A method for deriving leading causes of death

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Objective A standard list for ranking leading causes of death worldwide does not exist. WHO headquarters, regional offices and Member States all use different lists that have varying levels of detail. We sought to derive a standard list to enable countries to identify their leading causes of death and to permit comparison between countries. Our aim is to share the criteria and methodology we used to bring some order to the construction of such a list, to provide a consistent procedure that can be used by others, and to give researchers and data owners an opportunity to utilize the list at national and subnational levels.

Methods Results were primarily data-driven. Data from individual countries representing different regions of the world were extracted from the WHO Mortality Database. Supplementary information from WHO estimates on mortality was used for regions where data were scarce. In addition, a set of criteria was used to group the candidate causes and to determine other causes that should be included on the list.

Findings A ranking list of the leading causes of death that contains broad cause groupings (such as "all cancers", "all heart diseases" or "all accidents") is not effective and does not identify the leading individual causes within these broad groupings; thus it does not allow policy-makers to generate appropriate health advocacy and cost-effective interventions. Similarly, defining candidate causal groups too narrowly or including diseases that have a low frequency does not meet these objectives.

Conclusion For international comparisons, we recommend that countries use this list; it is based on extensive evidence and the application of public health disease-prevention criteria. It is not driven by political or financial motives. This list may be adapted for national statistical purposes.

Keywords Cause of death/standards; Mortality/trends (*source: MeSH, NLM*).

Mots clés Cause décès/normes; Mortalité/orientations (*source: MeSH, INSERM*).

Palabras clave Causa de muerte/normas; Mortalidad/tendencias (*fuente: DeCS, BIREME*).

Arabic

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Voir page 301 le résumé en français. En la página 302 figura un resumen en español.

Introduction

An essential component of obtaining an overview of the mortality patterns in a population is to rank the causes of death in order of their frequency and public health importance. Ranking causes of death is a popular method of describing the relative importance of cause-specific mortality in a population because it is based solely on the number of deaths. A population denominator is not required. Individuals and organizations frequently ask WHO for a list of the leading causes of death in countries, regions and the world by year, sex and age group. In response, WHO provides the information needed but it is always accompanied by a cautionary note about interpreting the results, which depend on the way in which the causes have been aggregated within the list. Why is it so difficult to provide the answer to such a straightforward question? The first reason is that there is no standard list or procedure used internationally to rank and compare the most frequent causes across countries. The second reason is that the way in which causes are grouped or split into subgroups will influence the rankings. The rank-order of any causal category depends on the list used; the application of different lists of causes and ranking rules will likely yield different leading causes of death. Moreover, a broad cause group, such as "all circulatory diseases", is more likely to score high in the rankings when compared with an individual disease, such as stroke. An additional objective of our work is to share the criteria and methodology used in deriving our list so that the method can be replicated by national statistical offices or health authorities to allow them to develop lists specific to certain age groups or populations. The sections below describe the criteria and methods that we used to derive a standard list to rank causes of death.

The *International statistical classification of diseases and related health problems*, tenth revision (ICD-10)[1] implemented worldwide since 1994, contains 12 421 codes distributed among 2036 categories. The greater degree of detail over previous ICD revisions allows for more in-depth analyses by disease or specific causal group. However, the use of such a level of detail to obtain a panoramic view of the health situation and identify the most relevant problems hinders the establishment of priorities and health policies. For this reason, the ICD itself offers shorter

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lists, based on the aggregation of several categories into a single group. It also offers four special (short or condensed) lists for tabulating mortality data and one for morbidity.

The process utilized to create condensed tabulations lists should be based on the intended analysis. Criteria for defining cause-groups for biomedical research usually require narrowly defined disease categories; the groups of criteria used to aid in organizing health-care delivery would be different than the groups used to assess the prevention and control efforts for major health problems. Policy formulation would benefit from a short list of cause-groups that provides an overview of the health situation in a country or an area and assists decision-makers and researchers in visualizing prevailing and emerging mortality trends. Special attention should be paid to preventable mortality in the light of current knowledge and available technology and to the early detection of newly emerging causes of mortality. In order to be useful at the international level condensed lists must also facilitate intercountry comparisons.

Constructing tabulation lists for mortality

In general, the following criteria should be followed when shortlists for the tabulation of mortality are constructed.[2]

- The organization of the list should be based on the current revision of the ICD, and the categories of causes should be mutually exclusive. The rationale is that the list should be oriented towards current situations and used for many years. The preparation of an equivalent list for previous revisions of the ICD is a secondary objective.
- The categories should be as informative as possible, avoiding residual categories usually identified by the expressions "other", "the remainder" or "not specified". However, in order to guarantee the inclusion of all events, at least one residual category (for example, "all the remainder") is necessary.
- In tabulating mortality data, the "ill-defined" causes (symptoms, signs and abnormal clinical and laboratory findings, chapter XVIII of ICD-10) should be shown separately and should not be a category on the list. This group is often used as a proxy indicator for data quality.
- The categories of the list do not need to follow the organization of the chapters of the ICD. Were they to do so, several residual categories would be required to complete the chapters, thereby increasing the proportion of events in categories which provide little useful information.
- The categories of the list could correspond to single codes in ICD (the three-character categories but not the four-character subcategories) and codes in different chapters or entire chapters of the ICD, in accordance with the needs of those who use the data.
- The number of categories in a short list should be sufficiently broad to meet the requirements above but should not be excessive to the point of hindering its complete presentation. The majority of the shortlists used to tabulate mortality and morbidity have between 30 and 150 categories.

Another important axis along which causes of death can be grouped is preventability criteria, as developed by Taucher.[3] Using Taucher's criteria, causal categories are oriented towards the definition of priorities and the evaluation of health measures and programmes. This type of list, which can also be used for morbidity, has a structure in which there are large groups that include diseases that can be prevented by similar measures. These would include, for example:

- deaths that can be avoidable by vaccination (e.g. measles or tetanus);
- deaths avoidable by early diagnosis and timely and adequate treatment (e.g. tuberculosis, syphilis or causes of maternal mortality);
- deaths avoidable by application of hygienic measures, environmental sanitation, and health education (e.g. intestinal infectious diseases, intoxication due to air pollution);
- deaths avoidable by application of a combination of measures (i.e. measures that are included in more than one group);
- deaths that are difficult to avoid with current knowledge and technological development; and
- all the remaining deaths (i.e. causes not identified by any of the previous groups).

The preventability criteria of causes of death may vary depending on the moment, the availability of technologies or resources, the experience of a country or region, and also when comparisons are made with specific paradigms. (An interesting discussion was published in 1990 in the *Epidemiological Bulletin* of the Pan American Health Organization.[4])

Shortlists for tabulating mortality are designed mainly for publishing and presenting statistical data over time. They are not appropriate for ranking leading causes of death because, most of the time, they were designed with a hierarchical structure that follows the ICD. The ICD structure is appropriate for classifying causes in an organized manner but is not suitable for ranking leading causes that are determined by the frequency of deaths.

Constructing an international list

The main objective in developing an international list to determine the leading causes of death in the general population is to recommend to countries a list of causes that is relevant from the perspectives of public health and prevention. It is also hoped that the list will be suitable and meaningful for use by all Member States. A review of the national lists used to determine leading causes of death in many countries showed a marked degree of non-uniformity in the cause categories; this raised concerns about their comparability and also raised the issue of a need for standardization. It was felt that these lists did not adequately respond to international objectives and that they were not particularly informative or detailed: many candidate groupings of causes were too broadly defined and included, for example, "all tumours", "all heart diseases" and "all accidents" as rankable causes. Conversely, some countries defined rankable cause groups too narrowly or included causes that had a low frequency. If broad ICD chapters were used, diseases of the circulatory system would rank first as the leading cause of death in 58 out of 61 countries during the latest year for which data are available, and neoplasms would be ranked second by 42 countries.

Any sequence of leading causes is strongly influenced by the criteria according to which the cause-groups of the list are defined. The ranking of a given category of cause of death depends not only on the relative frequency of deaths in that category but also on the definition of all the categories of causes that are candidates for ranking. Broadly defined categories have a better chance of qualifying as a leading cause than

narrower disease-specific categories. The rank-order of any category will depend on the list of candidate causes. The use of different cause lists and different ranking rules will likely produce different leading causes of death.

Criteria for determining leading causes of death

Causes of death are frequently ranked in order to prioritize problems and define policies and health programmes. In addition to the aforementioned criteria, shortlists used to determine leading causes of death should have the following characteristics.[2]

- The axis for grouping causes should have an epidemiological basis that is associated with the idea of control measures.
- Residual categories should be avoided; there should be only one category for "all remaining causes". Ideally, that residual category should not account for more than 10% of total deaths. Furthermore, that category and the "ill-defined" categories should not be included among the candidate categories for principal causes but should be presented separately.
- A balance should be sought between grouping and disaggregating causes so that the first five leading causes of death in the general population account for 40–50% of the deaths while the first 10 or 15 leading causes should account for about 60–70%.
- Overloaded and frequently heterogeneous categories, such as "heart diseases" or "malignant neoplasms", should be avoided. Since the intended purpose is to show the leading causes, diseases that occur less frequently — for example rabies, poliomyelitis or yellow fever — should be avoided as candidate causes.
- In order to facilitate tabulation and analysis, the list should consist of mutually exclusive diseases or groups of diseases. The breakdown of the categories into more elaborate analyses can be done with other types of tabulations.
- The list should be based on the ICD-10 and on the current situation since it will be used to support analyses and define priorities, health programmes and policies.
- A list that meets these criteria will likely contain a range of 40–80 candidate categories of causes.

A preliminary version of the list should be tested using the most recent mortality data. Using data from areas with different epidemiological profiles makes it possible to assess the consistency and sensitivity of the list under different health settings. Ranking the data according to different types of measures may also make it easier to evaluate the list. For example, the list could be ranked by frequency of death and by years of potential life lost.[2] Rankings based on crude death rates are not recommended since they are often expressed per 100 000 population and rounded to one decimal place, thus reducing the precision of the ranking criteria.

Methods

As a starting point, a provisional list that was being evaluated in the WHO Region of the Americas was utilized. To corroborate and further refine this list, ICD-10 three-character data from a number of countries representing all six WHO regions and levels of development were extracted from the WHO Mortality Database,[5] and their frequencies were evaluated. Approximately 100 ICD-10 codes accounted for around 90% of all registered deaths. Within these codes, two codes corresponded to diabetes, three to ischaemic heart disease, and three to cerebrovascular diseases. These codes were grouped into ICD-10 clinical groups, such as E10–E14, I20–I25, I60–I69. The analysis was then repeated and the most frequent 100 causes were determined for groups and three-character categories. More groupings were then created, and the analysis was repeated until a list containing 65 categories was derived (Appendix 1).

Currently, 115 countries report mortality data to WHO. While data from the WHO Mortality Database were used to derive the list of leading causes, supplementary information from WHO estimates on causes of death by region[6] was also crucial in determining which causes to include to reflect the different epidemiological regions. Cause-of-death estimates were produced in close collaboration with WHO technical programmes, UNAIDS and expert groups.

The determination of a number of the cause groupings in the list was driven by the data, but others were constructed according to prevention strategies (vaccine-preventable and vector-borne diseases) or to maintaining homogeneity within the group of cause categories. Some categories on the list, such as heart failure or cardiac arrest, are often among the leading causes of death and can thus provide an indicator of data quality. The external causes (suicide and homicide) are shown as separate categories because the manner in which they are carried out depends upon the means available (pesticides, painkillers, drugs, firearms, etc.). Prevention strategies are different for unintentional events involving firearms, falls, land transport accidents (motor vehicles, pedestrians), poisonings and drowning; these causes are shown separately in the context of rankable causes of death.

For broadly defined cause categories we made the decision to show the most frequent detailed cause groupings when a broad group is among the leading causes of death in a country (e.g. certain conditions originating in the perinatal period; congenital malformations, deformations and chromosomal abnormalities; pregnancy, childbirth and the puerperium; and diseases of the musculoskeletal system and connective tissue). In this way the list becomes more informative, and it shows the most important components making up the broadly defined category.

We also considered different certification and coding practices used in various countries. For example, for "dementia and Alzheimer's disease", data from the WHO database showed that there were variations in the reporting of both diseases. An analysis of 252 sets of mortality data for 61 countries reporting data by ICD-10 since 1995 revealed that the age-standardized death rates for dementia are greater than for Alzheimer's disease in 127 data sets where countries report both diseases. However, in 37 data sets deaths have been reported as being caused by Alzheimer's disease but not dementia. In six other data sets deaths have been reported as occurring only from dementia and not from Alzheimer's disease. Since both diseases are becoming increasingly important because of the rapid ageing of the population in some areas, it has been essential to group both diseases together to enable comparisons to be made across countries. However, the importance of each disease's contribution can be easily assessed within this category because they are shown separately in the list when the two diseases combined are ranked among the leading causes.

Table 1. **Results of 10 leading causes of death using two different methods of ranking, by sex, western Europe, 2001**

Cancer categories grouped				Cancer categories split			
Males				**Males**			
Rank	**Cause category**	**No. of deaths**	**% of all deaths[a]**	**Rank**	**Cause category**	**No. of deaths**	**% of all deaths[a]**
1	Malignant neoplasms	235 100	30.9	1	Ischaemic heart diseases	124 632	16.4
2	Ischaemic heart diseases	124 632	16.4	2	Malignant neoplasm of trachea, bronchus and lung	60 192	7.9
3	Cerebrovascular diseases	53 843	7.1	3	Cerebrovascular diseases	53 843	7.1
4	Heart failure and complications and ill-defined descriptions of heart disease	34 838	4.6	4	Heart failure and complications and ill-defined descriptions of heart disease	34 838	4.6
5	Chronic lower respiratory diseases	26 103	3.4	5	Malignant neoplasm of colon, rectosigmoid junction, rectum, anus and anal canal	26 214	3.4
6	Cirrhosis and other diseases of the liver	20 810	2.7	6	Chronic lower respiratory diseases	26 103	3.4
7	Intentional self-harm (suicide)	19 037	2.5	7	Malignant neoplasm of prostate	25 008	3.3
8	Diabetes	16 411	2.2	8	Cirrhosis and other diseases of the liver	20 810	2.7
9	Influenza and pneumonia	16 281	2.1	9	Intentional self-harm (suicide)	19 037	2.5
10	Land transport accidents	12 496	1.6	10	Malignant neoplasms of lymphoid, haematopoietic and related tissue	18 049	2.4
Females				**Females**			
Rank	**Cause category**	**No. of deaths**	**% of all deaths[a]**	**Rank**	**Cause category**	**No. of deaths**	**% of all deaths[a]**
1	Malignant neoplasms	189 811	23.4	1	Ischaemic heart diseases	128 557	15.8
2	Ischaemic heart diseases	128 557	15.8	2	Cerebrovascular diseases	87 431	10.8
3	Cerebrovascular diseases	87 431	10.8	3	Heart failure and complications and ill-defined descriptions of heart disease	65 761	8.1
4	Heart failure and complications and ill-defined descriptions of heart disease	65 761	8.1	4	Malignant neoplasms of the female breast	34 927	4.3
5	Dementia and Alzheimer disease	25 710	3.2	5	Malignant neoplasm of colon, rectosigmoid junction, rectum, anus and anal canal	26 725	3.3
6	Diabetes	24 495	3.0	6	Dementia and Alzheimer disease	25 710	3.2
7	Hypertensive diseases	22 270	2.7	7	Diabetes	24 495	3.0
8	Influenza and pneumonia	20 603	2.5	8	Hypertensive diseases	22 270	2.7
9	Chronic lower respiratory diseases	17 197	2.1	9	Influenza and pneumonia	20 603	2.5
10	Cardiac arrhythmias	14 305	1.8	10	Malignant neoplasm of trachea, bronchus and lung	18 586	2.3

[a] Excludes ill-defined causes (R00–R99).

Results

Table 1 shows the 10 leading causes of death in 2001 using two different lists for western Europe. When cancers were grouped, they became the leading cause of death for both males and females, accounting for 31% of all defined deaths among males and 23% among females. When cancers were disaggregated by site, they appeared in four of the top 10 causes of death in men and three in women. In this way, the list becomes more informative and useful to policy-makers and decision-makers.

Annex 1 (web version only, http://www.who.int/bulletin) presents the tabulation of registered mortality data from 2001 aggregated for several countries in western Europe using our ranking list for leading causes of death. All 65 cause categories are shown by rank-order and sex. Subcategories in the list that contribute 1% or more to the corresponding category total are also shown. The percentages shown for each main cause grouping are the proportionate mortality due to that cause relative to the total number of deaths from defined causes. In the case of tied ranks, the average rank value is shown for these cause groupings. In addition, Annex 2 shows the cumulative percentage by rank-order for each causal category.

Discussion

Customarily, an analysis of leading causes would highlight the first 10 causes on the list. The first five causes of death in the aggregated country data shown in Annex 1 account for 40% of deaths from

defined causes, and the first 10 causes account for 52% of the deaths from defined causes. These figures indicate that there is a good balance in the list's definition of aggregated and disaggregated categories. The residual category "all of the remainder" accounts for only 12% of deaths.

The results and conclusions of health analyses made using mortality data can be influenced in many different ways. Some factors that come into play are related to the coverage and quality of the data and include, among other considerations, the precision and adequacy of the medical information on diagnoses, the types of variables used, how deaths were coded, the consistency of the data and whether statistical standards were used correctly.[7] Other important factors in these analyses are the way in which the data are organized and tabulated and the type of analysis required. Consequently, choosing an adequate list (or constructing a specific one) is fundamental to organizing the data. It allows for the relative importance of specific health problems to be identified, thus avoiding the drawing of erroneous or biased conclusions that may negatively affect evaluations and decisions and hinder comparability between geographical areas or over different time periods.

Conclusion

Cause-of-death information is available on web sites and in the publications of national statistical offices and health authorities. Although some of them rank the leading causes of death, some lists may contain detailed causes while others may contain broad categories. In general the lists produced by different countries or organizations are not consistent or comparable, and they tend to produce different leading causes of death. We have described, for example, how grouping or splitting cancers, within lists of leading causes of death may affect the order of the ranking of the causes. We have therefore defined the criteria and the methods that can be used consistently to arrive at a list that ranks the leading causes of death; this should enable valid comparisons to be made internationally.

Countries with high levels of mortality should be able to adapt the list according to their epidemiological profile by applying the criteria and using the same methods. Modifications should consider the diseases that contribute nationally a large number of deaths and should reflect specific characteristics of the country's data, certification habits and coding practices. For instance, countries with a high number of deaths from infectious diseases may need to have additional subcategories organized by type of primary infection. In the continental part of WHO's African Region, only South Africa and Zimbabwe report cause-of-death statistics to WHO. In most high-mortality countries the lack of a vital registration system is a major problem. Consequently, information on civil events, including deaths, is not systematically recorded.[8] At this stage it is not possible for these countries to rank leading causes of death since the basic information is not available.

This list for ranking the leading causes of death is not intended to replace basic tabulation lists; these serve a different purpose. A ranking shows only the most frequent causes of death at a specific point in time; it is not suited to presenting changes in trends over time. A basic tabulation list is best suited to identifying patterns of disease over a long period because the list will always show the same diseases along with the annual number of deaths.

This list has been derived from the extensive information contained in the WHO Mortality Database. Data for 1994–2004 were analysed and gave a good balance of aggregated and disaggregated causal categories. This list is not driven by political motives or funding considerations and is conducive to producing a comparable ranking of leading causes of death across countries.

It should be emphasized that an analysis of leading causes is only a starting point in the overall analysis of the mortality profile of a country. In most cases, other supplemental analyses should be performed. For example, an analysis that investigates the overall structure of causes of mortality would overcome the problems that arise when a causal category may not be ranked across all the years in which data have been collected as part of a time–series analysis. More detailed cause-specific analyses could also be performed for cause categories identified as leading causes. For groupings of external causes that appear as leading causes of death or for detailed analyses of external causes in general, the use of the injury matrix developed by the International Collaborative Effort on Injury Statistics is recommended.[9] The injury matrix classifies the external cause by its mechanism and intent. ■

Competing interests: none declared.

Résumé

Méthode de détermination des principales causes de décès

Objectif Il n'existe pas de liste standard permettant de classer les principales causes de décès à l'échelle mondiale. Le siège de l'OMS, les Bureaux régionaux de cette organisation et ses États Membres utilisent tous des listes différentes, dont le niveau de détail est variable. La présente étude visait la mise au point d'une liste standard, permettant aux pays d'identifier les principales causes de décès sur leur territoire et de dresser des comparaisons entre pays. L'objectif est de fixer une méthodologie et des critères communs pour rationaliser l'organisation d'une telle liste, de définir une procédure cohérente utilisable par des tiers et d'offrir aux chercheurs et aux détenteurs de données la possibilité d'utiliser la liste à des niveaux nationaux et supranationaux.

Méthodes Les résultats de l'étude reposent principalement sur des chiffres. Des données provenant de différents pays représentatifs de diverses régions du monde ont été extraites de la base de données de mortalité de l'OMS. Dans le cas des régions pour lesquelles les données sont rares, l'étude a recouru également aux estimations de la mortalité de l'OMS. En outre, un jeu de critères a été utilisé pour regrouper les causes proposées et pour retenir des causes supplémentaires à introduire dans la liste.

Résultats Un classement des causes principales de mortalité reposant sur des regroupements causals larges (tels que « l'ensemble des cancers », « l'ensemble des cardiopathies » ou « tous les accidents ») manque d'efficacité et ne permet pas d'identifier les causes individuelles majeures de mortalité au sein

de ces regroupements, d'où l'impossibilité pour les décideurs de trouver des arguments sanitaires appropriés et de lancer des interventions présentant un bon rapport coût/efficacité. Ces objectifs sont également impossibles à remplir lorsqu'on définit de manière trop étroite les regroupements causals ou lorsqu'on y inclut des maladies peu fréquentes.

Conclusion Il est recommandé aux pays d'utiliser cette liste pour établir des comparaisons avec les autres nations; elle repose sur une grande quantité de données et sur l'application de critères de santé publique visant la prévention des maladies. Elle ne s'inspire d'aucune motivation politique ou financière et peut être adoptée pour l'établissement de statistiques nationales.

Resumen

Método para calcular las causas principales de defunción

Objetivo No existe una lista estándar para jerarquizar las causas principales de defunción a nivel mundial. La sede de la OMS, sus oficinas regionales y los Estados Miembros utilizan diferentes listas, con diverso grado de detalle. Decidimos elaborar una lista estándar que permitiera a los países identificar sus causas principales de defunción e hiciera posible las comparaciones entre países. Nuestro objetivo es compartir los criterios y metodología utilizados para introducir cierto orden en la elaboración de tal lista, presentar un procedimiento coherente que otros puedan utilizar, y brindar a los investigadores y los dueños de los datos la oportunidad de utilizar la lista a nivel nacional y subnacional.

Métodos Los resultados se basan principalmente en los datos empleados. A partir de la Base de Datos de la OMS sobre Mortalidad, se extrajeron datos sobre países representativos de diferentes regiones del mundo. En el caso de las regiones con escasez de datos, se usó información complementaria procedente de las estimaciones de la OMS sobre la mortalidad. Además, se empleó un conjunto de criterios para agrupar las causas consideradas y determinar qué otras causas debían incluirse en la lista.

Resultados Una jerarquización de las causas principales de defunción con grupos de causas generales (como «todos los cánceres», «todas las cardiopatías» o «todos los accidentes») carece de eficacia y no permite identificar las causas individuales principales dentro de esos grupos amplios; el resultado es que las instancias normativas no pueden desarrollar intervenciones costoeficaces de promoción de la salud. De manera análoga, si los grupos causales considerados se definen de forma demasiado estricta o incluyendo enfermedades que ocurren con escasa frecuencia, tampoco es posible lograr esos objetivos.

Conclusión Recomendamos que los países utilicen en sus comparaciones internacionales la lista propuesta, por cuanto está basada en una amplia evidencia y en criterios de prevención de enfermedades basados en la salud pública, no en criterios políticos o financieros. La lista puede adaptarse en función de las necesidades nacionales en materia de estadísticas.

Arabic

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Appendix 1. **Ranking to determine leading causes of death in ICD-10**

	All deaths A00-R99, V01-Y89
LC-01	Intestinal infectious diseases (A00-A09)
LC-02	Tuberculosis (A15-A19)
LC-03	* Vector-borne diseases and rabies (A20, A44, A75-A79, A82-A84, A852, A90-A96, A98.0-A98.2, A98.8, B50-B57)
LC-04	* Vaccine-preventable diseases (A33-A37, A80, B01, B05, B06, B15, B16, B17.0, B18.0, B18.1, B18.9, B19, B26)
LC-05	Meningitis (A39, A87, G00-G03)
LC-06	Septicaemia (A40-A41)
LC-07	Human immunodeficiency virus [HIV] disease (B20-B24)
LC-08	Malignant neoplasm of oesophagus (C15)
LC-09	Malignant neoplasm of stomach (C16)
LC-10	Malignant neoplasm of colon, sigmoid, rectum and anus (C18-C21)
LC-11	Malignant neoplasm of liver and intrahepatic bile ducts (C22)
LC-12	Malignant neoplasm of gallbladder and other parts of biliary tract (C23, C24)
LC-13	Malignant neoplasm of pancreas (C25)
LC-14	Malignant neoplasm of larynx (C32)
LC-15	Malignant neoplasm of trachea, bronchus and lung (C33, C34)
LC-16	Melanoma and other malignant neoplasms of skin (C43, C44)
LC-17	Malignant neoplasms of female breast (C50)
LC-18	* Malignant neoplasm of uterus (C53-C55)
LC-19	Malignant neoplasm of ovary (C56)
LC-20	Malignant neoplasm of prostate (C61)
LC-21	Malignant neoplasm of kidney, except renal pelvis (C64)
LC-22	Malignant neoplasm of bladder (C67)
LC-23	Malignant neoplasm of brain (C71)
LC-24	Malignant neoplasms of lymphoid, haematopoietic and related tissue (C81-C96)
LC-25	Benign neoplasms, in situ and uncertain behaviour (D00-D48)
LC-26	Diabetes (E10-E14)
LC-27	Malnutrition and nutritional anaemias (D50-D53, E40-E64)
LC-28	Disorders of fluid, electrolyte and acid-based balance (dehydration) (E86-E87)
LC-29	* Dementia and Alzheimer disease (F01, F03, G30)
LC-30	Mental and behavioural disorders due to psychoactive substance use (F10-F19)
LC-31	Parkinson's disease (G20)
LC-32	Epilepsy and status epilepticus (G40, G41)
LC-33	Chronic rheumatic heart diseases (I05-I09)
LC-34	Hypertensive diseases (I10-I15)
LC-35	* Ischaemic heart diseases (I20-I25)
LC-36	Pulmonary heart disease and diseases of pulmonary circulation (I26-I28)
LC-37	Nonrheumatic valve disorders (I34-I38)
LC-38	Cardiomyopathy (I42)
LC-39	Cardiac arrest (I46)
LC-40	Cardiac arrhythmias (I47-I49)
LC-41	Heart failure and complications and ill-defined heart disease (I50-I51)
LC-42	Cerebrovascular diseases (I60-I69)
LC-43	Atherosclerosis (I70)
LC-44	Aortic aneurysm and dissection (I71)
LC-45	Acute respiratory diseases other than influenza and pneumonia (J00-J06, J20-J22)
LC-46	Influenza and Pneumonia (J10-J18)
LC-47	Chronic lower respiratory diseases (J40-J47)
LC-48	Pulmonary oedema and other interstitial pulmonary diseases (J80-J84)
LC-49	Respiratory failure (J96)
LC-50	Appendicitis, hernia and intestinal obstruction (K35-K46, K56)
LC-51	* Cirrhosis and other diseases of liver (K70-K76)
LC-52	* Diseases of the musculoskeletal system and connective tissue (M00-M99)
LC-53	Diseases of the urinary system (N00-N39)
LC-54	* Pregnancy, childbirth and the puerperium (O00-O99)
LC-55	* Certain conditions originating in the perinatal period (P00-P96)
LC-56	* Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99)
LC-57	Land transport accidents (V01-V89)
LC-58	Accidental falls (W00-W19)

(Appendix1, cont.)

	All deaths A00-R99, V01-Y89
LC-59	Nonintentional firearm discharge (W32-W34)
LC-60	Accidental drowning and submersion (W65-W74)
LC-61	Accidental threats to breathing (W75-W84)
LC-62	Accidental poisoning (X40-X49)
LC-63	Intentional self-harm [suicide] (X60-X84)
LC-64	Assault [homicide] (X85-Y09)
LC-65	Event of undetermined intent (Y10-Y34)
LC-88	Remainder (all the rest)
LC-99	Symptoms, signs and ill-defined conditions (R00-R99)
*** Causal categories that can be expanded when appearing among the leading causes:**	
LC-03	Vector borne diseases and rabies[a]
LC-04	Vaccine-preventable diseases[a]
LC-18	Malignant neoplasm of uterus (C53-C55)
	Cervix (C53)
	Corpus (C54)
	Unspecified part (C55)
LC-29	Dementia and Alzheimer's disease (F01, F03, G30)
	Dementia (F01, F03)
	Alzheimer disease (G30)
LC-35	Ischaemic heart disease (I20-I25)
	Acute (I20-I24)
	Chronic (I25)
LC-51	Cirrhosis and other diseases of liver (K70-K76)
	Alcoholic liver disease (K70)
	Hepatic failure (K72)
	Fibrosis and cirrhosis of liver (K74)
LC-52	Diseases of musculoskeletal system and connective tissue (M00-M99)
	Inflammatory polyarthropathies (M05-M14)
	Arthrosis (M15-M19)
	Polyarteritis nodosa and other necrotizing vasculopathies (M30-M31)
	Systemic lupus erythematosus (M32)
	Systemic Sclerosis (M34)
	Disorders of bone density and structure (M80-M85)
	Osteomyelitis (M86)
LC-54	Pregnancy, childbirth and puerperium (O00-O99)
	Pregnancy with abortive outcome (O00-O07)
	Eclampsia and other hypertensive disorders (O10-O11, O13-O16)
	Complications of labour and delivery (O60-O75)
	Complications predominantly related to the puerperium (O85-O92)
LC-55	Certain conditions originating in the perinatal period (P00-P96)
	Birth trauma and other obstetric causes (P01-P03, P10-P15)
	Immaturity and related disorders (P05-P07)
	Respiratory disorders specific to the perinatal period (P20-P28)
	Bacterial sepsis of newborn (P36)
	Haemorrhagic and haematological disorders (P50-P61)
LC-56	Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99)
	Anencephaly and other malformations of the nervous system (Q00-Q07)
	Congenital malformations of heart (Q20-Q24)
	Congenital malformations of respiratory system (Q30-Q34)
	Congenital malformations and deformations of musculoskeletal system (Q65-Q79)
	Chromosomal abnormalities (Q90-Q99)

[a] Categories LC-03 and LC-04 can be expanded to show specific diseases within the category.

Annex 1. **Ranking of leading causes of death, western Europe, 2001**

LC	Cause category name	Rank	Total deaths both sexes	% Defined causes	Cumula-tive %	Rank	Male deaths	% Defined causes	Rank	Female deaths	% Defined causes
	All deaths		1,641,076				791,354			849,722	
99	Ill defined		68,559	4.2			31,358	4.0		37,201	4.4
	Defined causes		1,572,517	100			759,996	100		812,521	100
35	Ischaemic heart diseases*	1	253,189	16.1	16.1	1	124,632	16.4	1	128,557	15.8
	- Chronic (I25)		128,519				55,893			72,626	
	- Acute (I20-I24)		124,670				68,739			55,931	
42	Cerebrovascular diseases	2	141,274	9.0	25.1	3	53,843	7.1	2	87,431	10.8
41	Heart failure and complications and ill-defined descriptions of heart disease	3	100,599	6.4	31.5	4	34,838	4.6	3	65,761	8.1
15	Malignant neoplasm of trachea, bronchus and lung	4	78,778	5.0	36.5	2	60,192	7.9	10	18,586	2.3
10	Malignant neoplasm of colon, rectosigmoid junction, rectum, anus and anal canal	5	52,939	3.4	39.9	5	26,214	3.4	5	26,725	3.3
47	Chronic lower respiratory diseases	6	43,300	2.8	42.6	6	26,103	3.4	11	17,197	2.1
26	Diabetes	7	40,906	2.6	45.2	11	16,411	2.2	7	24,495	3.0
46	Influenza and Pneumonia	8	36,884	2.3	47.6	12	16,281	2.1	9	20,603	2.5
29	Dementia and Alzheimer disease*	9	36,619	2.3	49.9	16	10,909	1.4	6	25,710	3.2
	- Dementia (F01, F03)		20,292				5,682			14,610	
	- Alzheimer's1 disease (G30)		16,327				5,227			11,100	
17	Malignant neoplasms of female breast	10	34,927	2.2	52.1				4	34,927	4.3
24	Malignant neoplasms of lymphoid, haematopoietic and related tissue	11	34,734	2.2	54.3	10	18,049	2.4	12	16,685	2.1
34	Hypertensive diseases	12	32,718	2.1	56.4	17	10,448	1.4	8	22,270	2.7
51	Cirrhosis and other diseases of liver*	13	31,178	2.0	58.4	8	20,810	2.7	18	10,368	1.3
	- Alcoholic liver disease (K70)		17,928				12,809			5,119	
	- Fibrosis and cirrhosis of liver (K74)		10,753				6,681			4,072	
	- Hepatic failure NEC (K72)		1,025				566			459	
63	Intentional self-harm (suicide)	14	26,032	1.7	60.0	9	19,037	2.5	26	6,995	0.9
20	Malignant neoplasm of prostate	15	25,008	1.6	61.6	7	25,008	3.3			
13	Malignant neoplasm of pancreas	16	23,743	1.5	63.1	14	11,600	1.5	15	12,143	1.5
40	Cardiac arrhythmias	17	23,577	1.5	64.6	20	9,272	1.2	13	14,305	1.8
53	Diseases of the urinary system	18	22,369	1.4	66.1	19	9,387	1.2	14	12,982	1.6
9	Malignant neoplasm of stomach	19	20,899	1.3	67.4	15	11,598	1.5	20	9,301	1.1
43	Atherosclerosis	20	18,030	1.1	68.5	29	6,164	0.8	16	11,866	1.5
57	Land transport accidents	21	17,168	1.1	69.6	13	12,496	1.6	32	4,672	0.6
36	Pulmonary heart disease and diseases of pulmonary circulation	22	16,265	1.0	70.7	27	6,593	0.9	19	9,672	1.2
58	Accidental falls	23	15,352	1.0	71.6	25	6,984	0.9	22	8,368	1.0
11	Malignant neoplasm of liver and intrahepatic bile ducts	24	14,077	0.9	72.5	18	9,834	1.3	35	4,243	0.5

(Annex 1, cont.)

LC	Cause category name	Rank	Total deaths both sexes	% Defined causes	Cumulative %	Rank	Male deaths	% Defined causes	Rank	Female deaths	% Defined causes
25	Benign neoplasms, in situ and uncertain behaviour	25	14,071	0.9	73.4	28	6,576	0.9	24	7,495	0.9
39	Cardiac arrest	26	13,871	0.9	74.3	26	6,844	0.9	25	7,027	0.9
37	Nonrheumatic valve disorders	27	13,426	0.9	75.2	34	5,187	0.7	23	8,239	1.0
38	Cardiomyopathy	28	12,495	0.8	76.0	24	7,556	1.0	31	4,939	0.6
22	Malignant neoplasm of bladder	29	11,864	0.8	76.7	21	8,261	1.1	37	3,603	0.4
6	Septicaemia	30	11,026	0.7	77.4	33	5,255	0.7	27	5,771	0.7
19	Malignant neoplasm of ovary	31	10,952	0.7	78.1				17	10,952	1.3
31	Parkinson's disease	32	10,924	0.7	78.8	32	5,442	0.7	29	5,482	0.7
8	Malignant neoplasm of oesophagus	33	10,257	0.7	79.5	23	8,107	1.1	45	2,150	0.3
30	Mental and behavioural disorders due to psychoactive substance use	34	10,200	0.6	80.1	22	8,127	1.1	48	2,073	0.3
21	Malignant neoplasm of kidney, except renal pelvis	35	9,907	0.6	80.7	31	5,985	0.8	36	3,922	0.5
23	Malignant neoplasm of brain	36	9,709	0.6	81.4	35	5,182	0.7	33	4,527	0.6
44	Aortic aneurysm and dissection	37	8,906	0.6	81.9	30	6,080	0.8	39	2,826	0.3
18	Malignant neoplasm of uterus*	38	8,811	0.6	82.5				21	8,811	1.1
	- Unspecified part (C55)		3,249							3,249	
	- Cervix (C53)		3,109							3,109	
	- Corpus (C54)		2,453							2,453	
50	Appendicitis, hernia and intestinal obstruction	39	8,625	0.5	83.0	37	3,109	0.4	28	5,516	0.7
52	Diseases of the musculoskeletal system and connective tissue*	40	7,446	0.5	83.5	40	2,427	0.3	30	5,019	0.6
	- Inflammatory polyarthropathies (M05-M14)		1,490				330			1,160	
	- Disorders of bone density and structure (M80-M85)		745				108			637	
	- Polyarteritis nodosa and other necrotizing vasculopathies (M30-M31)		704				316			388	
	- Arthrosis (M15-M19)		632				189			443	
	- Osteomyelitis (M86)		321				158			163	
	- Systemic Sclerosis (M34)		305				65			240	
	- Systemic lupus erythematosus (M32)		137				25			112	
12	Malignant neoplasm of gallbladder and other and unspecified parts of biliary tract	41	6,399	0.4	83.9	45	2,090	0.3	34	4,309	0.5
16	Melanoma and other malignant neoplasms of skin	42	5,737	0.4	84.3	38	3,053	0.4	41	2,684	0.3
49	Respiratory failure, not elsewhere classified	43	4,657	0.3	84.6	39	2,534	0.3	46	2,123	0.3
61	Accidental threats to breathing	44	4,507	0.3	84.9	44	2,091	0.3	43	2,416	0.3
48	Pulmonary oedema and other interstitial pulmonary diseases	45	4,472	0.3	85.1	41	2,351	0.3	47	2,121	0.3

(Annex 1, cont.)

LC	Cause category name	Rank	Total deaths both sexes	% Defined causes	Cumula-tive %	Rank	Male deaths	% Defined causes	Rank	Female deaths	% Defined causes
56	Congenital malformations, deformations and chromosomal abnormalities*	46	4,309	0.3	85.4	42	2,296	0.3	49	2,013	0.2
	- Congenital malformations of heart (Q20-Q24)		1,290				698			592	
	- Chromosomal abnormalities (Q90-Q99)		885				451			434	
	- Anencephaly and other malformations of nervous system (Q00-Q07)		457				230			227	
	- Congenital malformations and deformations of musculoskeletal system (Q65-Q79)		297				158			139	
	- Congenital malformations of respiratory system (Q30-Q34)		154				97			57	
33	Chronic rheumatic heart diseases	47	4,199	0.3	85.7	53	1,302	0.2	38	2,897	0.4
45	Acute respiratory diseases other than influenza and pneumonia	48	4,108	0.3	85.9	48	1,580	0.2	42	2,528	0.3
28	Disorders of fluid, electrolyte and acid-based balance (dehydration)	49	3,998	0.3	86.2	52	1,308	0.2	40	2,690	0.3
55	Certain conditions originating in the perinatal period*	50	3,988	0.3	86.4	43	2,289	0.3	50	1,699	0.2
	- Immaturity and related disorders (P05-P07)		1,300				767			533	
	- Respiratory disorders specific to the perinatal period (P20-P28)		927				530			397	
	- Birth trauma and other obstetric causes (P01-P03, P10-P15)		542				281			261	
	- Haemorrhagic and haematological disorders (P50-P61)		352				204			148	
	- Bacterial sepsis of newborn (P36)		135				80			55	
14	Malignant neoplasm of larynx	51	3,768	0.2	86.7	36	3,389	0.4	59	379	0.0
32	Epilepsy and status epilepticus	52	3,482	0.2	86.9	47	1,915	0.3	51	1,567	0.2
65	Event of undetermined intent	53	3,296	0.2	87.1	46	2,016	0.3	52	1,280	0.2
27	Malnutrition and nutritional anaemias	54	3,115	0.2	87.3	54	948	0.1	44	2,167	0.3
62	Accidental poisoning	55	2,224	0.1	87.5	50	1,394	0.2	53	830	0.1
7	Human immunodeficiency virus [HIV] disease	56	1,864	0.1	87.6	49	1,455	0.2	58	409	0.1
60	Accidental drowning and submersion	57	1,836	0.1	87.7	51	1,339	0.2	56	497	0.1
64	Assault (homicide)	58	1,415	0.1	87.8	55	830	0.1	55	585	0.1
1	Intestinal infectious diseases	59	1,295	0.1	87.9	57	504	0.1	54	791	0.1
2	Tuberculosis	60	1,138	0.1	87.9	56	663	0.1	57	475	0.1

(Annex 1, cont.)

LC	Cause category name	Rank	Total deaths both sexes	% Defined causes	Cumulative %	Rank	Male deaths	% Defined causes	Rank	Female deaths	% Defined causes
4	Vaccine-preventable diseases including hepatitis A and B*	61	733	0.0	88.0	58	411	0.1	61	322	0.0
	- Hepatitis B (B16, B17.0, B18.0, B18.1)		515				302			213	
	- Viral Hepatitis, unspecified (B18.9, B19)		129				66			63	
	- Hepatitis A (B15)		35				16			19	
	- Chickenpox (B01)		28				17			11	
	- Tetanus (A35)		14				3			11	
	- Whooping cough (A37)		5				4			1	
	- Mumps (B26)		4				1			3	
	- Measles (B05)		3				2			1	
5	Meningitis	62	665	0.0	88.0	59	329	0.0	60	336	0.0
54	Pregnancy, childbirth and the puerperium*	63	100	0.0	88.0				62	100	0.0
	- Complications predominantly related to the puerperium (O85-O92)		28							28	
	- Eclampsia and other hypertensive disorders (O10-O11, O13-O16)		21							21	
	- Complications of labour and delivery (O60-O75)		19							19	
	- Pregnancy with abortive outcome (O00-O07)		5							5	
59	Nonintentional firearm discharge	64	61	0.0	88.0	60	59	0.0	64	2	0.0
3	Vector-borne diseases and rabies*	65	50	0.0	88.0	61	30	0.0	63	20	0.0
	- Malaria (B50-B54)		38				23			15	
	- Tick-borne viral encephalitis (A84)		5				4			1	
	- Bartonellosis (A44)		1				–			1	
	- Q fever (A78)		1				1			–	
	- Other rickettsioses (A79)		1				1			–	
	- Rabies (A82)		1				–			1	
	- Mosquito-borne viral encephalitis (A83)		1				–			1	
	- Leishmaniasis (B55)		1				1			–	
	- African trypanosomiasis (B56)		1				–			1	
88	Remainder		188,046	12.0	100.0		92,979	12.2		95,067	11.7