

Measuring premature and avoidable mortality:

ONS proposals for national indicators

Executive Summary:

(a) Background

The need to tackle the leading causes of early death was recognised in the Government White Paper, *Saving Lives: Our Healthier Nation*,¹ where the Prime Minister noted that “Too many people die too young from illnesses which are preventable.” To help assess the extent of this problem ONS is currently working on producing indicators of both premature and avoidable mortality. However, the questions of which illnesses may be considered preventable, and at what age a death may be regarded as too young, are not straightforward.

Although much work has been done internationally in recent decades to measure levels of avoidable or premature mortality within populations, there has been a lack of consensus on how these deaths should be defined. Definitions may always be subjective and open to criticism. The lack of consensus between researchers partly reflects the different purposes measurements of early death have been used for, for example examining the economic impact on societies, or attempting to identify deficiencies in health care provision. It also reflects the fact that advances in medical treatment and social changes mean that definitions of what is regarded as “avoidable” or “premature” may differ between societies and will certainly change over time.

(b) Objectives

ONS has examined recent research into both premature and avoidable mortality to inform the definition of indicators for use in National Statistics in England and Wales. It is the intention of ONS to develop national indicators that can, in the longer term, be applied at different geographic levels (e.g. for regions or local authorities). ONS plans to develop separate indicators of (i) avoidable and (ii) premature mortality, and is considering whether to develop an indicator of (iii) smoking-related mortality.

(c) Consultation

To inform the development of these new indicators we would like to invite contributions on their definition and use in monitoring public health. **Responses to the following questions would also be welcomed:**

1. (a) What age ranges should be used to measure premature mortality?
(b) Should males and females (given their different life expectancies) be measured against different age ranges?
2. (a) Which causes of death should be considered ‘avoidable’?
(b) At which ages?

3. What causes of death not previously considered as amenable to medical intervention could now be included in this category?
4. Are there some causes where only a proportion of deaths may be considered avoidable?
5. Should deaths from injury and poisoning be considered avoidable causes of death?
6. Should other causes of deaths which are open to primary prevention (e.g. lung cancer) be reported on?
7. What criteria should be used to assess which causes of death are included in the definition of avoidable mortality?
8. What statistical measures should be used to report indicators of premature and avoidable mortality?
9. How will these indicators address user needs, such as assessing the effectiveness of interventions?
10. What should the indicators be called?

Responses can be sent by e-mail, fax or post.

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Responses should be returned by: **Friday February 17th 2006**

The following six consultation criteria are reproduced from The Cabinet Office Code of Practice on Consultation.²

This consultation should abide by these criteria and respondents are invited to comment on the extent to which the criteria have been adhered to, and to suggest ways of further improving the consultation process.

Comments or complaints about the consultation process should be sent to:

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The consultation criteria

1. Consult widely throughout the process, allowing a minimum of 12 weeks for written consultation at least once during the development of the policy.
2. Be clear about what your proposals are, who may be affected, what questions are being asked and the timescale for responses.
3. Ensure that your consultation is clear, concise and widely accessible.
4. Give feedback regarding the responses received and how the consultation process influenced the policy.
5. Monitor your department's effectiveness at consultation, including through the use of a designated consultation co-ordinator.
6. Ensure your consultation follows better regulation best practice, including carrying out a Regulatory Impact Assessment if appropriate.

Responses will be used by Health & Care Division at ONS to inform work on developing indicators of premature and avoidable mortality.

Responses, including the names and addresses of respondents, may be made public unless confidentiality is specifically requested. In accordance with freedom of information legislation, individual responses will be made available to anyone who asks for them, unless one of the exceptions in the legislation applies, for example the information was provided in confidence, or its disclosure would prejudice third parties.

1. Introduction

1.1 ONS is currently working on producing indicators for both premature and avoidable mortality. However, the questions of which illnesses may be considered preventable, and at what age a death may be regarded as too young, are not straightforward. At a national level there is scope to develop several indicators of avoidable and premature mortality. These could include definitions based on:

(a) Conditions amenable to medical intervention

Studies of avoidable mortality have generally been based on the underlying assumption that for some diseases, such as female breast cancer, there is the potential for health care services to prevent almost all deaths, at least within certain age groups.

(b) Causes open to primary intervention

Some studies have used wider definitions of avoidable mortality which have included what have been termed causes open to “primary” intervention. Causes such as smoking and alcohol-related deaths, suicides and road traffic deaths, for example, may be considered preventable through public health policies, wider social interventions, or a combination of these.

(c) Premature mortality

Research into premature mortality has centred on quantifying mortality within definitions based on age at death. Studies of premature mortality have tended to measure the Potential Years of Life Lost (PYLL) from ‘early’ deaths. Many different age ranges have been used to measure PYLL, and there are various possible ages at which deaths are no longer considered ‘premature’. Some measures use arbitrary cut off points (age 65, 70, 75, etc) while others link the idea of prematurity with life expectancy.

2. Avoidable mortality

Measuring the quality of medical care – The Rutstein tables

2.1 Interest in the causes of avoidable deaths, and how this information can be used to identify potential deficiencies in health care provision, has principally been based on work conducted by Rutstein *et al*, published in the United States in 1976.³

2.2 Rutstein *et al* identified and published tables of avoidable causes in order to be able to measure outcomes of medical care. A later paper noted that the conditions listed would require constant surveillance because of developments in medical knowledge and practice, and social and environmental changes. The lists would therefore require periodic revision.⁴ Conditions in the three Rutstein tables were selected by a Working Group on Preventable and Manageable Diseases, with the assistance of specialists in many fields.

(a) Table A contained conditions where a single death or incidence of disease could justify the question, why did this occurrence happen? An indication was also made as to whether a condition was “preventable” or “treatable”. Thus measles was regarded as preventable, while cancer of the cervix was indicated as treatable. Some conditions, including those related to nutrient deficiencies and some infectious diseases were indicated as being both preventable and treatable.

(b) Table B listed conditions when prevention or management could be highly effective but where a single occurrence would not justify asking why the event had occurred. These were conditions in which increases in rates of untimely death could serve as an index of the quality of care. This list included conditions such as cancer of the large intestine and hypertensive disease.

(c) Table C identified conditions which could seriously affect health but for which prevention, diagnosis or treatment were not then defined well enough, or for which outcomes could not be predicted precisely enough to include them in an index of the quality of care. These conditions included alcohol-related diseases, drug dependence, suicide and homicide.

Use of the Rutstein tables in England and Wales

2.3 In the mid-1980s Charlton *et al* published a sequence of papers on avoidable mortality using a definition based on the Rutstein tables.^{5, 6, 7, 8} In the first of these papers⁵ conditions were selected from both Rutstein’s Tables A and B. The 14 chosen causes were those considered amenable to medical intervention, i.e. conditions Rutstein had indicated as treatable rather than preventable. These are listed in Table 1 with their codes from the Eighth Revision of the International Classification of Diseases (ICD-8). Causes were also only selected when there were sufficient numbers of deaths (more than 200 over 5 years) to allow analysis of variation in mortality among health authorities in England and Wales. Charlton *et al* further refined Rutstein’s initial list by setting age limits for each cause of death.

2.4 This list of conditions amenable to medical intervention was first used to examine variation between the then 98 health authorities in England and Wales. The results demonstrated that considerable variation in Standardised Mortality Ratios (SMRs) for these causes existed, even after social factors had been adjusted for.

2.5 If indicators of avoidable mortality were intended to provide warning signals of possible shortcomings in health care delivery then decisions would need to be taken as to what further investigation, if any, would be needed. This was considered in a second report by Charlton *et al* which suggested how health planners could use mortality indicators based on conditions considered amenable to medical intervention.⁶

Table 1 – Conditions amenable to medical intervention

Charlton *et al.* Geographical variation in mortality from conditions amenable to medical intervention in England and Wales. *Lancet* 1983; i: 691-696

Cause of death	ICD-8 code	Age group
Hypertensive disease	401-404	5-64
Cancer of cervix uteri	180	5-64
Pneumonia and bronchitis	480-486, 490	5-49
Tuberculosis (exc. silico)	010-019	5-64
Asthma	493	5-49
Chronic rheumatic heart disease	393-398	5-44
Acute respiratory disease	400-466, 470-474	5-49
Bacterial infections	004, 034, 320, 381-383, 390-392, 680-686, 710, 720	5-64
Hodgkin's disease	201	5-34
Abdominal hernias	550-553	5-64
Acute and chronic cholecystitis	574-575	5-64
Appendicitis	540-543	5-64
Maternal deaths	630-678	10-44
Deficiency anaemias	280-281	5-64

2.6 The same causes (with the exception of maternal deaths) were selected to reflect different aspects of medical intervention, including primary care, GP referrals to hospital, and hospital care. These conditions are listed in Appendix A, together with the factors that were identified as influencing mortality.

2.7 Charlton *et al* observed that mortality would be subject to influences such as variations in:

- i Severity of the disease in patients seeking treatment.
- ii Uptake of services (which will also vary with social characteristics).
- iii Availability of services, and appropriateness of their use.
- iv Quality of the medical care provided.

Current use of measures of avoidable mortality in England

2.8 The Compendium of Clinical and Health Indicators,⁹ published annually by the Department of Health, presents data for “mortality from potentially avoidable causes”. Numbers of deaths and SMRs, defined using a list based on Charlton’s selection of causes (but with the addition of breast cancer) are produced, and results are presented for health and administrative areas of England, including local authorities and Primary Care Organisations.

2.9 Data for the 2003 Compendium were presented for 2001-2003. Using its definition the Compendium identified 24,576 potentially avoidable deaths in England between 2001 and 2003, 1.6% of the total 1,502,797 deaths in this period. A list of the conditions used in the Compendium in both the Ninth and Tenth Revisions of the International Classification of Diseases (ICD-9 & ICD-10) is included in Appendix B.

International application of the Rutstein tables

2.10 A review of European studies of avoidable mortality¹⁰ by Mackenbach *et al* noted that although all papers they considered used a definition of avoidable causes based on Rutstein's tables, the conditions selected and methods of analysis used differed considerably from study to study. Mackenbach suggested this related to an informal process of selection of causes of death and recommended that in future studies the selection process should be more fully documented.

2.11 It was noted that where health care variables (such as indicators of supply or use) had been included in studies, the associations with avoidable mortality rates were frequently weak and inconsistent and there was insufficient evidence that variation in these rates reflected variation in effectiveness of health care provision. Mackenbach *et al* recommended that the use of aggregate data for avoidable causes could be used most effectively as a means to identify problem areas which would then merit further investigation.

Widening definitions of avoidable mortality

2.12 Some studies of avoidable mortality have used Rutstein's conditions as a base to which other diseases have been added. For example Treurniet *et al* added testicular cancer¹¹ while the Compendium of Clinical and Health Indicators was based on the causes selected by Charlton but with the addition of breast cancer.⁹ Other studies have selected other causes from Rutstein's original list that had not been chosen by Charlton.

2.13 Both breast and testicular cancer were included in the definition of avoidable mortality used by a European Community Working Group in its second volume of an atlas of avoidable mortality in the EC.¹² The atlas was described in its preface as representing, "an important step towards establishing outcome indicators to monitor health service performance, that are applicable nationally and internationally." The list of causes, together with interventions and health care providers for each, is included in Appendix C.

International comparisons – a recent study

2.14 A recent study of avoidable mortality has implemented earlier calls for a new evaluation of the conditions considered amenable to medical intervention. In November 2003 Nolte and McKee published a paper which examined avoidable mortality in 19 western countries.¹³ The selection of causes considered amenable to health care was derived from their recently released review of avoidable mortality, which includes a discussion of the reasoning behind their selection of conditions.¹⁴

2.15 The final list of conditions used by Nolte and McKee (see Appendix D) took account of earlier work by Tobias and Jackson,¹⁵ who had themselves updated earlier work by Mackenbach¹⁶ and Charlton *et al.*⁵ However, where Charlton *et al* had used an upper age limit of 64, Nolte and McKee considered deaths up to age 74 for most causes. Though recognising this upper age limit as arbitrary, it was justified as being generally consistent with life expectancy at birth, although the same age was used for both sexes.

2.16 The majority of the causes included by Nolte and McKee were listed in Rutstein's Tables A and B. However, a number of additional causes were added, including malignant neoplasms of the breast and testis, nephritis and nephrosis and benign prostatic hyperplasia. Some causes were also included which Rutstein had originally indicated as being "preventable" rather than "treatable".

Medical advances and attribution of proportions of causes - Ischaemic heart disease (IHD) as a case study

2.17 Nolte and McKee included IHD in their list of conditions. However, they treated this differently to other causes in their analysis, as they noted that "... the precise contribution of health care to reductions in deaths from this condition remains unresolved." Mortality rates were therefore calculated twice, once with ischaemic heart disease excluded from the list of conditions. In the second set of calculations 50 per cent of premature mortality from IHD was considered amenable to health care.

2.18 The decision by Nolte and McKee to consider 50 per cent of ischaemic heart disease (IHD) mortality as amenable to health care was based on a number of research studies considering the impact of new treatments on deaths from this cause. A report on a WHO project to monitor trends in cardiovascular disease noted that there has been a revolution in coronary care which began in the mid-1980s.¹⁷ This report observed that there had been a dramatic decline in deaths from IHD and coronary events but was not able to specify how much of this decrease could be directly attributed to coronary care treatments.

2.19 Capewell *et al* studied the decline in coronary heart disease deaths in Scotland¹⁸ and New Zealand¹⁹ and attempted to quantify the contribution of cardiovascular treatment and risk factor changes to this fall. They estimated that in Scotland in 1994 about 6,750 deaths from IHD were prevented or postponed by treatment or risk factor reductions (the total number of IHD deaths in that year was 15,234). Forty per cent of the reduction in deaths was attributed to treatments and just over 50 per cent to reductions in risk factors, primarily smoking. The findings for New Zealand were broadly similar to those in Scotland.

3. Preventable mortality

Beyond medical intervention – public health issues

3.1 Many studies of avoidable mortality have included only causes of death which have been regarded as amenable to medical intervention. Causes such as lung cancer, one of the cancers least amenable to medical treatment, have therefore often been excluded. The Rutstein lists did however identify certain causes of death as

being preventable rather than treatable, including some smoking-related diseases such as lung cancer and emphysema.

3.2 The studies by Capewell *et al*,^{18,19} indicating that declines in ischaemic heart disease mortality were only partly due to cardiovascular treatments, also identified changes in risk behaviours, particularly smoking, as being responsible for around half the fall in death rates. On this basis it may be appropriate to consider the inclusion in an indicator of early deaths, those causes which - although not amenable to health care - may be considered preventable through other primary interventions.

3.3 The first volume of the European Community Atlas of “Avoidable Deaths” for example was based on 14 causes which were regarded as being amenable to medical care.²⁰ It also included a further three causes of death (lung cancer, motor vehicle traffic accidents and chronic liver disease and cirrhosis) as indicators of national health policy for primary prevention.

Tobias and Jackson – avoidable mortality in New Zealand

3.4 The choice of conditions made by Nolte and McKee¹³ was partly based on work by Tobias and Jackson which considered avoidable mortality in New Zealand, 1981-1997.¹⁵ Tobias and Jackson made a departure from the work of many other researchers by considering not only those conditions that were ‘treatable’, but “also those responsive to individual and population-base preventive interventions.” Their list of avoidable causes therefore included (amongst others) smoking and alcohol-related diseases, road traffic and other accidents, suicides and AIDS deaths.

3.5 Tobias and Jackson subcategorised causes of death according to the level of intervention needed for mortality to be avoided. “Primary avoidable mortality” included causes preventable through individual behaviour modification or public health policies. “Secondary avoidable mortality” included conditions that were responsive to early detection and intervention through primary care, such as cancers preventable through screening programmes. “Tertiary avoidable mortality” included conditions where mortality rates could be reduced through medical or surgical intervention.

3.6 Using their definition Tobias and Jackson estimated that in 1996-1997 almost 70% of deaths of those aged under 75 in New Zealand could be considered potentially avoidable.

Smoking-related deaths

3.7 ONS is considering developing a separate indicator of smoking-related mortality. Deaths from smoking cannot be directly estimated, as smoking status is not included on the death certificate. Even if it were, some smokers may die of a disease that smoking can cause but for reasons unrelated to their use of tobacco. However, the proportion of deaths caused by smoking can be estimated.

3.8 The most recent estimate of smoking-attributable mortality in England is found in a report by Twigg *et al* published by the Health Development Agency (HDA).²¹ The HDA report estimated that, over the period 1998-2002, 86,500 deaths in England each year (an average of over 1,600 deaths per week) were attributable to smoking. Diseases related to smoking were identified, using both ICD-9 and ICD-10, and the proportion of each cause of death attributable to smoking then estimated by calculating the relative risks of death derived from comparing mortality rates between those who had never smoked with current and former smokers. The ICD codes of the selected causes and the proportions considered to be smoking-related are included in Appendix E.

4. Reporting Avoidable/Preventable Deaths

4.1 Several options exist for measuring deaths defined as avoidable or preventable. Directly-age standardised mortality rates could be used which would allow comparisons both over time and between geographic areas. Their calculation and interpretation could however be complicated if causes are included where deaths are considered avoidable at different ages. Other measures could include reporting proportions of deaths which are avoidable or calculating Person Years of Life Lost. The latter is discussed in more detail in the following section.

4.2 A further option could be based on the concept of the potential for prevention of deaths based on the areas with the lowest death rates. This was a method employed by William Farr in the 1860s. By taking the healthiest areas as a standard to which other areas should be able to rise, Farr calculated childhood mortality in 151 unhealthy districts and concluded that 65,000 annual childhood deaths occurred unnecessarily in these areas.²² More recently the Cancer Atlas of the United Kingdom and Ireland produced by ONS estimated that 8,360 deaths from cancer in the UK were potentially preventable each year.²³ This figure was based on the assumption that the death rate in every health authority could be reduced to the same level as the area with the lowest rate.

4.3 When reporting on these deaths ONS also wishes to consider how the measures should be described. The names chosen will in part reflect what is eventually being measured. Further consideration may be needed however for terms which could imply that individual deaths were, for example, avoidable through proper medical intervention.

5. Premature mortality

5.1 As with measures of avoidable mortality, indicators of premature deaths have been used increasingly in recent years in research studies and have also been routinely reported in England and Wales.²⁴ Although sharing some characteristics with avoidable mortality indicators, including a concern with deaths at younger ages, measures of prematurity have often been used for quite distinct purposes, and have different advantages and limitations. Indicators of avoidable deaths have only infrequently been used to measure socio-economic differences,²⁵ whereas measures based on prematurity are used more frequently to measure the social and economic consequences of early deaths.²⁶

Potential years of life lost (PYLL)

5.2 The great majority of studies of premature deaths have been based on the calculation of potential years of life lost (PYLL) in which deaths at younger ages are weighted more heavily than deaths at older ages. The use of PYLL has often been justified on the grounds that it is an appropriate measure to use to examine the impact of deaths at younger ages and can be used to illustrate the scale of early deaths in a population. Unlike indicators of avoidable mortality, where widely accepted measures such as directly age-standardised rates or SMRs have frequently been used, the use of PYLL to measure prematurity has been controversial, and limitations have been reported.

5.3 Romeder and McWhinnie in 1977 noted that the concept of PYLL originated with the principal objective of comparing the relative importance of different causes of death.²⁷ They developed a model of PYLL based on the calculation of years of life lost between the ages of 1 and 70. Although their paper considers other cut-off points they justify the selection of 1 and 70 by arguing that an arbitrary cut-off point, rather than one based on life expectancy, has the advantage of simplicity and would therefore be more likely to be understood and used.

5.4 Romeder and McWhinnie described their method for calculating PYLL as being designed to give a broad view of the relative importance of major causes of premature mortality. They noted that the PYLL indicator could be useful to those wishing to define priorities and programmes for the prevention of premature death and in evaluating priorities for health research activities.

Current use of PYLL indicators in England and Wales

5.5 ONS publishes a table of years of life lost in England and Wales in its annual DH1 series.²⁴ Numbers and rates are presented for working life (15-64) and total life (to age 85). The Compendium of Clinical and Health Indicators also publishes measures of PYLL for some causes of death, using the Romeder and McWhinnie methodology, excluding infant deaths but measuring mortality before age 75.⁹

Limitations of PYLL

5.6 In 1990 Gardner and Sanborn published a paper which asked what PYLL actually measured.²⁸ They conducted a literature review of studies which used PYLL as an indicator, and found many variations on the age ranges used to assess PYLL. The upper age cut-off point differed from study to study, with authors using upper limits including life expectancy at birth, life expectancy at age of death, the age at which 90% of people died (derived from life tables), as well as arbitrary ages, including Romeder and McWhinnie's age 70. Some other studies had used years of life lost during the working age period using ages 15 to 65, or variants of these.

5.7 There was also variation in the inclusion or exclusion of infant deaths. These were excluded by Romeder and McWhinnie because their causes of death tend to be specific to this period of life and because each infant death would contribute almost 70 years of potential years of life lost. This was considered an overestimation of

the weight that should be attached to these deaths. Others have argued, however, that is illogical to exclude infant mortality from a measure of premature deaths.³⁰

5.8 Using various methods of calculating PYLL identified in their literature review, Gardner and Sanborn calculated premature mortality for 12 causes of death in the United States in 1986. They demonstrated how rankings of the contribution of these causes would be dependent on the measure of calculation chosen. Similarly, Romeder and McWhinnie had also demonstrated that the leading causes of premature death would change depending on which arbitrary upper cut-off age was used. Gardner and Sanborn asked of PYLL “If one can manipulate the leading causes of premature death so easily by changing the method of PYLL calculation, then of what use is it in helping to set health priorities?”

5.9 While recognising these potential limitations ONS is considering the use of PYLL to measure premature mortality based on all causes of death. Its application to measure cause-specific avoidable deaths also remains an option. Alternative indicators of prematurity could also be developed, including ones based on life tables. These could, for example, be used to calculate the probability of dying before age 75 within a population. Estimates could then be reported of the percentage of people expected to die before this age (if they were to experience current death rates until their 75th birthday).

6. Determining the definitions

6.1 Before reaching conclusions on the constitution of new indicators ONS plans to report on mortality trends in England and Wales using a selection of existing definitions of avoidable and premature deaths. This work, and the results of this consultation process, will inform the development of new national indicators. These will then be assessed for application sub-nationally.

6.2 It is likely that indicators based on cause of death will be initially defined using ICD-10, with equivalent codes established in ICD-9. Data for 1999, which were coded using both revisions, will allow comparability to be tested. An assessment will be made of whether adjustments need to be made between ICD revisions, or at points when other coding changes were implemented.

7. Consultation questions

7.1 Views on the development of new indicators are invited. Key issues in their definition are listed below:

(a) Avoidable mortality:

The development of a definition for a new indicator of avoidable mortality may include:

1. Reconsideration of those causes amenable to medical intervention.

2. The possibility of also including causes of death which may be considered avoidable through public health policies or social interventions, including deaths from injury and poisoning.
3. Option of reporting on these latter 'preventable' deaths separately.
4. Appraisal of the criteria used to assess which causes should be included, and evaluation of the criteria employed.
5. Examination of age ranges where deaths might be considered avoidable for males and females.
6. Assessment of how an indicator of avoidable mortality should be reported, e.g. by a widely used measure such as directly age-standardised rates, or through development of an alternative such as a ratio of "avoidable" to "non-avoidable" deaths within a population or the number of deaths which could potentially be prevented.
7. The terminology which should be used to refer to new indicators.

(b) Premature mortality:

The development of a definition of a new indicator of premature mortality may include:

1. Reconsideration of age ranges where deaths might be considered premature for males and females.
2. Assessment of how an indicator of premature mortality should be reported, e.g. by a widely used measure such as Potential Years of Life Lost or through development of an alternative such as a life table based measure.

c) Smoking-related mortality

The development of an indicator for smoking-related deaths requires:

1. Assessment of the causes, or proportions of causes, of death that should be included. (Starting from an examination of the definition used in the recent publication by the HDA.²⁰⁾
2. Evaluation of the need to adjust for the introduction of ICD-10.

References:

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Measuring avoidable/premature mortality - Appendix A

Suggested mortality causes for use as outcome indicators

Charlton JRH, Bauer R, Lakhani A. Outcome measures for district and regional health care planning.

Community Medicine, 1984; **6**: 306-315

Disease group	ICD-9	Age	Health care providers*	Intervention	Factors potentially influencing mortality
					Other
Hypertension	401-405	5-64	<i>Primary care</i> , hospital	Case detection, anti-hypertensive medication	Coding error - ischaemic heart disease, stroke, lack of screening, social factors - compliance for treatment, nutrition (salt), weight
Cancer of cervix uteri	180	5-64	Primary care, hospital, <i>community health services</i> , pathology services	Screening, surgery, radiation therapy	Social class, sexual habits
Pneumonia and bronchitis	480-486, 490	5-49	<i>Primary care</i> , hospital	Antibiotics, early detection of complications	Social class, occupation, urban pollution, coding error - acute respiratory diseases
Tuberculosis	010-018	5-64	Public health programme <i>Primary care</i> , hospital	Immunization, contacts tracing, antibiotics	Social class, ethnic groups
Asthma	493	5-49	<i>Primary care</i> , hospital	Therapy, casualty department care	Social class, coding error - obstructive airways disease, allergies
Chronic rheumatic heart disease	393-398	5-49	Primary care, <i>hospital</i>	Case detection of streptococci, antibiotics, prophylaxis	Social class
Acute respiratory disease	400-466, 470-474	5-49	<i>Primary care</i> , hospital	Early detection of complications, antibiotics	Coding errors - pneumonia, bronchitis, cor pulmonale, occupation, social class, urban pollution
Bacterial infections	**	5-64	<i>Primary care</i> , hospital, public health programmes	Early detection of complications, antibiotics	Social class, urban areas, poor notification
Hodgkin's disease	201	5-34	Primary care, <i>hospital pathology services</i>	Case detection, chemotherapy and radiation therapy	Social class
Abdominal hernias	550-553	5-64	Primary care, <i>hospital</i>	Case detection, surgery prior to complications	Coding error - acute abdominal pain with no positive diagnosis
Acute and chronic cholecystitis	574-575.1	5-64	Primary care, <i>hospital</i>	Case detection, surgery prior to complications	Coding error - acute abdominal pain with no positive diagnosis
Appendicitis	540-543	5-64	Primary care, <i>hospital</i>	Case detection, surgery prior to complications	Coding error - acute abdominal pain with no positive diagnosis
Deficiency anaemias	280-281	5-64	Primary care, hospital pathology services	Case detection, laboratory services	Social class, ethnic groups

*Most important provider italicized

**004, 037, 320-322, 382-384, 390-392, 680-686, 711, 730

Measuring avoidable/premature mortality - Appendix B

Mortality from potentially avoidable causes

Department of Health. Compendium of Clinical and Health Indicators, 2002. London, 2003.

International Classification of Diseases, Ninth Revision

Hypertensive and cerebrovascular disease (ICD 401-405, 430-438), ages 35-64

Malignant neoplasm of cervix uteri (ICD 180), ages 15-64

Asthma (ICD 493), ages 5-44

Tuberculosis (ICD 010-018), ages 5-64

Chronic rheumatic heart disease (ICD 393-398), ages 5-44

Combined score for appendicitis, abdominal hernia, cholelithiasis and cholecystitis (ICD 540-543, 550-553, 574, 575.0, 575.1), ages 5-64

Hodgkin's disease (ICD 201), ages 5-64

Malignant neoplasm of female breast (ICD 174), ages 50-64

International Classification of Diseases, Tenth Revision

Hypertensive & cerebrovascular disease (I10 to I15, I60 to I69) Ages 35-64

Malignant neoplasm of the cervix uteri (C53) ages 15-64

Asthma (J45 to J46) ages 5-44

Tuberculosis (A15 to A19) ages 5-64

Chronic rheumatic heart disease (I05 to I09) ages 5-44

Combined appendicitis, abdominal hernia, cholelithiasis and cholecystitis (K35 to K38, K40 to K46, K86, K81) ages 5-64

Hodgkins disease (C81) ages 5-64

Malignant neoplasm of female breast (C50) ages 50-64

Measuring avoidable/premature mortality - Appendix C

European Community Atlas of 'Avoidable' Deaths - Volume Two

Holland WW (ed.). European Community Atlas of 'Avoidable Death': Volume Two.

Commission of the European Communities Health Services Research Series No 9. Oxford, 1993.

Selection of diseases

Disease	Age group	ICD-9 code	Interventions	Health care providers	Other potential contributory factors to excess mortality
Intestinal infections	0-14	001-009	Case detection Contact tracing Treatment of complications	Public health programmes* Primary health care Hospital	Incidence Social class Sewage/water supply Food safety Travel Housing/overcrowding
Cancer of the breast	25-64	174	Case finding Screening Surgery Radiotherapy Chemotherapy	Public health programmes: screening in ages 50-64* Primary health care Hospital	Incidence Risk factors: obesity, family history
Cancer of the skin	25-64	173	Primary prevention Case finding Surgery Radiotherapy	Public health programme Primary health care Hospital*	None
Cancer of the testis	0-64	186	Case finding Surgery Chemotherapy Radiotherapy	Public health programme Primary health care Hospital*	None
Leukaemias	0-44	204-208	Chemotherapy Radiotherapy Bone marrow transplant	Hospital*	Incidence
Ischaemic heart disease	35-64	410-414, 429.2	Primary prevention	Primary health care* Hospital Health education	Coding error Social factors
Peptic ulcers	25-64	531-534	Anti-ulcer drugs Surgery for complications	Primary health care Hospital*	Alcohol Smoking
Congenital cardiovascular anomalies	1-14	745-747	Drugs Surgery	Hospital*	None

*Most important provider

Measuring avoidable/premature mortality - Appendix D

Causes of death considered amenable to health care

Nolte E and McKee M. Measuring the health of nations: analysis of mortality amenable to health care. BMJ, 2003, 327: 1129

Cause of death	Age	ICD-9	ICD-10
Intestinal infections	0-14	001-009	A00-A009
Tuberculosis	0-74	010-018, 137	A15-A19, B90
Other infections (diphtheria, tetanus, poliomyelitis)	0-74	032, 037, 045	A36, A35, A80
Whooping cough	0-14	033	A37
Septicaemia	0-74	038	A40-A41
Measles	1-14	055	B05
Malignant neoplasm of colon and rectum	0-74	153-154	C18-C21
Malignant neoplasm of skin	0-74	173	C44
Malignant neoplasm of breast	0-74	174	C50
Malignant neoplasm of cervix uteri	0-74	180	C53
Malignant neoplasm of cervix uteri and body of uterus	0-44	179,182	C54, C55
Malignant neoplasm of testis	0-74	186	C62
Hodgkin's disease	0-74	201	C81
Leukaemia	0-44	204-208	C91-C95
Diseases of the thyroid	0-74	240-246	E00-E07
Diabetes mellitus	0-49	250	E10-14
Epilepsy	0-74	345	G40-G41
Chronic rheumatic heart disease	0-74	393-398	I05-I09
Hypertensive disease	0-74	410-405	I10-I13, I15
Cerebrovascular disease	0-74	430-438	I60-I69
All respiratory diseases (excluding pneumonia and influenza)	1-14	460-479, 488-519	J00-J09, J20-J99
Influenza	0-74	487	J10-J11
Pneumonia	0-74	480-486	J12-J18
Peptic ulcer	0-74	531-533	K25-K27
Appendicitis	0-74	540-543	K35-K38
Abdominal hernia	0-74	550-553	K40-K46
Cholelithiasis and cholecystitis	0-74	574-575.1	K80-K81
Nephritis and nephrosis	0-74	580-589	N00-N07, N17-N19, N25-N27
Benign prostatic hyperplasia	0-74	600	N40
Maternal death	All	630-676	O00-O99
Congenital cardiovascular anomalies	0-74	745-747	Q20-Q28
Perinatal deaths, all causes, excluding stillbirths	All	760-779	P00-P96, A33
Misadventures to patients during surgical and medical care	All	E870-E876, E878-E879	Y60-Y69, Y83-Y84
Ischaemic heart disease	0-74	410-414	I20-I25

Appendix E: The Smoking Epidemic in England: NHS/Health Development Agency:

A: Deaths attributable to smoking as a percentage of all deaths from that disease: England (1998-2002)

Disease	Men			Women		
	Observed	Attributable number	Attributable percentage	Observed	Attributable number	Attributable percentage
Cancer						
Lung	16,957	15,400	91	10,466	8,300	80
Upper respiratory	653	500	77	188	100	58
Oesophagus	3,575	2,500	70	2,110	1,500	72
Bladder	2,755	1,300	49	1,404	300	23
Kidney	1,509	600	42	942	100	7
Stomach	3,387	1,200	35	2,066	300	12
Pancreas	2,710	700	26	2,904	900	31
Unspecified site	4,536	1,500	33	4,738	300	7
Myeloid leukaemia	1,034	200	19	927	100	12
Respiratory						
Chronic obstructive lung disease	11,219	9,700	87	9,036	7,600	84
Pneumonia 35-64	542	200	34	324	200	51
Pneumonia 65+	6,377	1,600	24	9,752	1,500	15
Circulatory						
Ischaemic heart disease 35+54	3,676	2,100	57	767	500	63
Ischaemic heart disease 55-64	7,084	2,900	41	2,084	700	34
Ischaemic heart disease 65-74	15,337	4,100	27	7,454	1,600	22
Ischaemic heart disease 75+	30,470	2,900	10	35,977	2,700	8
Cerebrovascular disease 35-54	773	400	58	680	400	52
Cerebrovascular disease 55-64	1,298	400	33	967	300	35
Cerebrovascular disease 65-74	3,896	700	17	3,380	1,300	38
Cerebrovascular disease 75+	13,841	500	4	28,025	500	2
Aortic aneurysm	5,311	3,400	64	3,354	2,200	65
Myocardial degeneration	278	100	26	960	200	18
Atherosclerosis	416	100	22	754	100	17
Digestive						
Stomach/duodenal ulcer	1,482	800	54	1,649	1,000	58

A continued: Deaths attributable to smoking as a percentage of all deaths from that disease: England (1998-2002)

Disease	Men			Women		
	Observed	Attributable number	Attributable percentage	Observed	Attributable number	Attributable percentage
Diseases perverted by smoking						
Parkinson's disease	1,677	–900	–51	1,345	–500	–38
Endometrial cancer	na	na	na	810	–200	–20

B: Smoking attributable diseases and their ICD-9 and ICD-10 codes

Disease	ICD-9 code	ICD-10 code
Cancer		
Lung	162	C33 and C34
Upper respiratory sites	161 and 1490	C32 and C140
Oesophagus	150	C15
Bladder	188	C67
Kidney	1890	C64
Stomach	151	C16
Pancreas	157	C25
Unspecified site	1991	C80
Myeloid leukaemia	205	C92
Endometrial (uterus)	182	C54
Respiratory		
Chronic obstructive lung disease	496	J44
Pneumonia	486	J18
Circulatory		
Ischaemic heart disease	410–414	I20–I25
Cerebrovascular disease	430–438	I60–I69
Aortic aneurysm	441	I71
Myocardial degeneration	4291	I515
Atherosclerosis	440	I70
Digestive		
Stomach/duodenal ulcer	531 and 532	K25 and K26
Parkinson's disease	332	G20