Avoidable mortality in the UK QMI

Quality and Methodology Information for avoidable mortality in the UK, detailing the strengths and limitations of these data, methods used and data uses and users.

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Next release: To be announced

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1. Methodology background

<table>
<thead>
<tr>
<th>National Statistic</th>
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</table>

**Data collection**  
Death Registrations

**Frequency**  
Annual

**How compiled**  
Administrative data processing

**Geographic coverage**  
UK (England, Wales, Scotland, Northern Ireland)

**Related publications**  
Socioeconomic inequalities in avoidable mortality

2. About this Quality and Methodology Information report

This quality and methodology information report contains information on the quality characteristics of the data (including the European Statistical System five dimensions of quality) as well as the methods used to create it.

The information in this report will help you to:

- understand the strengths and limitations of the data
- learn about existing uses and users of the data
- understand the methods used to create the data
- help you to decide suitable uses for the data
- reduce the risk of misusing data

3. Important points

- **Avoidable mortality in the UK** presents statistics on the number of avoidable deaths and the age-standardised mortality rates by sex and cause of death for the UK and its constituent countries.

- Additional statistics are also presented for England and Wales for standardised years of life lost (SYLL) and number of deaths and mortality rates by sub-national areas.

- The deaths included in the avoidable mortality definition are defined using the **International Classification of Diseases, 10th Revision (ICD-10)**.

- With advances in medical technology and wider public health interventions, deaths from conditions previously not avoidable may have since become avoidable which means the avoidable mortality definition requires review, and if appropriate, revisions.

- The statistics are compiled using information supplied when a death is registered.

- Avoidable mortality data for England and Wales are held by ONS and data for Scotland and Northern Ireland are supplied by **National Records of Scotland** and the **Northern Ireland Statistics and Research Agency** respectively.
4. Quality summary

Overview

It is widely accepted that the contribution of healthcare to improvements in population health ought to be quantified. Avoidable mortality, which is based on the concept that premature deaths from certain conditions should be rare and ideally should not occur in the presence of timely and effective healthcare, is used as an indicator to measure this contribution.

With advances in medical technology and wider public health interventions, deaths from a condition previously not avoidable may have since become avoidable. This means that when the avoidable mortality definition is updated, it may not be appropriate to reproduce previously published data using the revised definition. For this reason, the data series begins in 2014 when the new avoidable mortality definition was introduced. Previously published data have not been reproduced using the revised avoidable mortality definition.

Avoidable mortality was not intended to serve as a definitive source of evidence of differences in effectiveness of healthcare systems. While a specific condition can be considered avoidable, this doesn’t mean that every death from that condition could be averted. This is because factors such as lifestyle, age, disease progression at diagnosis and potential existence of other medical conditions are not considered. Instead, this measure was designed to highlight areas of potential weaknesses in healthcare that could benefit from further in-depth investigation. Therefore, a degree of caution is recommended when interpreting the data.

Uses and users

This data is used as a high-level outcome measure of the performance of health systems in terms of prevention and health care interventions. Statistics on avoidable mortality are used by central government, Public Health England, Public Health Wales, NHS England, NHS Wales, academia and charitable organisations working to reduce the prevalence of specific diseases and conditions deemed to be avoidable causes of death. Avoidable deaths also provide context to the success of primary preventative actions aimed at reducing risk factors for disease, such as smoking, in the population as well as indicating the quality and timeliness of healthcare interventions, such as by-pass surgery.

The Department of Health and Social Care use these statistics as a means to determine progress in reducing the prevalence of preventable ill-health, premature death, and the gap between local authorities. Public Health England use preventable mortality, a subset of avoidable mortality, as an indicator in its Public Health Outcomes Framework. The measure of avoidable mortality across local authorities in England and Wales enables local administrations to benchmark themselves against national and regional norms, and use it as an outcome measure against local interventions aimed at reducing avoidable deaths.

NHS England include two measures of amenable mortality, a subset of avoidable mortality, in their Outcomes Framework, based on the definition of avoidable mortality developed by ONS.

In the UK, charitable organisations such as the Hepatitis C Trust, the British Lung Foundation and the British Association for the Study of the Liver have submitted requests for the conditions or diseases they campaign about included in the list of causes of death considered avoidable. It is anticipated that inclusion of these conditions on the cause list would draw increased attention towards them and allow comparisons of trends to be made against other conditions.

The European Union has funded a project Avoidable mortality in the European Union: Towards better indicators for the effectiveness of health systems (AMIEHS, 2011), which aims to develop a list of indicators (causes of death) for which mortality rates are likely to reflect variations in the effectiveness of healthcare, as defined by primary care, hospital care and personalised health services. To date, the project has developed an ATLAS containing trends in mortality for 45 possible amenable causes.
Similarly, the Office for Economic Co-operation and Development (OECD) published a working paper in 2011 Mortality amenable to healthcare in 31 OECD countries: estimates and methodological issues. The study assessed the feasibility of using amenable mortality as an indicator of the performance of healthcare systems in OECD countries, concluding that the potential for this indicator for cross-country comparisons of healthcare effectiveness is very high providing the UK with a benchmark on its success at tackling risk factors for disease and treating conditions manifest. Since then, the UK has participated in an OECD working group aiming to produce an international harmonised definition of avoidable mortality to improve international comparability in the future.

**Strengths and limitations**

**Strengths**

- Avoidable mortality in the UK is compiled using information supplied when a death is registered, which gives complete population coverage and ensures the estimates are of high precision and representative of the underlying population at risk.

- Coding for cause of death is carried out according to the World Health Organisation (WHO) ICD-10 and internationally agreed rules.

- The use of standardised automated coding software and the application of an agreed definition of avoidable, preventable and amenable mortality means the underlying data on cause of death are robust.

- Statistics on avoidable mortality are presented based on the year these deaths were registered rather than the year of occurrence; this method is used because there is a requirement for consistent and timely data, despite a potential limitation in data quality caused by registration delays.

- Estimates are comparable between local administrations and over time at national and sub-national level.

- We report two statistical measures, age-standardised rates and age-standardised years of life lost: Age-standardisation is undertaken using the European Standard Population 2013 (Word, 206KB); Age-standardisation weights data according to its age structure, thereby enabling populations with different age structures to be compared validly.

- The combining of constituent country data means we can produce a UK-level release, which has greater usability among international bodies such as OECD and Eurostat, as well as having the flexibility for constituent country benchmarking in a devolved health policy landscape.

**Limitations**
• Data is insufficiently robust to provide local authority estimates for single years, and must be aggregated over three years; this means the timeliness of non-overlapping time periods to make judgements on health improvement is limited.

• In a very small number of cause of death breakdowns, the number of deaths is either too small to report an age-standardised rate or too small to report a rate with reliability.

• It is our practice not to calculate rates based on such small numbers, as they are imprecise and susceptible to inaccurate interpretation; age-standardised rates based on 10 to 19 deaths are marked with a “u” to warn users that their reliability is low.

• As the definition of avoidable mortality requires review as new insights are gleaned about risk factors for disease and the state of health care technology to treat conditions improves, the ability to conduct time series analyses is constrained; we currently have a time series extending back to 2014 under the latest definition and 2001 under the previous definition.

• As certain causes of death contained within the definition of avoidable mortality are both preventable, and amenable to healthcare, it is not possible to mutually exclusively determine the proportion of avoidable deaths which are preventable through wider public health actions and which are amenable to health care once the condition has manifested and therefore no longer preventable.

Recent improvements

The bulletin was extended to cover the UK in the 2016 release. This has provided users with the means to compare avoidable mortality and cause of death breakdowns for each constituent country, an advantage in a devolved health policy landscape.

We extended the coverage to sub-national areas of England and Wales for the 2016 release for tracking health improvement on these measures and reporting spatial variations. Local authorities have a remit for public health and a measure of preventable mortality is useful to track the impact of local public health actions to tackle the wider determinants of diseases.

We also included Clinical Commissioning Groups in England and Health Boards in Wales to provide a measure of amenable mortality, which is a high-level outcome measure of timely and effective health care.

We have streamlined the bulletin by removing a section describing years of life lost from causes of death considered avoidable. Standardised years of life lost remain accessible in the data tables accompanying the release.

5 . Quality characteristics of the avoidable mortality data

Relevance

The concept of avoidable mortality was first introduced by Rutstein and others in the 1970s who argued that, in order to develop effective indicators of healthcare, lists of diseases which should not (or only infrequently) give rise to death or disability should be drawn up.

Rutstein also noted that the list of conditions considered to be avoidable would need to be updated in light of improvements in medical knowledge and practice, as well as social and environmental changes. Although avoidable mortality has been researched for the last three decades, there is little consensus among researchers about how to define it.
The list of causes of death used in defining avoidable mortality is primarily based on the cause lists produced by Nolte and McKee (2004) and Page, Tobias and Glover (2006). These cause lists were updated and amended to make them more relevant to the UK and to take account of more recent developments in healthcare public health policy. Changes to these lists were influenced by Wheller and others (2007), AMIEHS (2011) and views of respondents to the 2011 and 2015 consultations.

The measures of avoidable, preventable and amenable mortality represent a high-level outcome measure of the performance of health systems in terms of prevention and health care interventions.

**Accuracy and reliability**

Mortality statistics achieve 100% coverage, as it is a legal requirement that all deaths are registered. However, in some cases the registration of a death may not take place in the same calendar year as the death occurred. This is most likely to occur in cases where the death is referred to a coroner and an inquest is held. Deaths are referred to a coroner in cases where the cause of death is unknown, where the deceased was not seen by a doctor before or after death or where the death was violent, unnatural or suspicious. If the coroner chooses to hold an inquest, the death can only be registered once the inquest has taken place.

The accuracy of mortality statistics is dependent on the quality of information supplied when the death is registered. An incorrect underlying cause of death may be provided by the doctor completing the death certificate. Many thousands of practicing doctors’ complete death certificates and the nature and amount of training they have had in death certification varies greatly. Inaccurate information may also be supplied by the informant (usually a relative of the deceased) who must use the death certificate to register the death with the registrar. It is not possible to measure the magnitude of errors such as these.

Further information about the process involved in death registration and the checks carried out on the data we hold to ensure their quality can be found in Mortality statistics QMI and in the Methods used to produce the avoidable mortality data section within this report.

**Coherence and comparability**

Avoidable mortality statistics are based on death registrations data. We hold data for England and Wales and data for Scotland and Northern Ireland are supplied by the National Records of Scotland (NRS) and Northern Ireland Statistics and Research Agency (NISRA), respectively. NRS and NISRA produce annual updates on number of avoidable deaths using the same definition as ONS.

Deaths of non-residents are included in the figures for England and Wales combined, but excluded for England and Wales when presented separately. Therefore, the sum of the number of deaths in England and Wales separately does not equal the figure for England and Wales combined. Deaths of non-residents are excluded for Northern Ireland but included for Scotland. As such, for reasons of comparability, our UK estimate of avoidable mortality includes non-residents of England, Wales and Scotland. In the UK, causes of death are coded according to the International Classification of Diseases (ICD) produced by the World Health Organisation (WHO).

The European Union have aligned their definition of avoidable mortality with the UK definition and therefore there is scope to make comparisons with other European Union nations. However, variant definitions are used internationally, which the OECD is addressing through efforts to agree an internationally recognised definition.

As the avoidable mortality definition is subject to change over time, the scope for comparable data over long time frames using the same definition is hindered. However, given that knowledge of preventative actions grows and healthcare technology improves, causes of death previously not considered avoidable may become avoidable in future.
Accessibility and clarity

Our recommended format for accessible content is a combination of HTML webpages for narrative, charts and graphs, with data being provided in usable formats such as CSV and Excel. Our website also offers users the option to download the narrative in PDF format. In some instances, other software may be used, or may be available on request. Available formats for content published on the ONS website but not produced by the ONS, or referenced on the ONS website but stored elsewhere, may vary. For further information please refer to the contact details at the beginning of this document.

For information regarding conditions of access to data, please refer to the following links:

- Terms and conditions (for data on the website)
- Accessibility

In addition to this Quality and Methodology Information, basic quality information relevant to each release is available in the relevant statistical bulletin.

Timeliness and punctuality

The provisional date for the annual release of Avoidable mortality in the UK is pre-announced on the GOV.UK website and on the ONS release calendar 12 months in advance. The date is then finalised at least one month before publication. Statistics are published around February (14 months after the end of the reference period), following the release of the final annual death registrations data in November.

For more details on related releases, the GOV.UK website is available online and provides 12 months’ advance notice of release dates. In the unlikely event of a change to the pre-announced release schedule, public attention will be drawn to the change and the reasons for the change will be explained fully at the same time, as set out in the Code of Practice for Official Statistics.

Concepts and definitions

The first definition of avoidable mortality was developed in consultation with experts for the specific purpose of quantifying the number of avoidable deaths from 2001 onwards. This means that the causes of death are consistently defined using the International Classification of Diseases, 10th Revision (ICD-10).

The ICD-10 is the standard diagnostic tool for epidemiology, health management and clinical purposes. It is used to classify diseases and other health problems recorded on many types of health and vital records including death certificates and health records. In addition to enabling the storage and retrieval of diagnostic information for clinical, epidemiological and quality purposes, these records also provide the basis for the compilation of national mortality and morbidity statistics by WHO Member States. It is used for reimbursement and resource allocation decision-making by countries.

We plan to review and, if appropriate, revise the definition of avoidable mortality periodically to account for advancements in medicine and wider public health policy. Following such a review, we will not rebase published figures using the revised avoidable mortality definition. This is because deaths from the conditions listed in the definition have to be avoidable through the medical or wider public health context at the time of death.

In 2015 we conducted a public consultation to review the definition of avoidable mortality. Following this, a revised definition was published in May 2016 and from the data year 2014 onwards we have implemented this new definition.
The impact of this change was small when considering overall avoidable mortality rates, however for amenable mortality alone there was a significant increase in age-standardised mortality rates. This is in most part due to the reclassification of chronic obstructive pulmonary disorder as both amenable and preventable. Further information on the new definition and its impact on the reporting of avoidable mortality statistics can be found on the [ONS Review of Avoidable Mortality Definition](https://www.ons.gov.uk). As well as revising the existing definition, a new separate indicator of avoidable mortality in children and young people (aged 0 to 19 years) was developed.

The three concepts we report on in this bulletin are defined below:

**Avoidable mortality:** Avoidable deaths are all those defined as preventable, amenable, or both, where each death is counted only once. Where a cause of death falls within both the preventable and amenable definition, all deaths from that cause are counted in both categories when they are presented separately.

**Amenable mortality:** A death is amenable if, in the light of medical knowledge and technology at the time of death, all or most deaths from that cause (subject to age limits if appropriate) could be avoided through good quality healthcare.

**Preventable mortality:** A death is preventable if, in the light of understanding of the determinants of health at the time of death, all or most deaths from that cause (subject to age limits if appropriate) could be avoided by public health interventions in the broadest sense.
Table 1: Avoidable mortality definition for 2014 onwards
<table>
<thead>
<tr>
<th>Condition group and cause</th>
<th>ICD-10 codes</th>
<th>Age</th>
<th>Amenable</th>
<th>Preventable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infections</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intestinal infectious diseases</td>
<td>A00-A09</td>
<td>0-14</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>A15-A19, B90</td>
<td>0-74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selected invasive bacterial and protozoal infections</td>
<td>A38-A41, A46, A48.1, B50-B54, G00, G03, J02, L03</td>
<td>0-74</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Hepatitis C</td>
<td>B17.1, B18.2</td>
<td>0-74</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Pertussis (whooping cough)</td>
<td>A37</td>
<td>0-14</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Measles</td>
<td>B05</td>
<td>1-14</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Rubella</td>
<td>B06</td>
<td>0-14</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Other infections (Diphtheria, Tetanus, Poliomyelitis and Varicella)</td>
<td>A35, A36, A80, B01</td>
<td>0-74</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>B20-B24</td>
<td>All</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td><strong>Neoplasms</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malignant neoplasm of lip, oral cavity and pharynx</td>
<td>C00-C14</td>
<td>0-74</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Malignant neoplasm of oesophagus</td>
<td>C15</td>
<td>0-74</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Malignant neoplasm of stomach</td>
<td>C16</td>
<td>0-74</td>
<td>•</td>
<td></td>
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<tr>
<td>Malignant neoplasm of colon and rectum</td>
<td>C18-C21</td>
<td>0-74</td>
<td>•</td>
<td></td>
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<tr>
<td>Malignant neoplasm of liver</td>
<td>C22</td>
<td>0-74</td>
<td>•</td>
<td></td>
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<tr>
<td>Malignant neoplasm of trachea, bronchus and lung</td>
<td>C33-C34</td>
<td>0-74</td>
<td>•</td>
<td></td>
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<tr>
<td>Malignant melanoma of skin</td>
<td>C43</td>
<td>0-74</td>
<td>•</td>
<td></td>
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<tr>
<td>Mesothelioma</td>
<td>C45</td>
<td>0-74</td>
<td>•</td>
<td></td>
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<tr>
<td>Malignant neoplasm of breast</td>
<td>C50</td>
<td>0-74</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Malignant neoplasm of cervix uteri</td>
<td>C53</td>
<td>0-74</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Malignant neoplasm of bladder</td>
<td>C67</td>
<td>0-74</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Malignant neoplasm of thyroid gland</td>
<td>C73</td>
<td>0-74</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Hodgkin's disease</td>
<td>C81</td>
<td>0-74</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Condition</td>
<td>Code</td>
<td>Age Group</td>
<td>Entry Type</td>
<td></td>
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<tr>
<td>-----------------------------------------------------------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>Leukaemia</td>
<td>C91, C92.0</td>
<td>0-44</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Malignant neoplasm of testis</td>
<td>C62</td>
<td>0-74</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Malignant neoplasm of unspecified parts of uterus and body of uterus</td>
<td>C54-C55</td>
<td>0-44</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Benign neoplasms</td>
<td>D10-D36</td>
<td>0-74</td>
<td>•</td>
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</tr>
</tbody>
</table>

**Nutritional, endocrine and metabolic**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Code</th>
<th>Age Group</th>
<th>Entry Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes mellitus</td>
<td>E10-E14</td>
<td>0-74</td>
<td>•</td>
</tr>
<tr>
<td>Diseases of the Thyroid</td>
<td>E00-E07</td>
<td>0-74</td>
<td>•</td>
</tr>
<tr>
<td>Addison's disease</td>
<td>E27.1</td>
<td>0-74</td>
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</tr>
</tbody>
</table>

**Drug use disorders**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Code</th>
<th>Age Group</th>
<th>Entry Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol related diseases, excluding external causes</td>
<td>F10, G31.2, G62.1, I42.6, K29.2, K70, K73, K74 (excl. K74.3-K74.5), K86.0</td>
<td>0-74</td>
<td>•</td>
</tr>
<tr>
<td>Illicit drug use disorders</td>
<td>F11-F16, F18-F19</td>
<td>0-74</td>
<td>•</td>
</tr>
</tbody>
</table>

**Neurological disorders**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Code</th>
<th>Age Group</th>
<th>Entry Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epilepsy and status epilepticus</td>
<td>G40-G41</td>
<td>0-74</td>
<td>•</td>
</tr>
</tbody>
</table>

**Cardiovascular diseases**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Code</th>
<th>Age Group</th>
<th>Entry Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rheumatic and other valvular heart disease</td>
<td>I01-I09</td>
<td>0-74</td>
<td>•</td>
</tr>
<tr>
<td>Hypertensive diseases</td>
<td>I10-I15</td>
<td>0-74</td>
<td>•</td>
</tr>
<tr>
<td>Ischaemic heart disease</td>
<td>I20-I25</td>
<td>0-74</td>
<td>•</td>
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<tr>
<td>DVT with pulmonary embolism</td>
<td>I26, I80.1-I80.3, I80.9, I82.9</td>
<td>0-74</td>
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<tr>
<td>Cerebrovascular diseases</td>
<td>I60-I69</td>
<td>0-74</td>
<td>•</td>
</tr>
<tr>
<td>Aortic aneurysm and dissection</td>
<td>I71</td>
<td>0-74</td>
<td>•</td>
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</tbody>
</table>

**Respiratory diseases**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Code</th>
<th>Age Group</th>
<th>Entry Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza (including swine flu)</td>
<td>J09-J11</td>
<td>0-74</td>
<td>•</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>J12-J18</td>
<td>0-74</td>
<td>•</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disorder</td>
<td>J40-J44</td>
<td>0-74</td>
<td>•</td>
</tr>
<tr>
<td>Asthma</td>
<td>J45-J46</td>
<td>0-74</td>
<td>•</td>
</tr>
</tbody>
</table>
Selected respiratory diseases: J00-J06, J20-J22, J30-J39

Digestive disorders
- Gastric and duodenal ulcer: K25-K28
- Acute abdomen, appendicitis, intestinal obstruction, cholecystitis/lithiasis, pancreatitis, hernia: K35-K38, K40-K46, K80-K83, K85, K86.1-K86.9, K91.5

Genitourinary disorders
- Nephritis and nephrosis: N00-N07, N17-N19, N25-N27
- Obstructive uropathy and prostatic hyperplasia: N13, N20-N21, N35, N40, N99.1

Maternal and infant
- Complications of perinatal period: P00-P96, A33
- Congenital malformations of the circulatory system: Q20-Q28
- Spina Bifida: Q05

Unintentional injuries
- Transport Accidents: V01-V99
- Accidental Injury: W00-X59

Intentional injuries
- Suicide and self inflicted injuries: X60-X84, Y10-Y34
- Homicide/Assault: X85-Y09, U50.9
- Misadventures to patients during surgical and medical care: Y60-Y69, Y83-Y84

For most of the causes of death included in our avoidable definition there is an upper age limit of 74 years. This is because deaths at older ages are often difficult to attribute definitively to a single underlying cause and the chances of death are more affected by coexisting medical conditions and other factors.

It is important to note that our definition of avoidable mortality (Word, 657KB) is different to the measure of “avoidable deaths in hospital”: NHS trusts are required to publish figures on. We use a defined set of underlying causes of death that have been approved through consultation with users and expert guidance. It includes conditions where it is reasonable to expect deaths to be avoided through good quality health care, even after the condition has developed (amenable mortality), as well as those where it is possible to prevent the condition from occurring in the first place (incidence reduction) through wider public health interventions, such as those targeted at reducing the incidence of smoking (preventable mortality). The avoidable deaths in hospital measure is based on a record review of a sample of deaths deemed to be due to problems in care. Avoidable deaths in hospital data are not intended to be comparable and are not collated centrally.

Geography

The avoidable mortality for the UK release covers:
• UK and its constituent countries of England, Wales, Scotland and Northern Ireland
• lower tier local authorities in England
• clinical commissioning groups in England
• unitary authorities in Wales
• health boards in Wales

Output quality

Avoidable mortality in the UK is published 14 months after the reference period. The production of these statistics relies upon the availability of the annual death registrations data for each constituent country of the UK as well as the UK mid-year population estimates that we produce. Coding and quality assurance of death registration data is time-consuming and final figures for the whole of the UK are not available until several months after the reference period. For it to be published earlier, provisional data would need to be used and would need to subsequently revised. Users have not indicated that they are unhappy with this balance between timeliness and quality.

In England, Wales and Northern Ireland deaths should be registered within five days of the death occurring and within eight days in Scotland, but there are some situations that result in the registration of the death being delayed. Deaths considered unexpected, accidental or suspicious will be referred to a coroner who may order a post-mortem or carry out a full inquest to ascertain the reasons for the death.

Statistics on avoidable mortality are presented based on the year these deaths were registered rather than the year of occurrence. This method is used because there is a requirement for consistent and timely data, despite a potential limitation in data quality caused by registration delays. For the majority of the causes included in the avoidable mortality definition, deaths would be registered in the same year they occurred. However, for causes such as intentional injuries which were referred to a coroner for further investigation, deaths may not be registered in the same year they occurred.

Why you can trust our data

The User guide to mortality statistics provides detailed information on the processing and quality of mortality data for England and Wales. Internal consistency checks are conducted to eliminate any errors made during the recording of deaths, and to ensure the annual dataset is complete. Any concerns relating to cause of death are referred to a medical advisor or medical epidemiologist. For further information on mortality statistics in Scotland, please visit the National Records Scotland website, and for Northern Ireland, the Northern Ireland Statistics and Research Agency website.

In the compilation of these statistics, ONS itself independently determines the focus, content, commentary, illustration and interpretation of these measures presented in bulletins. We provide early access for quality assurance to a small number of people working in other government bodies. This is to acknowledge use of mortality data we do not own, in the case of Scotland and Northern Ireland, and for general comment on the plausibility of our findings.

6. Methods used to produce the avoidable mortality data
How we collect the data, main data sources and accuracy

Avoidable mortality in the UK is compiled using information supplied when a death is registered. A record for each death registered in England and Wales is held on the ONS Death Registrations Database while those registered in Scotland and Northern Ireland are held by National Records of Scotland and the Northern Ireland Statistics and Research Agency respectively. Further details about the information held on the ONS Death Registrations Database, as well as the methods used to quality assure the data can be found in the User Guide to Mortality Statistics.

The definition of avoidable deaths only includes those causes considered preventable or amenable to health care. The definition allows for consistent comparisons over time.

Age-standardised rates were not calculated where there were fewer than 10 deaths in a year. It is our practice not to calculate rates based on such small numbers, as they are imprecise and susceptible to inaccurate interpretation. Age-standardised rates based on 10 to 19 deaths are marked with a “u” to warn users that their reliability is low.

Age-standardised rates are calculated for local authorities in England and Wales, England’s Clinical Commissioning Groups (CCGs) and Health Boards in Wales. As the number of deaths for local authorities can be small, the data is published as three-year aggregates, for example, 2014 to 2016 to ensure higher data reliability. As the number of deaths is larger for CCGs and Welsh Health Boards, the data is published by single year.

Age-standardised rates and standardised years of life lost (SYLL) are published with 95% confidence intervals to allow users to identify significant differences between geographical areas, the sexes and over time. Significance is assigned on the basis of non-overlapping confidence intervals. As a general rule, if the confidence interval around an estimate overlaps with the interval around another, there is no significant difference between the two estimates. While more formalised and accurate methods of significance testing are available, the non-overlapping confidence interval method is used because it is both simple to calculate and easily understood.

Standard Error

In previous publications, the standard error for age-standardised rates was calculated using a simple approximation method as shown below. The standard error is denoted as SE(ASR) and calculated as:

$$SE(ASR) = \frac{ASR}{\sqrt{N}}$$

where:

- ASR is the age-standardised rate
- N is the total number of deaths in all age groups in each year

The age-standardised rate is a weighted sum of age-specific death rates where the age-specific weights represent the relative age distribution of the standard population (in this case the 2013 ESP). Therefore, it is more accurate to calculate its variance as the sum of the age-specific variances and to estimate its standard error as the square root of the variance as shown below.

$$SE(ASR) = \sqrt{\sum_i \left( w_i^2 \cdot \frac{r_i^2}{d_i} \right) / \left( \sum_i w_i \right)}$$
where:

- \( w_i \) is the number of individuals in the standard population in age group \( i \)
- \( r_i \) is the crude age-specific rate in the local population in age group \( i \)
- \( d_i \) is the number of deaths in the local population in age group \( i \)

The standard error calculation has now been modified so that it takes into account the variance of the weighted sum of age-specific rates.

**Confidence intervals**

The mortality data in this release are not subject to sampling variation as they were not drawn from a sample. Nevertheless, they may be affected by random variation, particularly where the number of deaths or probability of dying is small. To help assess the variability in the rates, they have been presented alongside 95% CIs.

The choice of the method used in calculating confidence intervals for rates will, in part, depend on the assumptions made about the distribution of the deaths data these rates are based on.

Traditionally, a normal approximation method has been used to calculate confidence intervals on the assumption that avoidable deaths are normally distributed. However, if the number of avoidable deaths is relatively small (fewer than 100), it may be assumed to follow a Poisson probability distribution. In such cases, it is more appropriate to use the confidence limit factors from a Poisson distribution table to calculate the confidence intervals instead of a normal approximation method.

The method now used in calculating confidence intervals for rates based on fewer than 100 deaths was proposed by Dobson and others (1991) as described in APHO, (2008). In this method, confidence intervals are obtained by scaling and shifting (weighting) the exact interval for the Poisson distributed counts (number of deaths in each year). The weight used is the ratio of the standard error of the age-standardised rate to the standard error of the number of deaths. The lower and upper 95% CIs are denoted as \( \text{ASR}_{\text{lower}} \) and \( \text{ASR}_{\text{upper}} \), respectively, and calculated as:

\[
\begin{align*}
\text{ASR}_{\text{lower}} &= \text{ASR} + (D_l - D) \cdot \sqrt{\frac{\nu(\text{ASR})}{\nu(D)}} \\
\text{ASR}_{\text{upper}} &= \text{ASR} + (D_u - D) \cdot \sqrt{\frac{\nu(\text{ASR})}{\nu(D)}}
\end{align*}
\]

Where:

- \( D_l \) and \( D_u \) are the exact lower and upper confidence limits for the number of deaths, calculated using confidence limit factors from a Poisson probability distribution table
- \( D \) is the number of deaths in each year
- \( \nu(\text{ASR}) \) is the variance of the age-standardised rate
- \( \nu(D) \) is the variance of the number of deaths

Where there are 100 or more deaths in a year the 95% confidence intervals for age-standardised rates are calculated using the normal approximation method shown below:
Where:

\[ ASR_{LL/UL} = ASR \pm 1.96 \cdot SE \]

Where:

- \( ASR_{LL/UL} \) represents the upper and lower 95% confidence limits, respectively, for the age-standardised rate

The standard error above also applies to the standardised years of life lost.

**How we process the data**

All deaths in England and Wales are coded by ONS according to the International Classification of Diseases, 10th Revision (ICD-10) produced by the World Health Organisation.

Avoidable deaths are all those defined as preventable, amenable (treatable) or both, where each death is counted only once. Where a cause of death is both preventable and amenable, all deaths from that cause are counted in both categories when they are presented separately.

The number of deaths where an avoidable condition was included as the underlying cause on the death certificate, by sex and age group (<1, 1-4, 5-9 to 90+) for England and Wales are extracted from the ONS Death Registrations Database. These data are combined with those for Scotland and Northern Ireland to produce statistics for the UK.

**How we analyse and interpret the data**

Two mortality indicators are presented in the annual bulletin – age-standardised mortality rates and age-standardised years of life lost (SYLL). SYLL is produced for England and Wales only.

Age-standardised mortality rates are calculated using the number of deaths and mid-year population estimates provided by our Population Estimates Unit. Information about the methods used to calculate mid-year population estimates can be found in the Methodology Guide for Mid-year Population Estimates.

Age-standardised mortality rates are calculated using the direct method of standardisation, while the 2013 European Standard Population (ESP) is used as the standard population. Age-standardised rates make allowances for the differences in the age structure of a population, over time and between sexes. The age-standardised rate for a specific cause of death is that which would have occurred if the observed age-specific rates for that cause had applied in the given standard population. In this method, the age-specific rates for each year are applied to a standard population structure to obtain the number of cases expected in each age group in the standard population. The numbers of expected cases are then added up across all age groups and divided by the total standard population to obtain a summary rate figure.

This Microsoft Excel template demonstrates how age-standardised rates and 95% confidence intervals are calculated.

Age-standardised rates are calculated as follows:

\[ \frac{\sum_i w_i r_i}{\sum_i w_i} \times 100,000 \]

where:
• \( i \) is the age group (<1, 1-4, 5-9, 10-14....85-89, 90+)

• \( w_i \) is the number, or proportion, of individuals in the standard population in age group \( i \)

• \( r_i \) is the observed age-specific rate in the subject population in age group \( i \), given by:

\[
r_i = \frac{d_i}{n_i}
\]

where:

• \( d_i \) is the observed number of deaths in the subject population in age group \( i \)

• \( n_i \) is the number of individuals in the subject population in age group \( i \)

We recommend the use of an abridged version of the ESP in the table with an upper age limit of 90 years and over. This is because official population denominators for the oldest age group in the ESP (95 years and over) are not available for all geographical area levels.
Table 2: The 2013 European Standard Population

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Population (number)</th>
<th>Abridged version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 1</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>1 to 4</td>
<td>4,000</td>
<td>4,000</td>
</tr>
<tr>
<td>5 to 9</td>
<td>5,500</td>
<td>5,500</td>
</tr>
<tr>
<td>10 to 14</td>
<td>5,500</td>
<td>5,500</td>
</tr>
<tr>
<td>15 to 19</td>
<td>5,500</td>
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<tr>
<td>20 to 24</td>
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<td>25 to 29</td>
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<td>30 to 34</td>
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<td>35 to 39</td>
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<td>45 to 49</td>
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<td>50 to 54</td>
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<td>55 to 59</td>
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<td>60 to 64</td>
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<td>65 to 69</td>
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<td>90 to 94</td>
<td>800</td>
<td>-</td>
</tr>
<tr>
<td>95 and over</td>
<td>200</td>
<td>-</td>
</tr>
<tr>
<td>90 and over</td>
<td>-</td>
<td>1000</td>
</tr>
<tr>
<td>Total</td>
<td>100,000</td>
<td>100,000</td>
</tr>
</tbody>
</table>

Source: Eurostat

SYLL is a measure of the number of years lost when a person dies prematurely from any cause. The basic concept underpinning SYLL is that deaths at younger ages are weighted more heavily than those at older ages. The advantage of doing this is that deaths at younger ages may be seen as less important if cause-specific death rates were used on their own in highlighting the burden of disease and injury. This is because conditions such as cancer and heart disease often occur at older ages and have relatively high mortality rates.

To enable comparisons between areas and over time, SYLL rates are calculated. These rates represent the years of life lost if the population of England and Wales had the same population structure as the 2013 ESP. SYLL rates are presented as years of life lost per 100,000 people.

SYLL is calculated as the sum of the mortality rate in each age group weighted by the number of years of life lost as indicated by remaining life expectancy for each age group. This is then standardised to the 2013 ESP as shown below:
\[
\text{SYLL Rate} = \frac{\sum_i \left( w_i \cdot \frac{a_i d_i}{n_i} \right)}{\sum_i w_i} \times 100,000
\]

where:

- \( i \) is the age group (<1, 1-4, 5-9, 10-14…85-89, 90+)
- \( d_i \) is the number of deaths in age group \( i \)
- \( a_i \) is the weight, or average age-specific period life expectancy in age group \( i \) for a given year
- \( n_i \) is the population in age group \( i \)
- \( w_i \) is the number of individuals in the standard population in age group

How we quality assure and validate the data

Quality assurance is carried out at all stages of production. Specific procedures include:

- independent extraction of base mortality and population data by two research officers
- independent analyses by two research officers and use of check sheets to match analyses before writing up results.
- reproducing estimates in the previous publication to ensure they match
- plausibility checking of new estimates through cross-referencing with past publications and more widely what we know about the general trend in mortality
- identification of outliers in sub-national estimates
- checks across cause of death components of the definition

How we disseminate the data

Avoidable mortality estimates are available online for the UK and its constituent countries, together with local administrations in England and Wales. A back series using the new definition is available from 2014.

Links from the release calendar make the release date and location of each new avoidable mortality release easy to locate. The bulletin can be downloaded free of charge as a PDF and the data tables in Microsoft Excel format. The underlying data for the charts and tables in the bulletin can be downloaded, while the digital interactive maps can be embedded into other media.

Other data not published on the web are available on request by emailing mortality@ons.gov.uk. Metadata describing the limitations of the data for more detailed tables are provided with each individual request. Most queries can be answered from the website datasets or supporting methods documents. Any additional enquires regarding avoidable mortality can be made by emailing mortality@ons.gov.uk.
How we review and maintain the data processes

The definition of avoidable mortality is regularly reviewed. We ran a public consultation in 2015 to review our definition of avoidable mortality. The aim of this consultation was to review and, if necessary, update the current definitions of avoidable mortality and associated age limits. In addition, we wanted to gather user perceptions about implementing a new avoidable mortality indicator for children and young people.

The definition of avoidable mortality evolves as new knowledge about the aetiology of disease is acquired and improvements to health technologies make certain conditions more amenable to health care intervention. We have a contract with a medical advisor who is an expert in the field of avoidable deaths and we are guided by the advisor as to when a review is pertinent.

We also liaise with Eurostat and nations within the OECD. Recently we have contributed our knowledge and expertise to an OECD-led working group brought together to develop a harmonised definition of avoidable mortality. Further reviews of the definition will be considered in light of the findings of that working group.

We also have an Avoidable Mortality Stakeholder Interest Group which we use as a sounding board for testing new ideas for inclusion in our bulletins. We will also use this group as an overseeing body in future reviews of the definition.

We published a summary of the responses we received to the consultation and we have now developed a revised avoidable mortality definition (Word, 284KB).

7. Other information

Here are some useful links to other sources of data on avoidable mortality.

Health at a Glance: OECD iLibrary

Amenable and preventable death statistics: Eurostat

Avoidable mortality: National Records of Scotland

Deaths: Northern Ireland Statistics and Research Agency

Review of avoidable mortality definition

Revised definition of avoidable mortality 2014 (Word, 657KB)

Impact of change to avoidable mortality definition (XLS, 211KB)

Avoidable mortality consultation 2015 (Word, 284KB)

Deaths registered in England and Wales

The avoidable mortality for the UK bulletin can be cited as:
ONS (year of publication): Avoidable mortality in the UK