

The burden of lung disease

Introduction: the global perspective



Key points

- Four respiratory disease categories appear in the global top 10 causes of mortality, together accounting for one in six deaths as well as one in 10 disability-adjusted life-years lost.
- In the 28 countries of the European Union, these diseases account for one in eight deaths.
- In European countries where detailed data are available, 7% of hospital admissions result from respiratory causes.
- Smoking and respiratory infections are major causes of the burden of lung disease in Europe, and are potentially preventable.
- In the next two decades, the proportion of deaths caused by respiratory disease in Europe is likely to remain stable, with a decrease in deaths from lung infections balanced by a rise in lung cancer and COPD mortality.

Respiratory diseases are among the leading causes of death worldwide (table 1). Lung infections (mostly pneumonia and tuberculosis), lung cancer and chronic obstructive pulmonary disease (COPD) together accounted for 9.5 million deaths worldwide during 2008, one-sixth of the global total. The World Health Organization estimates that the same four diseases accounted for one-tenth of the disability-adjusted life-years (DALYs) lost worldwide in 2008 (table 2).

The Global Burden of Disease (GBD) Study recently compared the contribution of major diseases to deaths and disability worldwide for 1990 and 2010. Among the leading causes of death, lower respiratory infections were ranked 3rd in 1990 and 4th in 2010, whereas COPD was ranked 4th in 1990 and 3rd in 2010. Lung cancer rose from 8th- to 5th-commonest cause of death, while tuberculosis fell from 6th to 10th position in the ranking.

The GBD Study also presented rankings for years lived with disability, among which asthma ranked 13th worldwide in 1990 and 14th in 2010, while COPD ranked 6th in 1990 and 5th in 2010. When premature deaths and disability were combined as DALYs lost, lower respiratory infections were ranked the leading cause worldwide in 1990, and the 2nd most important cause of DALYs lost in 2010. Also among the 25 most important causes were COPD (ranked 6th in 1990 and 9th in 2010), tuberculosis (ranked 8th in 1990 and 13th in 2010) and lung cancer (ranked 24th in 1990 and 22nd in 2010).

“*Each year in EU28 countries, lung diseases cause two-thirds of a million deaths, and at least 6 million hospital admissions, accounting for over 43 million in-patient bed-days*”

Deaths attributed to	Worldwide	WHO European Region
Ischaemic heart disease	7.3 million (12.8%)	2.40 million (24.7%)
Cerebrovascular disease	6.2 million (10.8%)	1.40 million (14.0%)
Lower respiratory infections	3.5 million (6.1%)	0.23 million (2.3%)
COPD	3.3 million (5.8%)	0.25 million (2.5%)
Diarrhoeal diseases	2.5 million (4.3%)	0.03 million (0.3%)
HIV/AIDS	1.8 million (3.1%)	0.08 million (0.8%)
Trachea/bronchus/lung cancer	1.4 million (2.4%)	0.38 million (3.9%)
Tuberculosis	1.3 million (2.4%)	0.08 million (0.8%)
Diabetes mellitus	1.3 million (2.2%)	0.17 million (1.7%)
Road traffic accidents	1.2 million (2.1%)	0.12 million (1.2%)

Table 1 – The 10 most common causes of death in 2008. Source: World Health Organization (WHO) World Health Statistics 2011.

DALYs lost to	Worldwide	WHO European Region
Lower respiratory infections	79 million (5.4%)	2.2 million (1.5%)
HIV/AIDS	65 million (4.4%)	2.6 million (1.8%)
Ischaemic heart disease	64 million (4.4%)	16.0 million (11.3%)
Diarrhoeal diseases	56 million (3.8%)	1.1 million (0.7%)
Cerebrovascular disease	48 million (3.3%)	9.3 million (6.4%)
Road traffic accidents	45 million (3.1%)	3.4 million (2.4%)
COPD	33 million (2.3%)	2.9 million (2.0%)
Tuberculosis	29 million (2.0%)	1.7 million (1.2%)
Diabetes mellitus	22 million (1.5%)	2.6 million (1.8%)
Trachea/bronchus/lung cancer	13 million (0.9%)	3.2 million (2.2%)

Table 2 – The 10 most common causes of disability-adjusted life-years (DALYs) lost worldwide in 2008. Source: World Health Organization World Health Statistics 2011.

These figures confirm that lung diseases have remained globally important causes of death and disability during the past two decades.

Where does the information come from?

This White Book includes all countries of the World Health Organization (WHO) European Region, which extends from the Atlantic coast to central Asia. The 28 countries of the European Union (EU28) have been distinguished for some presentational purposes. Within the EU28, 14 countries have reported data for both mortality and hospital admissions for recent years in a form that allows a detailed breakdown by respiratory condition. These 14 countries were selected for illustrative comparisons of disease burden in figures 3, 4, 8 and 9.

There are two main sources of Europe-wide data on hospital admissions: the WHO-Europe Hospital Morbidity Database (HMDB) and data from the European commission statistical agency, Eurostat. This publication uses information from HMDB where available, supplemented with Eurostat data. Data are available from the WHO database on hospital admissions (discharges and deaths), day-cases, and bed-days for 27 European countries. Eurostat supplies discharge data for 30 countries of which nine supplement the HMDB data. These are available for a limited set of conditions on the International Short Hospital Morbidity Tabulation (HMT). The non-HMT respiratory conditions, which comprise a small proportion of the total admissions for lung disease, are shown separately in figure 5, for countries where they are available.

Respiratory deaths in Europe

In the WHO European Region, the four most commonly fatal lung diseases accounted for one-tenth of all deaths and 7% of the DALYs lost in 2008 (tables 1 and 2). The proportion of deaths due to respiratory disease was higher among the 28 countries of the European Union (EU28) – 12.5% (661 000 deaths annually) – than among the remainder of the WHO European countries, where it was 7.5% (292 000 deaths annually).

The proportion of all deaths due to lung diseases is influenced by the age of the population, and the age-specific death rates from respiratory and nonrespiratory causes. If we concentrate solely on respiratory deaths (including lung cancer and pulmonary vascular disease) and adjust each country's mortality rates to the European Standard Population, then the age-standardised death rates are similar for EU28 and non-EU28 countries. However, within each of these groups of countries there is considerable international variation (figures 1 and 2).

Figure 1 maps the age-standardised death rates for respiratory causes in each European country in recent years. The same information is shown as a bar chart in figure 2. The highest rates tend to occur in parts of north-western Europe (Belgium, Denmark, Ireland, and the UK), central Europe (Hungary, Romania and Moldova) and some central Asian republics (Kazakhstan and Kyrgyzstan).

The specific respiratory conditions contributing to the toll of respiratory mortality in selected EU28 countries are illustrated in figure 3. The pattern is similar in the remaining EU28 countries. Over half of the respiratory deaths are due to lung

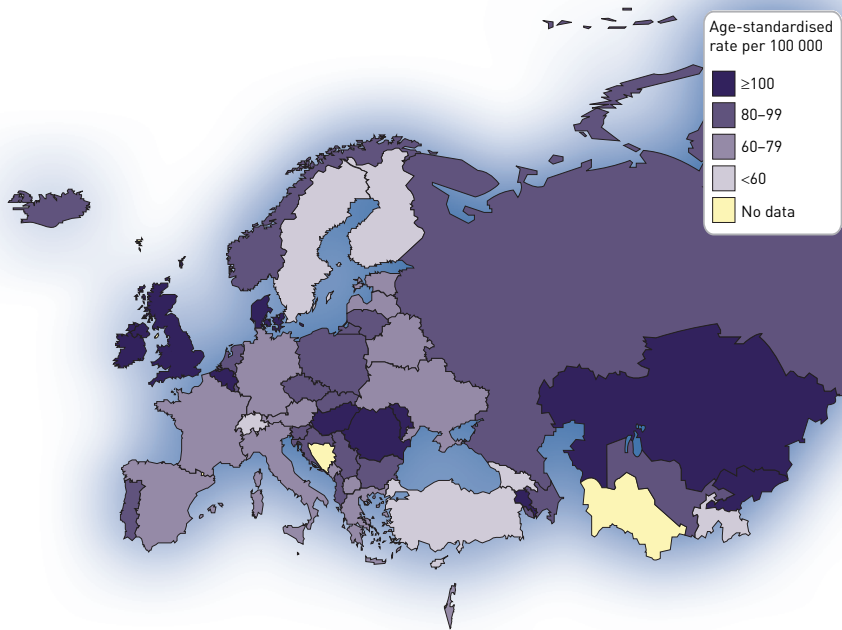


Figure 1 – Map of age-standardised mortality rates for all respiratory conditions. Source: World Health Organization World and Europe Detailed Mortality Databases, November 2011 update.

cancer or COPD, conditions that are mainly caused by tobacco smoking. Smoking is also a risk factor for pneumonia and pulmonary vascular disease, conditions which also contributed substantial fatalities.

The impact on health services

Information on hospital use for respiratory diseases is available for all EU28 countries except Greece, and for a few of the non-EU28 countries. However, some countries contribute information only on the most common conditions. Among European countries that report in greater detail, about 7% of all hospital admissions are due to lung disease.

The proportion of all hospital admissions contributed by specific lung diseases is illustrated in figure 4, for the same countries as selected for the equivalent presentation of deaths in figure 3. Almost half of respiratory admissions are attributable to acute infections (including pneumonia), and episodes of infection are often a cause of exacerbations of asthma and COPD. More than one quarter of respiratory admissions are due to lung cancer and COPD, diseases which are strongly related to smoking.

Age-standardised admission rates for lung diseases vary substantially within western and central Europe (figures 5 and 6), showing some similarity of geographical pattern to that for mortality, but also important differences. Thus, while some high-mortality countries (such as Belgium, Hungary, Ireland and Romania) also have relatively high respiratory admission rates, there are countries with high mortality but below-average admission rates (such as the UK), and others with low or average mortality rates but high admission rates (for example, Austria and Lithuania).

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*The burden
of lung disease
in Europe
remains as
large today as
it was at the
turn of the
millennium,
and is likely to
remain so for
several
decades*
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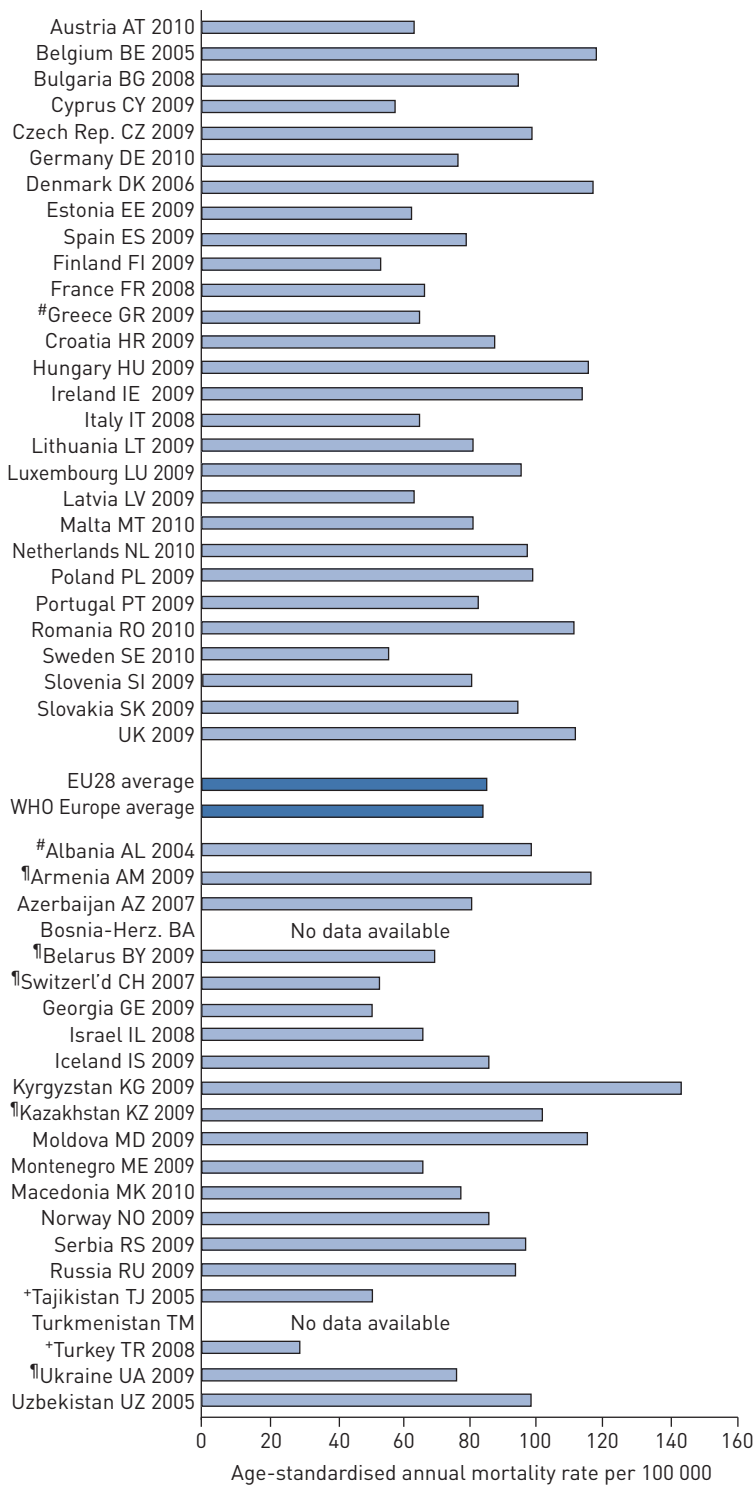


Figure 2 – Age-standardised mortality rates for all respiratory conditions, by country. #: International Classification of Diseases (ICD)-9 diagnoses; ¶: ICD-10 condensed list of diagnoses; *: ICD-9 condensed diagnoses or ICD-8 diagnoses. All other countries used full ICD-10 codes. Source: World Health Organization World and Europe Detailed Mortality Databases.

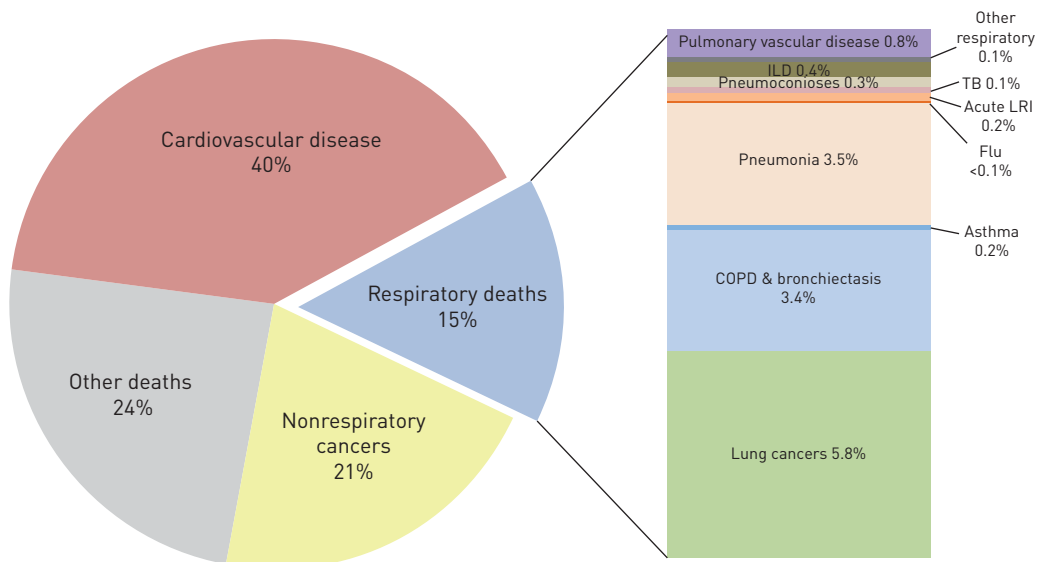


Figure 3 – Percentage of deaths in selected European Union countries, by respiratory condition. ILD: interstitial lung disease; TB: tuberculosis; LRI: lower respiratory infections; COPD: chronic obstructive pulmonary disease. The countries represented are those for which full ICD-10 coding of diagnoses was available for both hospital admissions and deaths (Austria, Croatia, Cyprus, Czech Republic, Denmark, Finland, Latvia, Lithuania, Luxembourg, Malta, Poland, Slovenia, Slovakia, UK). Source: World Health Organization World and Europe Detailed Mortality Databases.

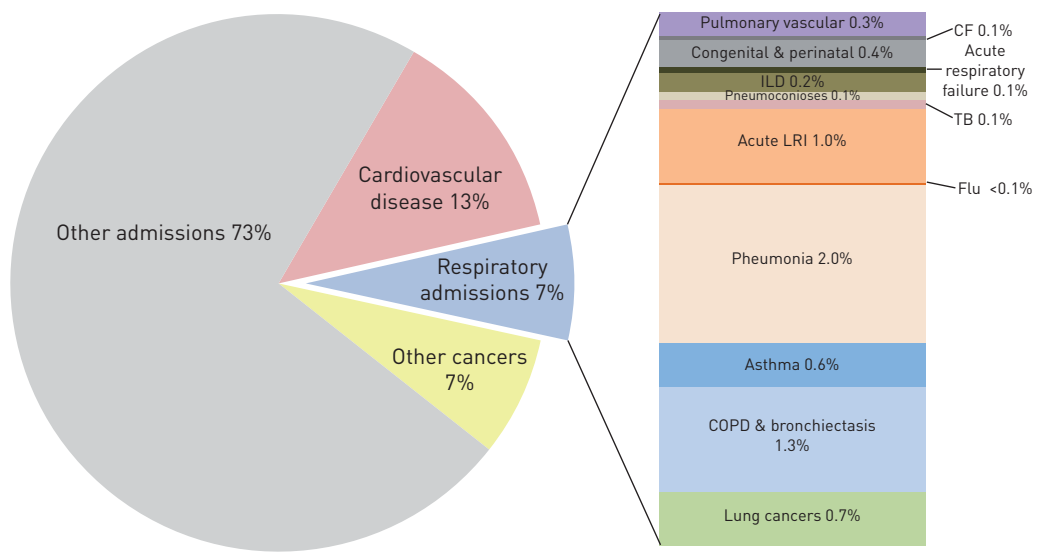


Figure 4 – Percentage of hospital admissions in selected European Union countries, by respiratory condition. CF: cystic fibrosis; ILD: interstitial lung disease; TB: tuberculosis; LRI: lower respiratory infections; COPD: chronic obstructive pulmonary disease. The countries represented are those for which full ICD-10 coding of diagnoses was available for both hospital admissions and deaths (Austria, Croatia, Cyprus, Czech Republic, Denmark, Finland, Latvia, Lithuania, Luxembourg, Malta, Poland, Slovenia, Slovakia, UK). Source: World Health Organization Hospital Morbidity Database and Eurostat.

The “iceberg of disease”

National mortality and hospital utilisation statistics present an incomplete picture of the burden of lung disease. Variations in disease coding and death certification may lead to spurious international differences, and for many diseases, hospital admissions and deaths are only the “tip of the iceberg”.

“ More than half of all the deaths from lung disease in Europe, and at least one-quarter of all respiratory hospital admissions, are due to diseases caused by smoking ”

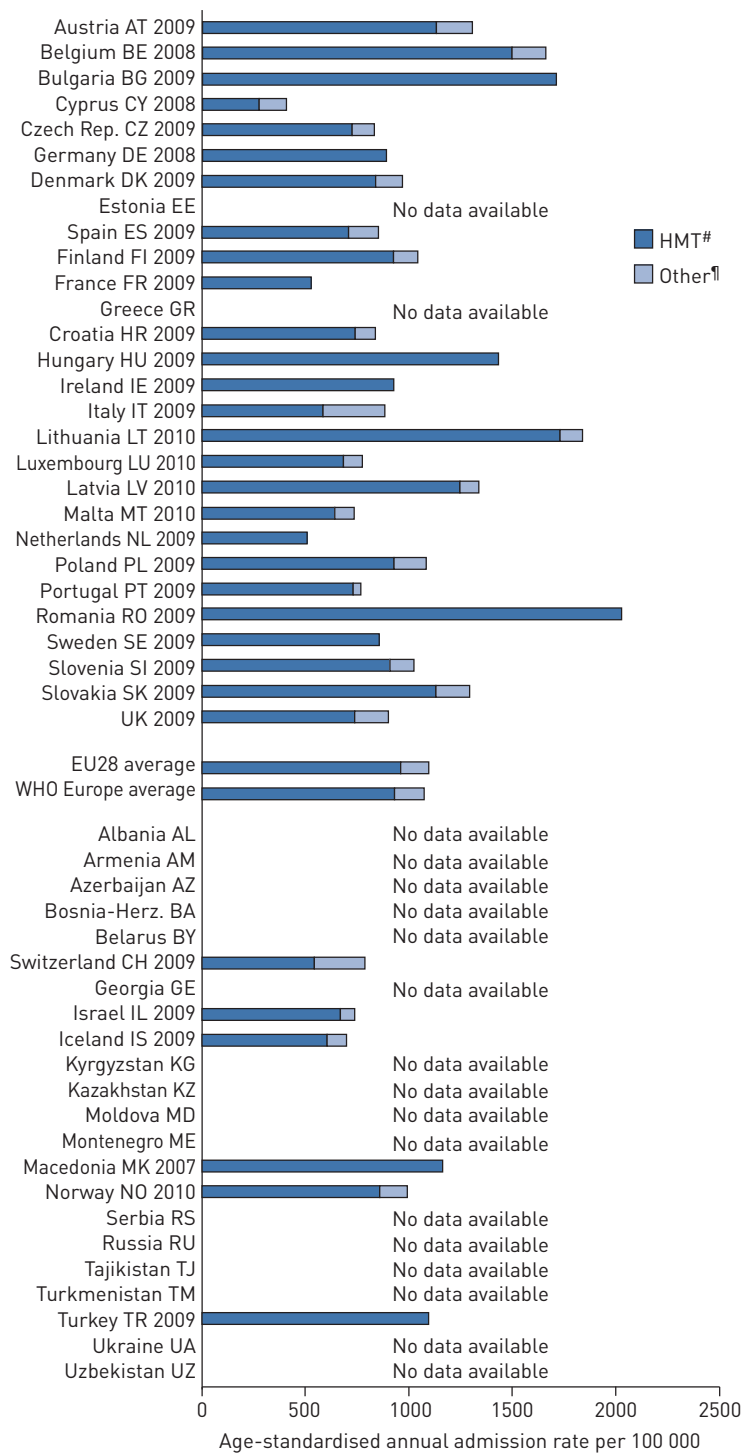


Figure 5 – Age-standardised admission rates for all respiratory conditions, by country. HMT: International Short Hospital Morbidity Tabulation. #: Asthma, COPD, bronchiectasis, acute lower respiratory infections, pneumonia, lung cancer, tuberculosis, pulmonary vascular disease; ¶: influenza, interstitial lung disease, cystic fibrosis, congenital respiratory disease, pneumoconioses, mesothelioma. Source: World Health Organization Hospital Morbidity Database and Eurostat.

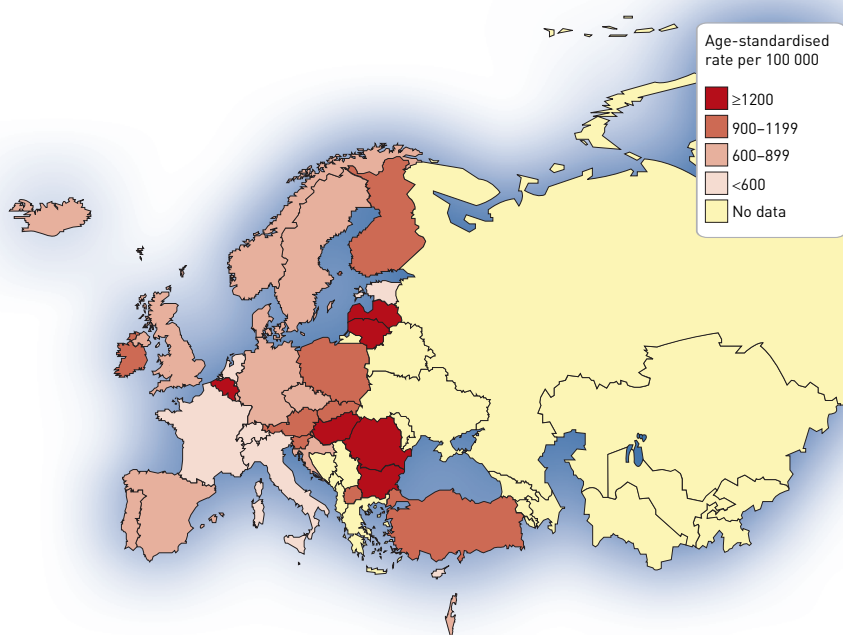


Figure 6 – Age-standardised admission rates for all respiratory conditions. The figure shows International Short Hospital Mortality Tabulation (HMT) categories only (as these are covered by both data sources, giving a wider comparable set of countries). Combined rates are shown for asthma, COPD, bronchiectasis, acute lower respiratory infections, pneumonia, lung cancer, tuberculosis and pulmonary vascular disease. Source: World Health Organization Hospital Morbidity Database (October 2011 update) and Eurostat (March 2012 update).

Sources of routinely collected data do not extend beyond deaths and hospital admissions for all respiratory conditions, but for some diseases it is possible to place the routine data into context against the frequency of the condition in the general population. Figure 7 summarises the burden of asthma, COPD, lung cancer and tuberculosis in EU28 countries, taking data from a range of sources for recent years.

These estimates highlight the widespread nature of obstructive lung disorders (asthma and COPD), for which a substantial proportion of patients are managed in the community and never reach hospital. In contrast, most new (incident) cases of lung cancer and tuberculosis come to the attention of hospital services. For tuberculosis, deaths represent only the tip of the iceberg, but for lung cancer, which is often rapidly fatal once diagnosed, the incidence and death rates are similar.

Recent trends

Over the first decade of the 21st century, age-standardised rates of mortality from lung diseases have declined across the EU, as illustrated for selected countries in figure 8. Similar trends have occurred for mortality in other EU countries. In contrast, there has been little change in the crude, unstandardised respiratory mortality rates for the same countries over this 10-year period, due to the ageing of the European population, and the tendency for mortality rates to be higher in the elderly. In non-EU countries, both crude and age-standardised mortality rates have changed little over the past decade.

Age-standardised rates of hospital admission have been stable in most countries (figure 9), and this pattern is similar for crude admission rates. The impact of lung diseases

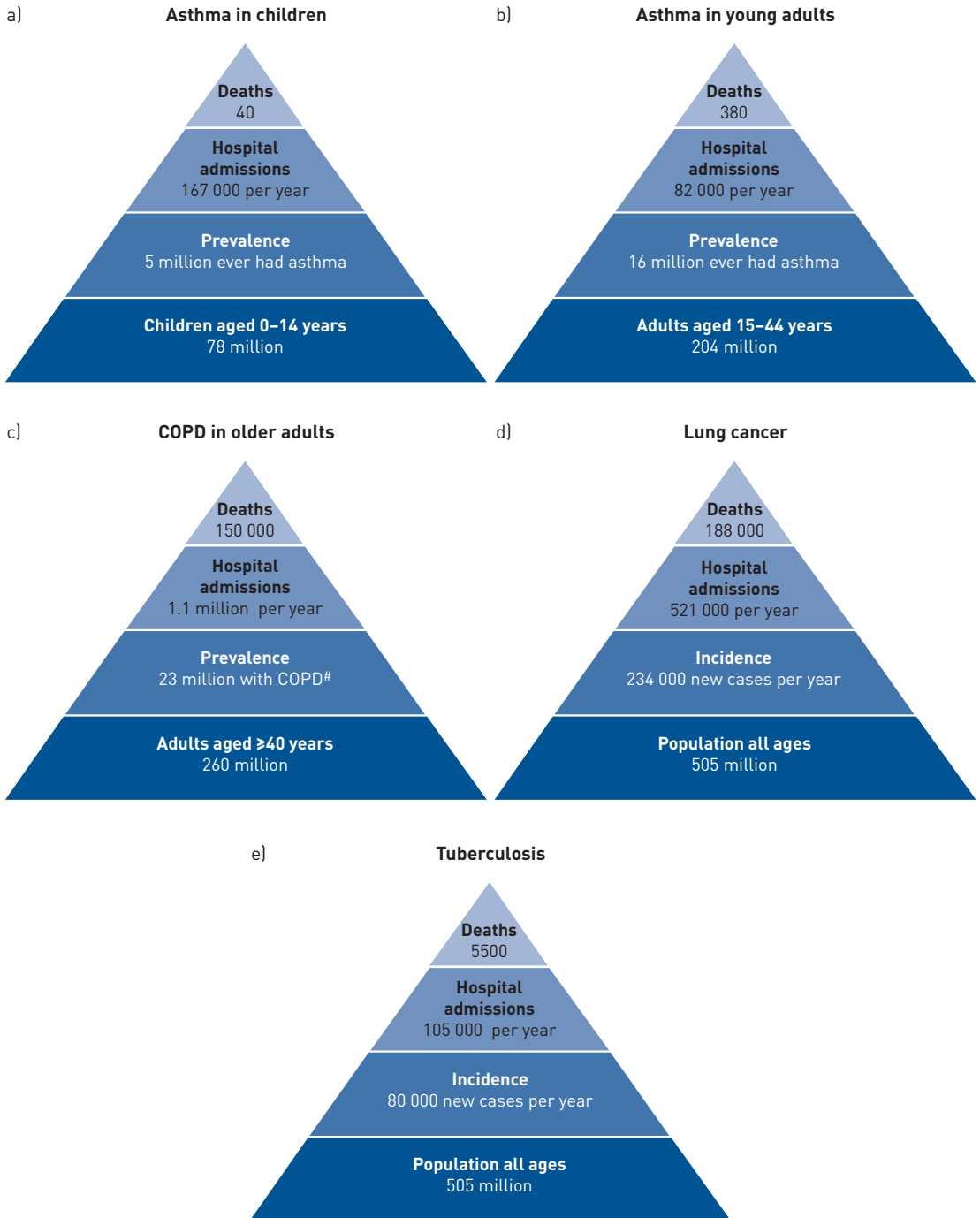


Figure 7 – The burden of various respiratory diseases, around 2010, in the 28 countries of the European Union. #: Global Initiative for Chronic Obstructive Lung Disease stages II–IV. An additional 17 million adults aged ≥40 years had stage I chronic obstructive pulmonary disease (COPD). Sources: BOLD study; EPISCAN study; European Cancer Observatory; ISAAC studies; World Health Organization (WHO) Detailed Mortality Database; WHO Hospital Morbidity Database; WHO Europe Surveillance Report; WHO World Health Survey.

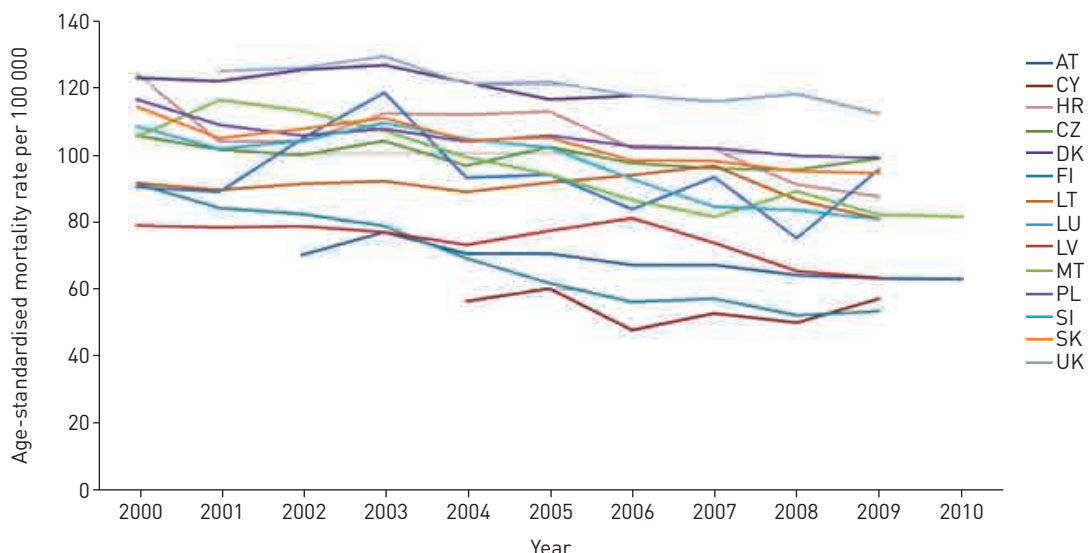


Figure 8 – Trends in age-standardised respiratory mortality rates in selected countries, 2000–2010. The countries represented are those for which full ICD-10 coding of diagnoses was available for both hospital admissions and deaths. Source: World Health Organization Detailed Mortality Database.

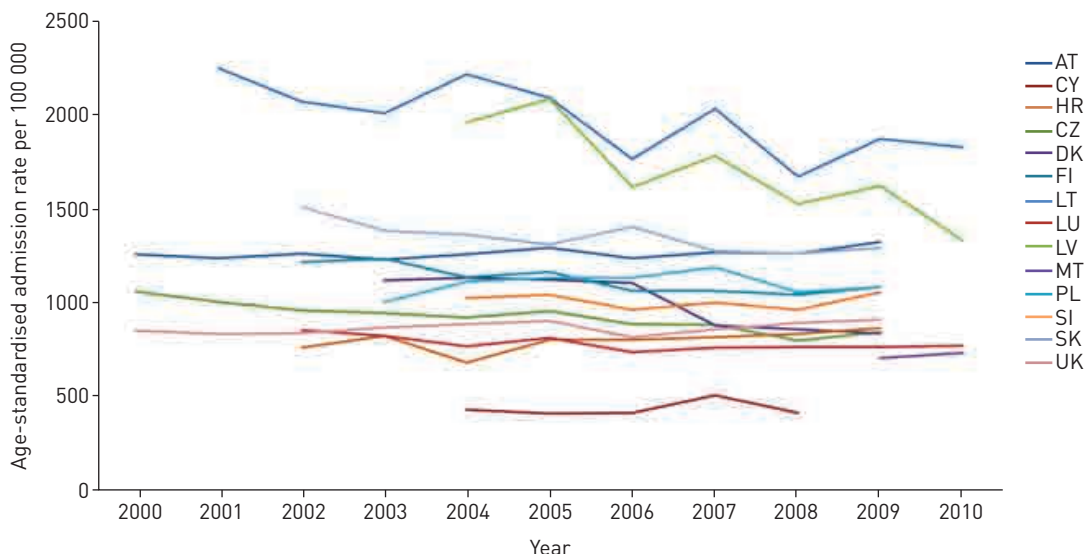


Figure 9 – Trends in age-standardised respiratory admission rates in selected countries, 2000–2010. The countries represented are those for which full ICD-10 coding of diagnoses was available for both hospital admissions and deaths. Source: World Health Organization Hospital Morbidity Database and Eurostat.

on in-patient health services has diminished substantially only in Latvia and Lithuania, countries which formerly had high rates.

One of the factors underlying the decline in age-standardised rates of mortality and hospital admissions is the generally favourable trend in smoking over the past four decades, at least in western European states (figure 10). Nevertheless, higher rates of smoking in earlier years contribute to the burden of lung disease now, and will continue to do so for several decades. There is still considerable room for improvement, both among men and women, and in several countries smoking rates in women have changed little over the past 20 years (figure 10b).

Percentage of deaths worldwide	2008	2015	2030
Lower respiratory infections	6.1	5.5	4.2
COPD	5.8	6.6	8.6
Trachea/bronchus/lung cancer	2.4	2.8	3.4
Tuberculosis	2.4	1.6	3.4
Percentage of deaths in WHO European region	2008	2015	2030
Lower respiratory infections	2.3	2.2	1.9
COPD	2.5	2.7	3.2
Trachea/bronchus/lung cancer	3.9	3.9	4.1
Tuberculosis	0.8	0.7	0.4

Table 3 – Projected proportion of deaths due to leading respiratory causes. COPD: chronic obstructive pulmonary disease. Source: World Health Organization World Health Statistics 2011.

Percentage of DALYs worldwide	2008	2015	2030
Lower respiratory infections	5.4	4.6	3.2
COPD	2.3	2.7	3.8
Trachea/bronchus/lung cancer	0.9	1.0	1.4
Tuberculosis	2.0	1.6	1.1
Percentage of DALYs in WHO European region	2008	2015	2030
Lower respiratory infections	1.5	1.3	1.0
COPD	2.0	2.0	2.2
Trachea/bronchus/lung cancer	2.2	2.2	2.6
Tuberculosis	1.2	1.1	0.6

Table 4 – Projected disability-adjusted life-years (DALYs) lost due to leading respiratory causes. COPD: chronic obstructive pulmonary disease. Source: World Health Organization World Health Statistics 2011.



Future projections

By 2030, the WHO estimates that the four major potentially fatal respiratory diseases (pneumonia, tuberculosis, lung cancer and COPD) will account for about one in five deaths worldwide, compared to one-sixth of all deaths globally in 2008. Within the WHO European Region, the proportion is expected to remain stable at about one-tenth of all deaths, with an increase in COPD and lung cancer deaths balancing a decline in deaths from lower respiratory infections and tuberculosis (tables 3 and 4).

Although asthma causes few deaths, it is an important cause of disability. There are no well-informed projections of the future burden of asthma, but in many

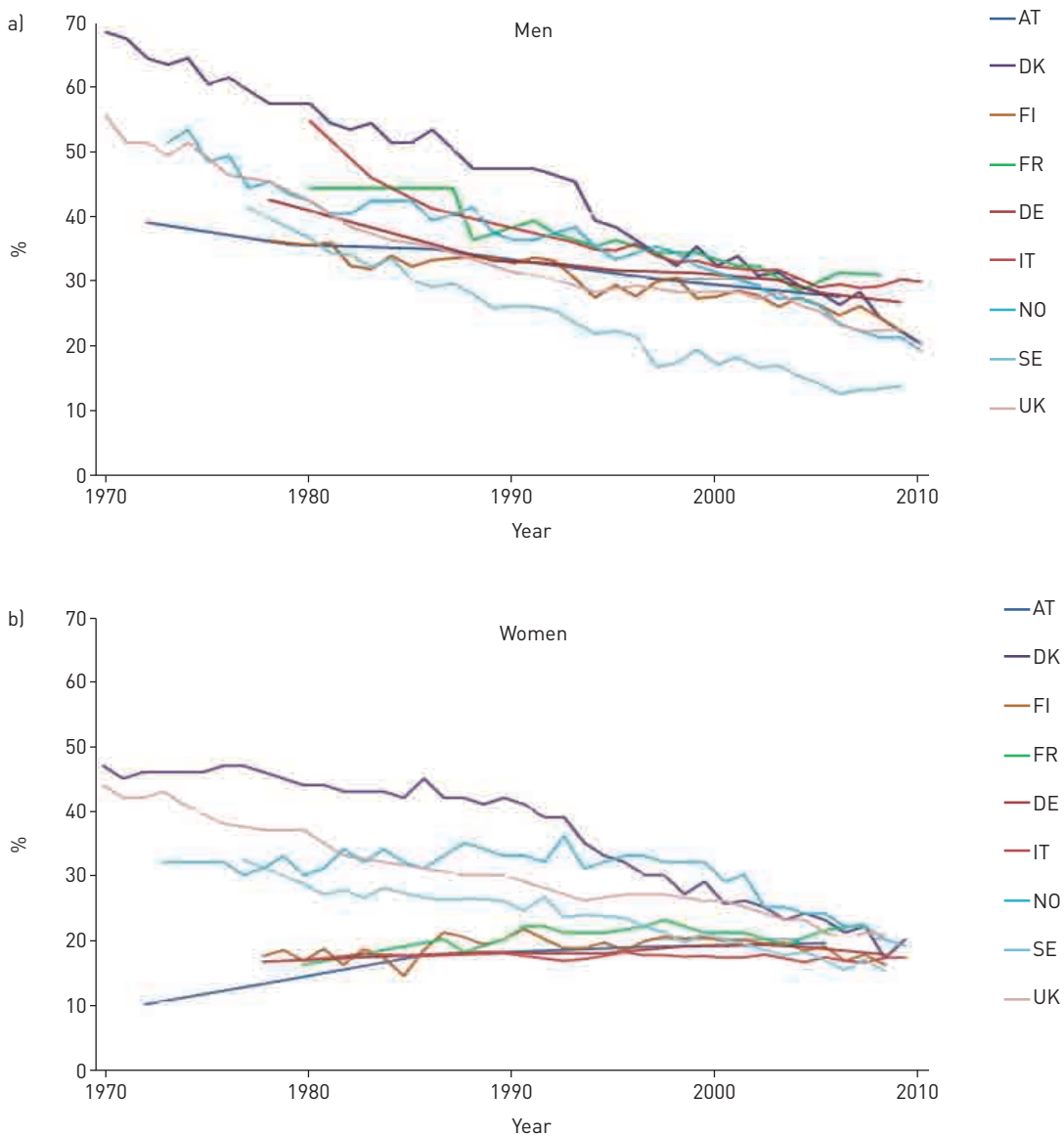


Figure 10 – Trends in daily smoking prevalence among a) men and b) women in selected countries, 1970-2010. Source: Organisation for Economic Co-operation and Development StatExtracts.

European countries the prevalence of childhood wheezing increased between the late 1990s and the early 2000s, as measured by the International Study of Asthma and Allergies in Childhood (ISAAC). Whether these trends continue, or are matched in older age-groups, is uncertain.

Respiratory diseases are therefore likely to remain a major burden on European societies for decades to come. Both the prevention and treatment of lung diseases will need to be improved if their impact on longevity and quality of life of individuals, and their economic burden on society, are to be reduced in Europe and worldwide.

Terminology and data

Prevalence

The prevalence of a disease measures the number of cases of existing disease in the population at a given time, or over a period such as the past 12 months. It is calculated as the number of people with the disease divided by the total population, and is usually expressed as a percentage. Age- and sex-specific prevalences can also be calculated. The prevalence of a disease can be difficult to measure directly as these data are usually not collected routinely. In this book, we present information for a number of countries on the prevalence of asthma and COPD derived through multi-centre cross-sectional surveys which have used the same methodology. Data on some other conditions, such as cystic fibrosis and occupational lung diseases, are available through local or national registries.

Incidence

The incidence of a disease measures the number or rate of new cases of disease occurring in the population, over a specified period such as 12 months. Annual incidence is calculated as the number of new cases of a disease occurring in 12 months divided by the population who were disease-free at the beginning of the period. Incidence can be hard to measure, as it involves knowing who was disease-free at the beginning of the period. Incidence data for lung cancer, tuberculosis and certain occupational diseases are available through routine data collection sources and are usually related to an estimate of the mid-year population. Incidence data for other diseases and conditions are sparse.

Mortality

Deaths are coded to an underlying cause using conventions established by the WHO's International Classification of Diseases (ICD). Mortality data are available for European countries coded under the ICD-10, ICD-9 and ICD-8 revisions. In the data presented here, most countries used ICD-10 coding, usually individual ICD-10 codes, although a few used one of two ICD-10 condensed lists or an ICD-9 condensed list and Turkey used an ICD-8 condensed list. A list of the required respiratory conditions with ICD-10 codes was drawn up and a mapping exercise carried out to ascertain the equivalent ICD-9 and ICD-8 codes. The World Detailed Mortality Database (World DMDB, November 2011 update) was used as the primary source and numbers of deaths and corresponding populations by year, sex and 5-year age-group for 50 European countries were extracted. For each country, the latest available year of data was used (2005–2010). No data were available for Bosnia & Herzegovina, and no recent data were available for Turkmenistan (latest available 1998). For countries not reporting by individual ICD-10 codes, data for some conditions, such as asthma and COPD, were not available. To increase coverage, the WHO Europe Detailed Mortality Database was also downloaded (Europe DMDB, last accessed February 2012) as this database contains deaths coded by individual ICD-9 codes.

Hospital admissions

Admissions are episodes of hospital in-patient care, classified by ICD coding on discharge. They are a measure of health service utilisation and reflect local medical care practices, data coding and recording patterns as well as the epidemiology of the conditions described. Since admissions are a complex outcome (measuring episodes or patients, including or excluding transfers and emergency admissions and sometimes covering multiple comorbidities), in this book we present admissions data from two large international databases – the WHO Europe Hospital Morbidity Database (HMDB) and data from the European Commission statistics agency, Eurostat – for greater comparability. This publication uses information from HMDB where available, supplemented with Eurostat data. Data are available from the WHO database on hospital admissions (discharges and deaths), day-cases, and bed-days for 27 European countries. Eurostat supplies discharge data for 30 countries of which nine supplement the HMDB data. These are available for a limited set of conditions on the International Short Hospital Morbidity Tabulation (HMT). For some countries in the Eurostat database (Bulgaria, Estonia, Romania, Sweden), data are only available for all ages combined so for these countries, admission rates for age-specific conditions (childhood and adult asthma, paediatric respiratory disease and acute lower respiratory infections in adults) are not available.

Age-standardised rates

In this book, most of the country-specific hospital admission and mortality rates presented are age-standardised to the European Standard Population. The age-standardised rate for a particular disease or condition is calculated by applying the country's age-specific rates to the standard population. This enables comparisons to be made between countries with different age-structures and time-periods. As some conditions vary with age, countries with a relatively high proportion of elderly people might have proportionately more cases. The European Standard Population is the same for males and females.

Data sources



Analyses, interpretations and conclusions are the responsibility of the authors and not the World Health Organization.

Mortality

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