

# 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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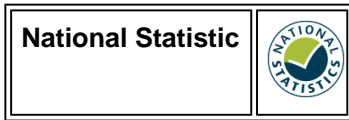
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# 1 . Methodology background



<b>Data collection</b>	Death Registrations
<b>Frequency</b>	Annual
<b>How compiled</b>	Administrative data processing
<b>Geographic coverage</b>	UK (England, Wales, Scotland, Northern Ireland)
<b>Related publications</b>	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 subnational 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.
- An Organisation for Economic Co-operation and Development (OECD) working group created a [harmonised avoidable mortality definition](#) to be used internationally; the Office for National Statistics (ONS) implemented this definition in 2020 for data years 2001 onwards.
- Avoidable mortality data for England and Wales are held by the 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.

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 does not 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

These data are used as a high-level outcome measure of the performance of health systems in terms of prevention and healthcare 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 (now known as treatable mortality), a subset of avoidable mortality, in their [Outcomes Framework](#).

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 (treatable) causes.

Similarly, the Organisation 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 (treatable) 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 to produce an [international harmonised definition of avoidable mortality](#) to improve international comparability in the future. This definition was implemented by the Office for National Statistics (ONS) in 2020 for data years 2001 onwards.

## 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 Organization (WHO) [International Classification of Diseases, 10th Revision \(ICD-10\)](#) and internationally agreed rules.
- The use of standardised [automated coding software](#) and the application of an agreed definition of avoidable, preventable and treatable 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](#).
- The implementation of the new avoidable mortality definition means our statistics are internationally comparable, as well as comparable between local administrations and over time at national and subnational level.
- The implementation of the new definition also means it is possible to mutually exclusively determine the proportion of avoidable deaths that are preventable or treatable.
- 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 are 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 fewer than 10 deaths and rates based on 10 to 19 deaths are marked with a “u” to warn users that their reliability is low.

## 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 subnational 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 treatable mortality, which is a high-level outcome measure of timely and effective healthcare.

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 datasets accompanying the release.

In 2020, the new avoidable mortality definition created by an OECD working group was implemented. The definition was introduced for data years 2001 onwards, replacing the two definitions previously used. A [public consultation was run](#) on the definition and an [impact paper \(Word, 730KB\)](#) was created.

## 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 that 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.

With advances in medical technology and wider health interventions, the definition of avoidable mortality requires regular review as deaths from conditions previously not avoidable may have since become avoidable. Two public consultations were previously conducted in 2011 and 2015 to consult with statistical users, academics and experts to determine the causes of death that should be included in our definition.

Internationally, a number of definitions of avoidable mortality are used to inform the impacts of preventive and healthcare programmes, which constrains cross-country comparisons.

In 2017, an Organisation for Economic Co-operation and Development (OECD) working group on avoidable mortality was set up to look further into these definitions and seek agreement on a definition that can be used for international comparisons. The overall mandate of this group was to compare the selection of causes of death and age groups considered to be preventable and treatable in current leading lists of avoidable mortality and to recommend a universal avoidable mortality definition.

In 2018, the OECD released their [proposed definition of avoidable mortality](#), which has been adopted by Eurostat. We ran a [consultation](#) in 2019 to seek users' views on the implementation of the new definition of avoidable mortality. The new definition was implemented in 2020.

The measures of avoidable, preventable and treatable mortality represent a high-level outcome measure of the performance of health systems in terms of prevention and healthcare 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 practising 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 the number of avoidable deaths using the same definition as the Office for National Statistics (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 Organization (WHO).

As the new definition of avoidable mortality is to be implemented internationally, we should expect in the future to be able to make comparisons across countries.

## 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 report.

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

- [Terms and conditions \(for data on the website\)](#)
- [Accessibility](#)

## 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 August.

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 Statistics](#).

## Concepts and definitions

The definition of avoidable mortality is 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.

In 2020, the new avoidable mortality definition created by an OECD working group was implemented. The definition was introduced for data years 2001 onwards, replacing the two avoidable mortality definitions previously used. Further information on the new definition and its impact on the reporting of avoidable mortality statistics can be found via the [ONS Review of the avoidable mortality definition](#).

The three concepts we report on in this bulletin are:

- preventable mortality: causes of death that can be mainly avoided through effective public health and primary prevention interventions (that is, before the onset of diseases or injuries, to reduce incidence)
- treatable mortality (previously known as amenable mortality): causes of death that can be mainly avoided through timely and effective healthcare interventions, including secondary prevention and treatment (that is, after the onset of disease, to reduce case fatality)
- avoidable mortality: avoidable deaths are all those defined as preventable or treatable

Table 1: Avoidable mortality definition for 2001 onwards



Condition group and cause	ICD-10 codes	Age	Treatable	Preventable
Infectious diseases				
Intestinal diseases	A00-A09	0-74		•
Diphtheria, Tetanus, Poliomyelitis	A35, A36, A80	0-74		•
Whooping cough	A37	0-74		•
Meningococcal infection	A39	0-74		•
Sepsis due to streptococcus pneumonia and sepsis due to haemophilus influenzae	A40.3, A41.3	0-74		•
Haemophilus influenza infections	A49.2	0-74		•
Sexually transmitted infections (except HIV/AIDS)	A50-A60, A63, A64	0-74		•
Varicella	B01	0-74		•
Measles	B05	0-74		•
Rubella	B06	0-74		•
Viral Hepatitis	B15-B19	0-74		•
HIV/AIDS	B20-B24	0-74		•
Malaria	B50-B54	0-74		•
Haemophilus and pneumococcal meningitis	G00.0, G00.1	0-74		•
Tuberculosis	A15-A19, B90, J65	0-74	• (50%)	• (50%)
Scarlet fever	A38	0-74	•	
Sepsis	A40 (excl. A40.3), A41 (excl. A41.3)	0-74	•	
Cellulitis	A46, L03	0-74	•	
Legionnaires disease	A48.1	0-74	•	
Streptococcal and enterococci infection	A49.1	0-74	•	
Other meningitis	G00.2, G00.3, G00.8, G00.9	0-74	•	
Meningitis due to other and unspecified causes	G03	0-74	•	
Neoplasms				
Lip, oral cavity and pharynx cancer	C00-C14	0-74		•
Oesophageal cancer	C15	0-74		•

Stomach cancer	C16	0-74		•
Liver cancer	C22	0-74		•
Lung cancer	C33-C34	0-74		•
Mesothelioma	C45	0-74		•
Skin (melanoma) cancer	C43	0-74		•
Bladder cancer	C67	0-74		•
Cervical cancer	C53	0-74	• (50%)	• (50%)
Colorectal cancer	C18-C21	0-74	•	
Breast cancer (female only)	C50	0-74	•	
Uterus cancer	C54, C55	0-74	•	
Testicular cancer	C62	0-74	•	
Thyroid cancer	C73	0-74	•	
Hodgkin's disease	C81	0-74	•	
Lymphoid leukaemia	C91.0, C91.1	0-74	•	
Benign neoplasm	D10-D36	0-74	•	
Endocrine and metabolic diseases				
Nutritional deficiency anaemia	D50-D53	0-74		•
Diabetes mellitus	E10-E14	0-74	• (50%)	• (50%)
Thyroid disorders	E00-E07	0-74	•	
Adrenal disorders	E24-E25 (except E24.4), E27	0-74	•	
Diseases of the nervous system				
Epilepsy	G40, G41	0-74	•	
Diseases of the circulatory system				
Aortic aneurysm	I71	0-74	• (50%)	• (50%)
Hypertensive diseases	I10-I13, I15	0-74	• (50%)	• (50%)
Ischaemic heart diseases	I20-I25	0-74	• (50%)	• (50%)
Cerebrovascular diseases	I60-I69	0-74	• (50%)	• (50%)
Other atherosclerosis	I70, I73.9	0-74	• (50%)	• (50%)
Rheumatic and other heart diseases	I00-I09	0-74	•	
Venous thromboembolism	I26, I80	0-74	•	
Diseases of the respiratory system				

Influenza	J09-J11	0-74	•
Pneumonia due to streptococcus pneumonia or haemophilus influenza	J13-J14	0-74	•
Chronic lower respiratory diseases	J40-J44	0-74	•
Lung diseases due to external agents	J60-J64, J66-J70, J82, J92	0-74	•
Upper respiratory infections	J00-J06, J30-J39	0-74	•
Pneumonia, not elsewhere classified or organism unspecified	J12, J15, J16-J18	0-74	•
Acute lower respiratory infections	J20-J22	0-74	•
Asthma and bronchiectasis	J45-J47	0-74	•
Adult respiratory distress syndrome	J80	0-74	•
Pulmonary oedema	J81	0-74	•
Abscess of lung and mediastinum pyothorax	J85, J86	0-74	•
Other pleural disorders	J90, J93, J94	0-74	•
Diseases of the digestive system			
Gastric and duodenal ulcer	K25-K28	0-74	•
Appendicitis	K35-K38	0-74	•
Abdominal hernia	K40-K46	0-74	•
Cholelithiasis and cholecystitis	K80-K81	0-74	•
Other diseases of gallbladder or biliary tract	K82-K83	0-74	•
Acute pancreatitis	K85.0, K85.1, K85.3, K85.8, K85.9	0-74	•
Other diseases of pancreas	K86.1, K86.2, K86.3, K86.8, K86.9	0-74	•
Diseases of the genitourinary system			
Nephritis and nephrosis	N00-N07	0-74	•

Obstructive uropathy	N13, N20-N21, N35	0-74	•
Renal failure	N17-N19	0-74	•
Renal colic	N23	0-74	•
Disorders resulting from renal tubular dysfunction	N25	0-74	•
Unspecified contracted kidney, small kidney of unknown cause	N26-N27	0-74	•
Inflammatory diseases of genitourinary system	N34.1, N70-N73, N75.0, N75. 1, N76.4, N76.6	0-74	•
Prostatic hyperplasia	N40	0-74	•
Pregnancy, childbirth and the perinatal period			
Tetanus neonatorum	A33	0-74	•
Obstetrical tetanus	A34	0-74	•
Pregnancy, childbirth and the puerperium	O00-O99	0-74	•
Certain conditions originating in the perinatal period	P00-P96	0-74	•
Congenital malformations			
Certain congenital malformations (neural tube defects)	Q00, Q01, Q05	0-74	•
Congenital malformations of the circulatory system (heart defects)	Q20-Q28	0-74	•
Adverse effects of medical and surgical care			
Drugs, medicaments and biological substances causing adverse effects in therapeutic use	Y40-Y59	0-74	•
Misadventures to patients during surgical and medical care	Y60-Y69, Y83-Y84	0-74	•
Medical devices associated with adverse incidents in diagnostic and therapeutic use	Y70-Y82	0-74	•
Injuries			
Transport Accidents	V01-V99	0-74	•
Accidental Injuries	W00-X39, X46-X59	0-74	•

Intentional self-harm	X66-X84	0-74	•
Event of undetermined intent	Y16-Y34	0-74	•
Assault	X86-Y09, U50.9	0-74	•
Alcohol-related and drug-related deaths			
Alcohol-specific disorders and poisonings	E24.4, F10, G31.2, G62. 1, G72.1, I42. 6, K29.2, K70, K85.2, K86. 0, Q86.0, R78. 0, X45, X65, Y15	0-74	•
Other alcohol-related disorders	K73, K74.0-K74.2, K74.6-K74.9	0-74	•
Drug disorders and poisonings	F11-F16, F18-F19, X40-X44, X85, Y10-Y14	0-74	•
Intentional self-poisoning by drugs	X60-X64	0-74	•

Source: Organisation for Economic Co-operation and Development

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 may 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.

For all 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 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 healthcare, even after the condition has developed (treatable 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 uptake of smoking (preventable mortality).

The avoidable deaths in hospital measure is based on a record review of a sample of deaths deemed to be caused by 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 them to be published earlier, provisional data would need to be used and would need to be 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 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 of Scotland](#) website, and for [Northern Ireland, the Northern Ireland Statistics and Research Agency](#) website.

In the compilation of these statistics, the 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 Office for National Statistics (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 treatable to healthcare. 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 are 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 are 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 in this section. 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 European Standard Population (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:

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

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% confidence intervals.

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% confidence intervals are denoted as  $ASR_{lower}$  and  $ASR_{upper}$ , respectively, and calculated as:

$$ASR_{lower} = ASR + (D_l - D) \cdot \sqrt{\frac{v(ASR)}{v(D)}}$$

$$ASR_{upper} = ASR + (D_u - D) \cdot \sqrt{\frac{v(ASR)}{v(D)}}$$

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
- $v(\text{ASR})$  is the variance of the age-standardised rate
- $v(D)$  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:

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

where:

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

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

## How we process the data

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

Avoidable deaths are all those defined as preventable or treatable. The number of deaths where an avoidable condition was included as the underlying cause on the death certificate, by sex and age (less than 1 to 74 years) 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 (less than 1, to 70 to 74 years)
- $w_i$  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  $i$

Table 2: The 2013 European Standard Population  
Office for National Statistics

Age group (years)	Population (number)
Under 1	1,000
1 to 4	4,000
5 to 9	5,500
10 to 14	5,500
15 to 19	5,500
20 to 24	6,000
25 to 29	6,000
30 to 34	6,500
35 to 39	7,000
40 to 44	7,000
45 to 49	7,000
50 to 54	7,000
55 to 59	6,500
60 to 64	6,000
65 to 69	5,500
70 to 74	5,000
Total	91,000

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:

$$\text{SYLL Rate} = \frac{\sum_i \left( w_i \cdot \frac{a_i d_i}{n_i} \right)}{\sum_i w_i} \times 100,000$$

where:

- $i$  is the age group (less than 1, to 70 to 74 years)
- $d_i$  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 subnational 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 2001.

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 datasets 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](mailto: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](mailto:mortality@ons.gov.uk).

## How we review and maintain the data processes

In 2020, the new avoidable mortality definition created by an OECD working group was implemented. In the future, the definition of avoidable mortality will be regularly reviewed.

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 treatable to healthcare 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 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.

## 7 . Other information

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

- [Avoidable mortality: National Records of Scotland](#)
- [Health inequalities annual report – Department of Health Northern Ireland](#)
- [Review of avoidable mortality definition 2019 \(Word, 730KB\)](#)
- [Review of avoidable mortality definition 2019 – data tables \(XLS, 99KB\)](#)
- [Review of avoidable mortality definition 2019 – consultation response and finalised definition \(Word, 421KB\)](#)
- [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