M	F
<45	8	5
45-64	7	16

4. Amler & Dull

	M	F
<45	1	11
45-64	1	31

5. Royal College of Physicians (1987) -

Accidents caused by fire	39
Accidents caused by drowning	15
Homicide	50
Suicide	30

6. The Nation's Health (1988) - Traffic Accidents 35

7. DHSS unpublished

M	F
75	60

An alternative way to use available evidence is to consider behaviour patterns, such as alcohol and tobacco, and to attempt to associate life years lost with the behaviour pattern. In most cases, the same epidemiological data were used, but occasional special surveys of reviews which have concentrated on a particular behaviour pattern can supplement a disease analysis. Results from such studies may, however, also result in double counting, especially as risky behavioural patterns are linked. These links will be discussed in the following section.

In Table 3.4 some calculations of alcohol related life years lost are presented. The figures indicate that a large proportion of these life years lost are attributed to injuries and poisoning, especially road accidents.

The conclusions from the Amler and Dull study suggested that tobacco, injury risks, alcohol, gaps in primary prevention, unintended pregnancy, high blood pressure and over-nutrition were the most important precursors of deaths, potential life years lost and days of hospital care. In terms of life years lost, injury risks, alcohol, tobacco and gaps in primary prevention accounted for 75 per cent of the years of potential (avoidable) life years lost before the age of 65 in the US. High blood pressure and over-nutrition were ranked much higher in terms of deaths, but, because of the age distribution of deaths, were less prominent causes of life years lost.

There are a number of reasons to expect a similar attribution of life years lost as a group to the main risk factors, but the relative importance of risk factors may vary. For example, rates of motor vehicle accidents in England and Wales are low internationally, whereas heart disease rates are high. This may decrease, although not by large amounts, the relative importance of alcohol (the main factor in the US with 22% of life years lost) and increase the relative importance of tobacco (18% of life years lost in the US).

Table 3.4

Alcohol Related Life Years Lost from Various Causes

	Total Life Years Lost	AF %	Alcohol-related Life Years Lost
Alcohol diseases	30,029	100	30,029
Neoplasms	976,020	3[1]	29,280
Road accidents	166,416	35[1]	58,246
Accidents caused by fire	14,092	39[2]	5,496
Accidents caused by drowning	10,294	15[2]	1,544
Homicide	13,430	50[2]	6,715
Suicide	108,059	30[2]	30,257
			161,567

Sources of Factors

1. 'The Nation's Health' (1988)
2. Royal College of Physicians (1987)

Although the analyses of avoidable life years lost give very clear results, some cautionary concluding comments must be made. The first remark is that present mortality from many diseases is linked to past behaviour patterns. Evidence for some risk factors, e.g. diet and serum cholesterol levels, although not all, e.g. smoking, suggests that only if behaviour patterns of the very young are changed can appreciable decreases in mortality be expected. This type of evidence can determine the focus of campaigns but the evidence of a successful outcome of the intervention will take a long time to materialise. The second caveat has already been discussed and that is the influence of non life threatening conditions such as mental illness on the quality of life of individuals which is undervalued in the crude application of this model. The third and final problem is taking account of new diseases and life threatening conditions such as AIDS. There will, however, always be a number of uncertainties surrounding the patterns and causes of disease and the potential for health promotion activities. These and other criticisms do not imply that all attempts to prioritise health activities should be abandoned, but the robustness of the assumptions of any model should be examined with care.

4. Lifestyle Factors

In the previous section a number of different lifestyle factors such as diet, smoking and alcohol use were linked with avoidable illness. The potential priorities for lifestyle changes may be indicated from such work but the results do not give any indication of the relative difficulties or costs

attached to such changes. In this section, the available data on lifestyle behaviours and the role of economists in analysing the data are considered.

A starting point for this exercise would be to compile baseline data on aspects of behaviour like smoking, drinking, nutrition, exercise and sexual habits. If this information is additionally broken down by such factors as age, sex and social class, some idea of the potential for change and the possibilities for targetting education campaigns may emerge. Information is required both on participation in activities whether good or bad for health and the amount of consumption by those participating, e.g. numbers of cigarettes smoked or hours of exercise.

Supplementary data on attitudes to activities and knowledge of the links between activities and health are also useful for building up a picture of the potential for change. The relationship between knowledge, attitudes and behaviour is, however, complex, as research into smoking behaviour has indicated (Marsh and Matheson, 1983). This research suggests that it is important that the benefits from changing lifestyles are known. Smokers are, for example, well informed about the dangers of smoking but may believe that health damage has already taken place and that no benefits may accrue from quitting smoking. The study by Marsh and Matheson illustrates the importance of the type of data collected and the usefulness of well structured theoretical models which can use the data to test hypotheses. The results from such

research can feed into the process of improving the efficiency of health education programmes (Marsh, 1988).

Acquiring information on lifestyles and commissioning special surveys is costly and it is important to exploit existing data and research.

Time Series Data

Sources of data are varied and have different advantages and disadvantages. Economists have until recently concentrated on estimating models using data over time aggregated over all individuals (Godfrey, 1989). Data on alcohol, tobacco and food consumption are collected annually for compiling national account statistics, and a major advantage of these data is their accuracy. Using these data, estimates have been made of the health information and other factors such as price and income on the consumption of cigarettes. These estimates indicate that publicity surrounding health scares led to a decline in smoking and that such health information continues to lead to an annual 3 per cent decrease in cigarette consumption, other things being equal (Godfrey and Maynard, 1988). Well specified and properly tested multivariate economic models are useful in providing estimates of the effect of health information on consumption behaviour, controlling for other factors. The results from these models may also be useful in providing forecasts of trends in health behaviour and disease incidence. Current patterns of disease outlined in earlier sections, however, result from both current and past health behaviour

which complicates the prediction of future disease incidence.

There has been little economic research on the role of health beliefs and attitudes on lifestyle patterns other than smoking. This is due, in part, to the lack of general awareness campaigns and publicity which surrounded the smoking debate and could be measured in models attempting to explain changes in behaviour averaged over the whole population.

Data from Sample Surveys

The disadvantage of time series aggregate data is that differences between separate groups of the population cannot be investigated. To obtain such disaggregated data, however, sample surveys are required. For alcohol and tobacco, estimates of consumption obtained from samples only account for a proportion of the total consumption obtained for national accounts. The shortfall from annual benefit surveys, such as the Family Expenditure Survey for example, has been estimated at 22 to 26 per cent for tobacco and 40 to 45 per cent for alcohol.

This evidence does not necessarily imply that people are untruthful about their habits but may reflect the fact that people who drink and smoke heavily may be excluded from the survey design or be overrepresented in the non-respondents (Kemsley, Redpath and Holmes, 1980). Some care is therefore needed in interpreting results from models using these data. It is also important to compare data from different sources in

order to test the robustness of survey methodology.

Data on lifestyle behaviour are available from some of the continuing surveys, such as the General Household Surveys, one-off occasional surveys on particular lifestyle factors such as smoking and drinking, cohort surveys which follow the same group of people over periods of time and data accumulated from individual research projects. It is outside the scope of this paper to review all the evidence from these surveys but some aspects of previous research and the potential use of the different types of survey are discussed.

a) Regular Survey Data

There are several surveys which are carried out at regular intervals and provide a rich source of data from some behaviours. The three main surveys concerned are the Family Expenditure Survey, the General Household Survey and the National Food Survey. The Family Expenditure Survey (FES) is a household survey undertaken annually and provides information on expenditure on all goods, including alcohol, tobacco and different types of food. It has considerable information on income and has been used by economists to study alcohol and tobacco consumption patterns (Godfrey, 1989). The General Household Survey (GHS) is also conducted annually, but the coverage of the questionnaire varies. Detailed questions on smoking and drinking habits are included biannually and the GHS has been one of the main sources of data on smoking habits and knows they have changed over time, see Table 4.1.

These figures show changes over time and different rates of declining smoking between occupational groups and between men and women. Further analysis is required to explain why there are differences between groups. Research on these figures in the UK and similar surveys in the other countries have suggested that the size of effects such as prices and health education vary between groups. Research in the United States, for example suggests that the young are more responsive to price than estimates derived from the whole population would suggest (Lewit, Coate and Grossman, 1981). Clearly while health education campaigns are taking place, other factors such as behaviour patterns are changing and consequently, the impact of health education campaigns can not be evaluated accurately.

Other research has indicated the case that has to be taken in interpreting sets of statistics that cover only one aspect of behaviour. The figures in Table 4.1 refer only to cigarette smoking. Using these figures alone would seem to suggest that more men have been successful in giving up smoking than women. Jarvis (1984) has, however, reanalysed the data from the GHS to take account of those who do not give up smoking entirely but change to smoking pipes or cigars. If the analysis of Table 4.1 is repeated to include smokers of all types of tobacco, the differences between the sexes in quitting smoking is much narrower.

The National Food Survey is one of the most valuable data sets for studying changes in diet. In Table 4.2 changes in consumption between 1961 and 1987 of selected commodities are

Table 4.1

Prevalence of cigarette smoking by sex and socio-economic group: 1972 to 1986 (Great Britain)

Year	Socio-economic group						
	Professional	Employers and managers	Intermediate and junior non-manual	Skilled manual and own account non-professional	Semi-skilled manual and personal service	Unskilled manual	All aged 16 and over
	Percentage smoking cigarettes						
Men							
1972	33	44	45	57	57	64	52
1974	29	46	45	56	56	61	51
1976	25	38	40	51	53	58	46
1978	25	37	38	49	53	60	45
1980	21	35	35	48	49	57	42
1982	20	29	30	42	47	49	38
1984	17	29	30	40	45	49	36
1986	18	28	28	40	43	43	35
Women							
1972	33	38	38	47	42	42	42
1974	25	38	38	46	43	43	41
1976	28	35	36	42	41	38	38
1978	23	33	33	42	41	41	37
1980	21	33	34	43	39	41	37
1982	21	29	30	39	36	41	33
1984	15	29	28	37	37	36	32
1986	19	27	27	36	35	33	31

Source: General Household Survey, 1986

shown. These figures show significant changes in dietary norms in Great Britain. The consumption of butter fell by almost two thirds between 1961 and 1987 and purchases of low fat products have increased rapidly in recent years. Also the consumption of brown and wholemeal bread has increased over 2.5 times. Dietary changes, nutrition needs and the links with health are complex. Health guidelines are normally stated in terms of the percentage of fat in the total diet. While total fat consumption has decreased, total calorie intake has also declined partly because of changing work and exercise patterns. As a result fat as a proportion of the energy value of the diet has remained at a constant level of about 40 per cent for a number of years.

Although models to explain these changes in dietary intake may be more complex than for smoking behaviour, there is a need for research of this kind so that the processes leading to marked changes in nutrition are more fully understood.

The National Food Survey excludes alcohol consumption, but data are available from both the FES on an annual basis and the GHS every two years. Drinking habits, like diet, are considerably more complex than smoking and trends in harmful behaviours between different groups especially in recent years have not been so clear cut.

Table 4.2 Purchases[1] of selected foods for home consumption

Great Britain	Indices of average quantities per person[2] per week, 1980 = 100										
	1961	1971	1976	1980	1981	1982	1983	1984	1985	1986	1987
Type of food											
Milk and cream	114	113	111	100	97	96	94	94	90	91	89
Cheese	79	93	97	100	100	98	103	99	101	107	105
Eggs	126	123	111	100	100	95	96	87	85	82	78
Beef and veal	112	98	94	100	86	87	81	77	80	81	83
Mutton and lamb	150	120	93	100	94	80	86	74	73	67	59
Pork	47	74	70	100	92	97	85	80	84	88	77
Poultry	36	73	90	100	109	102	104	108	102	107	119
All other meat and meat products	98	105	98	100	102	103	103	99	100	100	98
Fish and fish products	119	107	95	100	103	105	107	102	102	108	106
Butter	153	137	127	100	91	78	81	71	70	56	53
Margarine	86	82	80	100	107	113	107	107	98	107	104
All other fats	76	87	82	100	97	104	99	100	104	123	117
Fresh potatoes	138	120	86	100	102	100	97	97	100	95	92
Other fresh vegetables[3]	101	99	92	100	98	95	94	92	90	99	94
Other vegetables and vegetable products[3]	61	78	92	100	105	107	107	105	114	121	120
Fresh fruit	83	96	88	100	96	90	94	91	89	98	97
Other fruit and fruit products	88	92	88	100	109	113	125	122	118	144	148
Bread, standard white loaves	165	137	121	100	100	99	95	92	89	76	73
Bread, brown and wholemeal	58	55	65	100	100	97	106	118	132	165	151
Cakes, biscuits, etc	128	123	105	100	100	103	99	97	95	99	99
Sugar	162	141	109	100	99	92	88	82	75	72	67
Tea	139	117	108	100	97	99	100	88	85	85	83
Instant coffee	30	81	94	100	96	94	98	100	100	102	96

1 Includes also the household consumption of "free" foods, eg, garden and allotment produce etc.
2 Irrespective of age.
3 Includes tomatoes.

Source: Social Trends 19, 1989.

From regular surveys it is therefore possible to build up some knowledge of lifestyle behaviours, and research using this data could help explain changes in behaviour over time. One of the disadvantages of regular surveys is, however, that they do not contain information on all health related behaviours. There are limitations on the number of additional topics that can be covered in any detail. The GHS is able to cover a variety of behaviours by changing its coverage from year to year. From 1977, for example, it has on a three year basis included questions on participation in sports, games and physical activities. These questions have not been included over a long enough period for clear trends to emerge although as indicated in Table 4.3 there is some evidence of an increase in physical activities for both sexes.

b) Occasional Surveys

Not all lifestyle factors are covered by existing regular surveys and even if questions are introduced they are by necessity limited in coverage because of the need to keep the total questionnaire within reasonable limits. Specially designed surveys on particular aspects of lifestyles can therefore be important sources of information. There have been a number of official surveys related to smoking and drinking. Some have been general such as the 1978 and 1987 drinking surveys whereas others have been more specific, for example, drinking habits, regional variations in drinking patterns and smoking among secondary school children.

Table 4.3

Changes in Sports, Games and Physical Activities
(% participating)

	Men				Women			
	1977	1980	1983	1986	1977	1980	1983	1986
At least one outdoor activity	35	37	39	40	21	24	24	24
At least one indoor activity	31	32	33	35	13	15	18	21
At least one outdoor/or indoor activity	n.a.	53	54	57	n.a.	33	35	37

One recent survey covered the heights and weights of adults in UK. This survey provides some baseline data on obesity. Using the Royal College of Physician's definition that those with a Body Mass Index (BMI) of over 25 could be regarded as overweight and those with a BMI of over 30 as obese, the results indicate that 39 per cent of men aged between 16 and 64 had a BMI of over 25 compared to 32 per cent of women. More women than men, however, had a BMI over 30. For women the proportion who are overweight or obese tends to rise steadily with age, but for men the proportions tend to stabilise in early middle age. The survey contains information on many other health behaviours, particularly alcohol consumption, smoking, exercise and the number slimming. As with other surveys, a number of basic tables are provided but there is considerable scope for further analysis, particularly multivariate modelling.

One difficulty associated with using occasional surveys is that there is a tendency to consider aspects of health behaviour in isolation. It is however clear that, for example, heavy smoking is associated with heavy drinking (General Household Survey, 1984). Some researchers have suggested that benefits from health education may be overestimated if, for example, ex-smokers are assumed to have the same other lifestyle behaviour as non-smokers. Leu and Schaub (1983) arbitarily assumed that only 65 per cent of the differences in premature mortality could be attributed to smoking and that ex-smokers would continue to have higher premature mortality rates than life-time non-smokers because of other life style behaviours. Also it is not clear whether changing one behaviour will affect others. So, for example, ex-smokers may gain weight or conversely adopt other health promoting activities.

Such interactions in health behaviour have not in general been well researched. It would be useful to compile information on the relationships between different aspects of health related behaviour. This type of information would be useful input into the comparative evaluation of multi-factor and single factor education programmes. Also the results from such research may help identify various groups of the population with different patterns of lifestyle behaviours who require different health education programmes.

Multi-risk factor analysis requires considerable breadth of information which may not be available in the data sets already considered. The Health and Lifestyle Survey (HLS) was

an attempt to create an initial data set of this sort. The preliminary report did contain a considerable amount of baseline data. A number of research projects are underway (including one at York) to use these data to test further the understanding of differences in health behaviour across the population.

c) Other Data Sources

The official data sources, surveys and independent surveys such as the HLS have the advantage of being readily available and in the majority of cases the data can be obtained for further secondary analyses. A number of other data sources do exist although access to them, and the breadth of information on lifestyle factors may be limited.

Cohort analyses are particularly interesting for research purposes because the same individual is followed up through time and this allows the testing of hypotheses about changes in behaviour over the life-cycle. Some of the national cohort surveys have covered some life style data in some of the sweeps (e.g. National Child Development Study). Including questions on life styles in new sweeps of existing data sets is of course far less expensive than mounting new surveys.

There are also considerable amounts of data generated from specific social service and medical research projects. Compiling such data can be problematic as results can be published in a wide variety of different publications.

Results may also be based on small numbers and only address very specific questions or sub groups of the population.

Summary

There is information available on some risk factors and the data could be useful in helping set health priorities. In particular there has been information compiled on changes in smoking habits, although research is still necessary to determine the exact relationships between different factors and the changes in behaviours. There are also some data on labour, dietary habits and alcohol use, although for various reasons there have been fewer attempts to compile and analyse this information. For some aspects of behaviour there are still few data available, particularly for health promoting activities such as exercise and sexual habits. Also insights could be obtained by examining interactions in lifestyle behaviours. From work on existing data sets it is clear that accumulating data alone is not sufficient and theoretical frameworks which encompass economic and other social science behavioural models need to be developed and tested.

5. Economic Evaluation of Health Promotion Policies

The analysis of avoidable life years lost and a study of life style behaviour may give some indication of priority areas for health promotion. For example, it could be forecast that changes in diet and smoking behaviour would result in a reduction of life years lost and improvements in the quality of life. There are many health promotion policies which could

be adopted to change behaviour but there are limited resources to fund them. Consequently choices about policies must be made. To identify the "best buy" it is necessary to carry out a good economic appraisal of the alternative health promotion policies. The results of such studies can then be used in turn to refine the process of setting health promotion priorities.

In this section of the paper, the information requirements for good economic evaluation are outlined briefly. The extent to which economic evaluation techniques have been used to appraise health promotion programmes is limited (some examples are critically analysed in Drummond, et al. 1987).

Many of the existing studies are incomplete for a variety of reasons. In the first part of this section, a checklist is outlined by which evaluations can be judged. Examples are given to illustrate the need for good economic evaluations. There are a number of different types of economic evaluation and these are briefly described in the second part of the section and the results of some economic appraisals are then examined. Finally both the benefits and limitations of economic evaluations are discussed.

The Characteristics of Good Economic Appraisals

The purpose of economic evaluation of alternative policies is to identify which option gives the greatest

benefit at the least cost. The objective of this approach is to identify, measure and quantify the characteristics of alternative policies. In economic evaluations it is necessary to examine the inputs, processes and outcomes i.e. identifying, measuring and valuing the resources consumed in health promotion, the health promotion activities and the outcomes in terms of improvements in health. This process is illustrated in more detail in Figure 5.1, and the terms defined in this figure are used throughout this section.

A number of authors have outlined problems that can occur with inadequate evaluations. The check list of questions which are described in turn below are similar to those provided in standard references on the subject (e.g. Drummond, Stoddart and Torrance, 1987).

(a) What is the objective of the appraisal?

It is essential to identify what alternative policies are to be evaluated. A question such as "is an anti-smoking policy in the workplace worthwhile?" is not useful because it does not specify the alternative interventions or indicate who gains from the policy. A more useful specification of this question might be: "From the point of view of (i) the individual, (ii) the NHS and (iii) society, is anti-smoking policy intervention 'A' preferable to existing policies (e.g. doing nothing)?" This approach would require the quantification of the costs to (i), (ii) and (iii) for each option and the identification of their effects in some health,

economic or value measure, (see Figure 5.1).

(b) Are the competing policies described fully?

For the results of the evaluation to be useful, a full description is essential. Without such details it may be impossible to identify the nature of the intervention and thus a judgement about its relevance in other settings may be difficult and replication may be impossible. Also a full description of the options enables the use of the study's results to determine whether all relevant costs (C1, C2, C3 in Figure 5.1) are included.

Any description should indicate:

i) who does what to whom

ii) where and how often

iii) with what effects for whom

(c) Were the costs and outcomes identified, measured and valued adequately?

The costs of options will be borne by:

(i) the health promotion agency (e.g. professionals' time, supplies, equipment, capital costs).

(ii) the recipient and their family (e.g. inputs by the recipient and her relatives and time lost from work or leisure for all relevant actors).

(iii) costs to those other than the health promotion sector, the individual and her family, e.g. private agencies such

as Alcohol Concern or Action on Smoking and Health.

The outcomes will be changes in physical, psychological and social well-being. These outcomes can be measured in terms of resource consequences (B1, B2, and B3 in Figure 5.1) and enhancements in the length and quality of life (QALYs) for individuals and their families (see below).

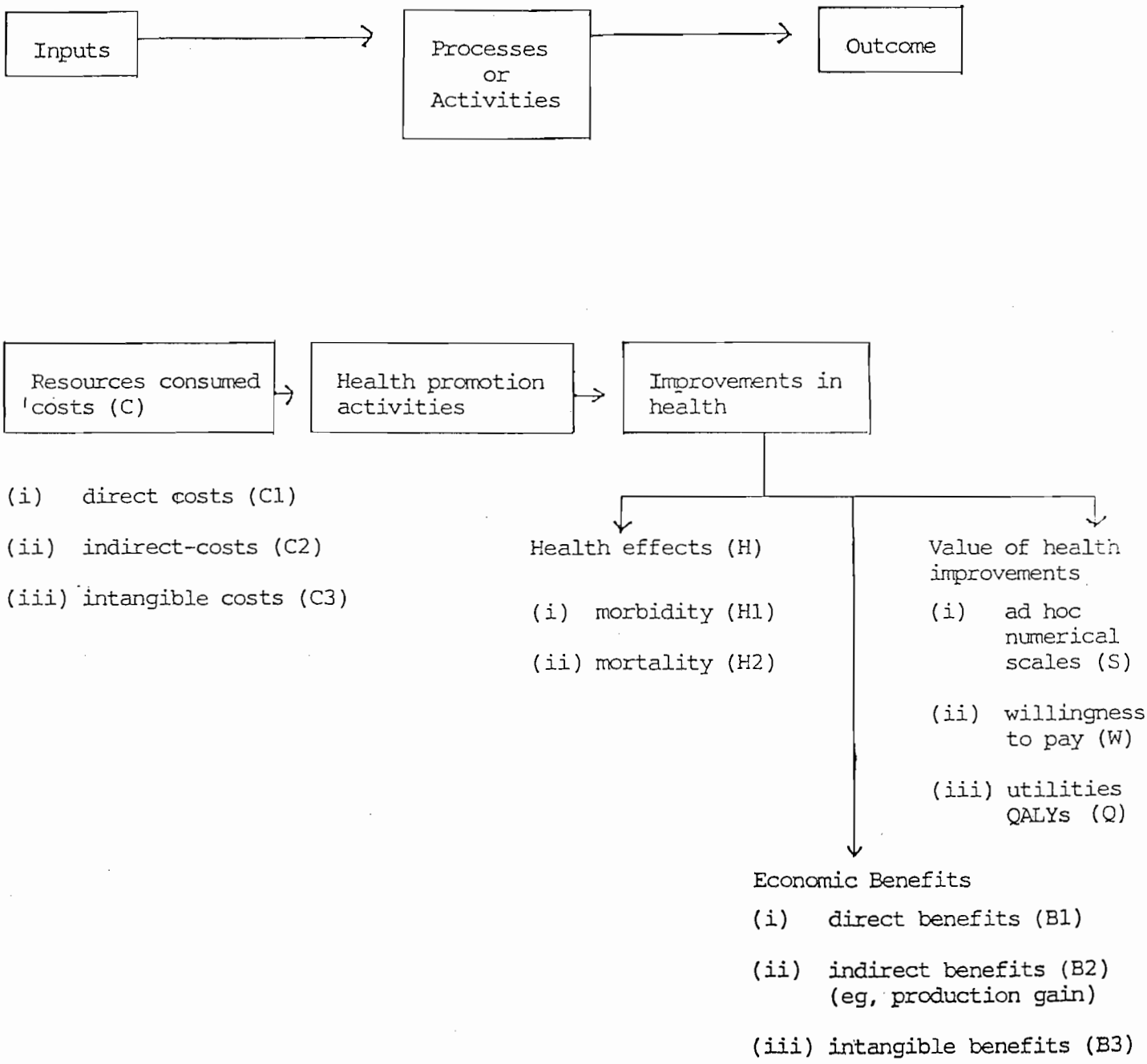
For both costs and outcomes, each part of the processes of identifying, measuring (in suitable units) and valuing is complex and must be done explicitly and with care. There are a variety of "cook-books" to facilitate such work (e.g. Drummond, Stoddart and Torrance (1987)).

(d) Other questions.

i) Were costs and outcomes adjusted for time preference? We prefer benefits today and costs tomorrow. Different health promotion programmes may have differing time profiles for both costs and outcomes. To ensure that pounds spent or saved in the future should not be counted equally to pounds spent and saved now, the estimates of these flows are discounted.

ii) Was marginal analysis performed? The data in Table 5.1 are taken from Neuhauser and Lewicki (1976) and refer to tests of blood in stools to identify cancer of the colon. With one test there are false negatives (i.e. cases missed). How many repeat tests should be performed to pick up these missed cases? From Table 5.1 it can be seen that the average cost rises moderately with additional tests, from $1175 for one

Figure 5.1 The Nature of Economic Evaluation



Source: Derived from Torrance, G. (1986), Measurement of Health State Utilities for economic appraisal, Journal of Health Economics, 5, 1, 1-30.

test to $2451 for the sixth test.

Neuhauser and Lewicki used these data to answer the (marginal) question i.e. how much does it cost to identify one additional unit of benefit, measured crudely here as an additional case of colon cancer? The data in Table 5.2 indicate that the marginal (additional) cost of identifying a marginal case rises rapidly to over $47 million (in 1968 prices) per additional case with the sixth test!

This classic example shows that marginal analysis -

Table 5.1

Test Results and Costs for One to Six Stool Guaiacs

No of guaiacs	No of cancers found	No of cancers missed (false negatives)	Total cost of diagnosis ($)	Average cost per cancer ($)
1	65.946	5.995	77511	1175
2	71.442	0.4996	107690	1507
3	71.900	0.0416	130199	1811
4	71.938	0.0035	148116	2059
5	71.941	0.0003	163141	2268
6	71.942	0.00003	176331	2451

Source: Neuhauser and Lewicki (1976), P 181

Table 5.2

Marginal Results and Costs for Subsequent Stool Guaiacs

No of guaiacs	Increase in number of cancers found	Increase in total costs ($)	Marginal cost per cancer found ($)
1	65.946	77511	1175
2	5.496	30179	5491
3	0.458	22509	49146
4	0.038	17917	471500
5	0.00372	15025	4038978
6	0.00028	13190	47107143

Source: Neuhauser and Lewicki (1976), P 181.

asking the question what is the additional (marginal) cost of acquiring an additional (marginal) benefit - can be very valuable in illuminating the nature of choices. Whilst there are additional benefits to be gained from additional action, the costs may be exhorbitant and it may be efficient to do nothing about some deviant health behaviours and treatable diseases.

iii) Was sensitive analysis performed? Because of uncertainty about the nature of future costs and outcomes and the imprecision of their measurement, it is essential to provide an array of possible results derived from plausible alternative values for the cost-outcome streams being evaluated.

(a) Costing. One approach, which is incomplete but common place, is to measure the costs of the options. A comprehensive costing would involve the measurement of direct costs (e.g. the cost in terms of professionals' time required for screening for high alcohol use in the workplace), indirect costs (e.g. the value of the time lost from production whilst the worker is screened) and intangible costs (e.g. the costs, arising from embarrassment, for instance, for workers identified as high alcohol users). Thus the cost of the programme is $C = C_1 + C_2 + C_3$ in terms of Figure 1.

(b) Cost-effectiveness analysis.

The costing approach informs decision makers about the cost of each option but gives no information about its benefits in terms of health improvements. The cost-effectiveness approach seeks to identify the net economic cost to society, C1 + C2 - B1 - B2, where B1 are the direct savings to society arising from the programme and B2 are the indirect savings to society arising, for instance, from increased work productivity. This cost estimate is then divided by a measure of the effects on health of the programme being evaluated. Thus an alcohol screening and intervention policy in the workplace could be evaluated in terms of cost (e.g. pounds) per life saved or pounds per life year saved.

This approach enables the evaluator to bring together both costs (input) and health benefit (outcome) data. Unfortunately the outcome measures used in cost-effectiveness analysis are not always in the same units and are thus non-comparable. Also they are incomplete measures of the effects of alternative health promotion programmes, e.g. measuring effect in terms of life years saved gives no information about the quality of survival as discussed in the earlier part of the paper.

(c) Cost utility analysis.

Attempts to resolve these problems have explored a variety of solutions (e.g. see Williams (1985) Torrance (1986) and Kaplan, Atkins and Wilson (1988)) and the preferred approach is cost utility analysis where the objective is to estimate the costs of producing a measure of the effect of the programme, the quality adjusted life year (QALY) or a well year (WY).

The Results of Economic Appraisal

The objective of economic evaluation of alternative health promotion policies using a cost utility approach would be to identify the policy which is efficient i.e. produces the maximum benefit (e.g. QALYs or well years) at the least possible cost. Some results of such cost utility analysis are set out in Table 6.3 and are taken from the work of Alan Williams and the Department of Health. It can be seen from

these results that GP advice to stop smoking, GP control of hypertension and GP control of total serum cholesterol are better than the cost-QALY outcome of breast cancer screening as set out in the Forest Report (DHSS (1987)).

If the objective is to maximise benefits (QALYs) from a given budget of £1 million and there are constant returns to scale, the four promotion - prevention policies in Table 5.3 would be ranked as follows

GP advice to stop smoking	5988 QALYs
GP control of hypertension	588 QALYs
GP control of cholesterol	588 QALYs
Breast cancer screening	302 QALYs

and it would be efficient to spend the budget on GP advice to stop smoking. This would leave people with treatable conditions which would be left untreated because of their lower rate of return (in terms of QALYs).

If there were not constant returns to scale (which is likely the larger the budget) then rankings could change. For example with current rates of smoking GPs advice to stop smoking is an effective means of helping people to quit, but the success rate may fall as the number of smokers in society declines. This would imply the cost per QALY would begin to rise and returns to scale would therefore no longer be constant.

Table 5.3

UK Data on Costs and QALYs

Intervention	Cost per QALY (£)
GP advice to stop smoking	167
Pacemaker implementation for atrioventricular heart block	700
Hip replacement	750
Valve replacement for aortic stenosis	900
CABG for severe angina with LMD	1040
CABG for severe angina with 3VD	1270
CABG for moderate angina with LMD	1330
GP control of hypertension	1700
GP control of total serum cholesterol	1700
CABG for severe angina with 2VD	2280
CABG for moderate angina with 3VD	2400
CABG for mild angina with LMD	2520
Kidney transplant	3200
Breast cancer screening	3309
Heart transplant	5000
Hospital haemodialysis	14000

Source: Williams (1985, 1986), Department of Health and Social Security (1987).

Some similar data from the USA are presented in Table 5.4. These data give the cost of producing a well year (QALY) for different types of intervention. These data show that some surgical procedures (e.g. coronary artery by-pass grafts (CABG)) are expensive ways of producing improved health (WYs). Vaccination, screening and a behavioural (diet) intervention for non-insulin dependent patients with diabetes mellitus (NIDDM) give "good value for money".

The Limits and Benefits of Economic Evaluation

The economic approach to the evaluation of alternative health promotion policies provides a logical and explicit framework (Figure 5.1) in which to assess the costs and effects of these competing policies. The limits of this approach are obvious. The cost data in many studies tend to be incomplete. This defect can be detected if the user of the results carefully appraises them and provide an incentive for all to strive to identify better data. The benefit data in many studies are poor and experimental (QALYs) (e.g. or crude and incomplete life years saved). However such data do provide a stimulus for improvement : if these data are criticised as unacceptable, the critic is obliged to produce superior alternatives if choices are to be informed by explicit "best-guesses" rather than rhetoric and shroud waving.

A powerful argument in favour of the economic approach to evaluating policy options in health promotion is that without

Table 5.4

The Cost Utility of Competing Interventions

	Cost ($ US 1987) per well year
Pneumococial vaccine, older adults	1,500
Phenlketonuria screening	7,000
Screening for severe hypertension (diastolic blood pressure above 105)	9,200
Behavioural intervention in NIDDM	10,870
Screening for mild hypertension (diastolic blood pressure 95-105)	18,600
Oestrogen replacement in post menopausal women	23,500
Rehabilitation in chronic obstructive pulmonary disease	24,600
CABG, two vessel disease	32,700
Pneumococial vaccine, young children	114,900
CABG, single vessel disease	516,500

Source: Kaplan, Atkins and Wilson (1988), Table 5, p.337.

the data from such studies it will be impossible to prioritise alternative policies and it will be difficult to convince funding agencies that prevention is better than cure. It is essential to recognise that curative policies are poorly evaluated from an economic perspective; indeed most activities in hospitals are unproven from the efficiency point of view. Providing cost-utility data for health promotion policies is thus even more likely to be powerful in affecting resource allocation. The processes of resource allocation in health promotion and health care will be determined increasingly in an economic framework and a failure to use this approach by resorting to rhetoric and lobbying is likely to lead to the inefficient use of society's scarce resources.

Conclusions

The economic framework for prioritising competing health promotion policies which are outlined in this paper involve the consideration of both the outcomes and the costs of options. The nature of the information needed to set initial priorities and to undertake good economic evaluations of future health promotion activities has been outlined. Setting health priorities is a continuing process. The patterns of the overall burden of illness and lifestyle changes help to inform policy choice. Results from evaluations of specific health education programmes assist in the process of improving the efficiency of future programmes.

In this paper, the nature of the economic approach to health promotion (agreeing targets (ends), identifying policies (means), and evaluating the cost effectiveness of alternative policies) has been described and some preliminary results have been presented. There are a number of ways in which these approaches could be amplified and tested more rigorously. In describing the burden of disease, it would be useful to examine a fuller range of diseases and different groupings of health problems. The sensitivity of the results to the age cut-off point could be explored. The analysis could be extended by compiling data on morbidity and the quality of life associated with different diseases to supplement the analysis based on mortality figures.

A replication of the detailed analysis of the Amler and Dull (1987) study would be necessary to obtain a more accurate picture of the amount of avoidable mortality in England and Wales. This would involve a review of the most recent epidemiological research, and the means of determining risk factor estimates and testing results with a range of estimates form part of this process. One factor in need of further study that has emerged is the role of interactions between different risk factors. Also care must be taken to avoid double counting of disease groups or risk factors.

Although there is information about the pattern of some aspects of life style behaviour, there has been research on factors, including health information, which may influence them. The estimates from well specified and tested

theoretical models could provide a useful input into the process of assessing the potential of educational programmes to change behaviour, the patterns of disease resulting from such changes and the design of specific policy targets.

Gaps in information cannot be closed in the short term and the indices, such as QALYs, used to evaluate the benefits of health promotion activities produce tentative but explicit guestimates of outcome values.

Results need to be carefully appraised in the light of these difficulties, but the economic framework allows an explicit examination of the assumptions being made and challenge all professionals to contribute to the processes of agreeing policy instruments and evaluating the costs and benefits of competing means of improving the population's health by using efficient health promotion policies.

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