

Article

Cause of death coding in mortality statistics, software changes: January 2020

The differences in mortality data for England and Wales coded to ICD-10, produced by changing from cause of death coding using the software IRIS 4.2.3 to the updated version MUSE 5.5.

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1 . Main points

- When comparing a sample of deaths dual coded using the existing IRIS 4.2.3 software and the updated MUSE 5.5 version, over 98% of deaths remained in the same ICD-10 chapter with both versions.
- Deaths allocated an underlying cause of death in the ICD-10 chapter, “Certain infectious and parasitic diseases”, decreased by 19.8%; this was largely because of a change in the coding rules to count more deaths with an immediate cause of sepsis as resulting from a serious health condition that preceded the infection.
- Changes in the coding of deaths with an immediate respiratory cause but an underlying degenerative condition (such as Parkinson’s disease) contributed to an increase of 5.8% in deaths allocated to the ICD-10 chapter, “Diseases of the nervous system”.

2 . Analysis

Dual coding of 42,413 deaths registered in 2017 in England and Wales showed statistically significant percentage increases in the deaths allocated to an underlying cause in three [International Classification of Diseases, Tenth Revision \(ICD-10\)](#) chapters and, when coded in Multicausal and Unicausal Selection Engine (MUSE) 5.5, statistically significant decreases for four chapters. However, over 98% of deaths remained in the same chapter with both software versions. This shows that the statistical impact of the change from IRIS 4.2.3 to MUSE 5.5 is less than the last software change, which was the original move to the IRIS coding software from the Mortality Medical Data System (MMDS) in 2014, when 95% of deaths remained in the same chapter.

Deaths allocated an underlying cause of certain infectious and parasitic diseases decreased by 19.8% following the recoding of deaths involving sepsis or septicaemia to other chapters. The IRIS 4.2.3 to MUSE 5.5 code changes had the biggest impact where A41.9 (Sepsis, unspecified organism) from IRIS 4.2.3 was recoded in MUSE 5.5 to codes mainly in the “Neoplasms”, “Diseases of the respiratory system” and “Diseases of the circulatory system” chapters. Additional impact is caused by A41.5 (Sepsis due to other Gram-negative organisms) in IRIS 4.2.3 recoded in MUSE 5.5 to multiple other chapters.

A change in the coding of “Diseases of the nervous system” created an increase of 5.8% in deaths allocated an underlying cause of nervous system disease. Some of the main drivers are recoding of J18.0 (Bronchopneumonia, unspecified organism) and J18.9 (Pneumonia, unspecified organism) from “Diseases of the respiratory system” to G20 (Parkinson’s disease). This is similar to the previous coding change in 2014.

Deaths given an underlying cause of “Diseases of the genitourinary system” decreased as a result of the IRIS 4.2.3 to MUSE 5.5 recoding changes, mainly caused by N18.5 (Chronic kidney disease, stage 5) and N18.9 (Chronic kidney disease, unspecified) in IRIS 4.2.3 recoded in MUSE 5.5 to ICD-10 chapters “Neoplasms”, “Mental and behavioural disorders”, and “Diseases of the circulatory system”. The total percentage change in deaths attributed to an underlying cause of “Diseases of the genitourinary system” was -2.8%.

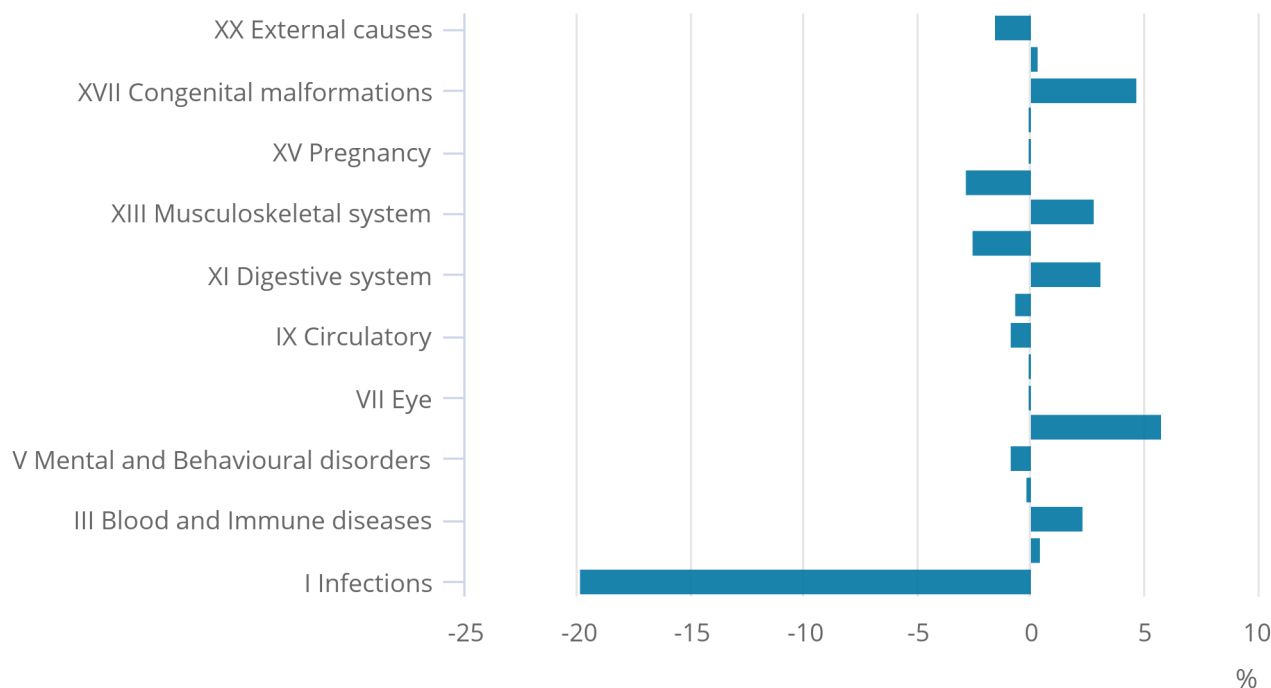
The change in coding from IRIS 4.2.3 to MUSE 5.5 has changed the way deaths involving sepsis or septicaemia are coded. This has impacted ICD-10 chapter, “Diseases of the digestive system”. This chapter saw a 3.2% increase largely as a result of the recoding of many records with the underlying cause of A41.9.

Figure 1: “I Infections” was the ICD-10 chapter most impacted by the software change, with a loss of 19.8 percentage points

Percentage change in underlying cause of death by ICD-10 chapter caused by software change, sample of 42,413 deaths registered in England and Wales in 2017

Figure 1: “I Infections” was the ICD-10 chapter most impacted by the software change, with a loss of 19.8 percentage points

Percentage change in underlying cause of death by ICD-10 chapter caused by software change, sample of 42,413 deaths registered in England and Wales in 2017



Source: Office for National Statistics – Death registrations for England and Wales 2017

Notes:

1. Dual-coded data are sampled from 2017 death registrations for England and Wales.

3 . Background

The Office for National Statistics (ONS) codes cause of death for deaths registered in England and Wales using the [World Health Organization's \(WHO\) International Classification of Diseases, Tenth Revision \(ICD-10\)](#). Where possible, the causes of death mentioned in the registration are automatically coded and a single underlying cause is derived using specialist software. When the software cannot complete the process automatically, the remaining deaths are manually coded by staff trained in ICD-10 and its rules.

Deaths in neonates (under 28 days), stillbirths and deaths following a coroner's inquest are always coded manually in the ONS. This differs from the practice in some other countries.

ICD-10 was introduced for causes of death in England and Wales in January 2001. Since then, various amendments to the ICD-10 codes and rules have been authorised by the WHO. Amendments may, for example, correct errors in the classification and its index, accommodate new codes in response to new conditions, or incorporate advances in medical knowledge of the relationship between conditions.

From January 2001 to December 2010, the ONS used the Mortality Medical Data System (MMDS) ICD-10 version 2001.2 software provided by the United States National Center for Health Statistics (NCHS) to code cause of death. In January 2011, this was updated to version 2010, which incorporated most of the WHO amendments authorised up to 2009.

On 1 January 2014, we changed the software used to code cause of death to IRIS (version 2013). The development of IRIS was supported by Eurostat, the statistical office of the European Union, and is now managed by the IRIS Institute hosted by the German Institute of Medical Documentation and Information (DIMDI) in Cologne. IRIS software version 2013 incorporated all updates to ICD-10 approved by the WHO, which were timetabled for implementation before 2014.

We currently use IRIS version 4.2.3 software, which incorporates all changes to ICD-10 that have been authorised by the WHO up to the end of 2016. On 1 January 2020, we will update the software to the successor of IRIS, which is known as the Multicausal and Unicausal Selection Engine (MUSE) (IRIS version 5.5).

Since version 5, the IRIS software uses the MUSE. The MUSE operates based on internationally agreed decision tables that reflect the most recent version of ICD-10. Components of IRIS that were based on the former NCHS MMDS have been replaced with new versions developed by the IRIS Institute.

This system increases the automation of coding compared with previous software. A coding test conducted on 3,844 records (in November 2018) found that IRIS 4.2.3 auto-coded 76.7% (2,947 records) whereas MUSE 5.5 auto-coded 80.4% (3,089 records). The use of the MUSE 5.5 software will also improve the comparability of our mortality statistics across Europe and internationally. MUSE 5.5, due to be implemented in January 2020, incorporates up to and including 2018 WHO updates.

MUSE 5.5 reflects the latest medical and epidemiological thinking. It is therefore inevitable that some deaths that would have been coded to one ICD-10 chapter in IRIS 4.2.3 are treated differently in MUSE 5.5. For example, the big changes in sepsis deaths re-coded in MUSE 5.5 to codes mainly in the "Neoplasms", "Diseases of the respiratory system" and "Diseases of the circulatory system" chapters reflect a move to clearer "underlying cause" reporting.

The wider impact of these differences is yet to be seen. For example, there may be a small effect on the ranking of the leading causes of death as a result of the coding changes. For any time series analysis, therefore, it is important that comparability ratios are used for accurate comparison.

4 . Coding the underlying cause of death

The [death certificate \(PDF, 225KB\)](#) used in England and Wales for deaths over 28 days of age is similar to that recommended by the World Health Organization (WHO). The cause of death information is set out in two parts. Part I gives the condition or sequence of conditions leading directly to death, while Part II gives the details of any associated conditions that contributed to the death but are not part of the causal sequence.

The process of coding cause of death consists of first converting each of the conditions mentioned on the death certificate into an International Classification of Diseases, Tenth Revision (ICD-10) code and second, deciding which of the conditions is the underlying cause of death for statistical purposes. Rules for these decisions are provided by [the WHO](#).

The General principle for selection of the underlying cause of death states that when more than one condition is entered on the death certificate, the condition entered on the lowest used line of Part I should be selected, but only if it could have given rise to all the conditions entered above it. If this is not the case, then the following selection rules are applied:

Rule 1. If there is a reported sequence terminating in the condition entered first on the death certificate, select the originating cause of this sequence.

Rule 2. If there is no reported sequence terminating in the condition first entered on the death certificate, select the first-mentioned condition.

Rule 3. If the condition selected by the General principle, Rule 1 or Rule 2 is obviously a direct consequence of another reported condition (whether in Part I or Part II of the death certificate), select this primary condition.

Modification tables allow the identification of valid causal sequences of conditions and give rules to improve the usefulness and precision of mortality data. For example, the tables will identify a direct causal sequence between two conditions. However, there are particular conditions, combinations or circumstances when modification rules are applied to select the correct underlying cause of death. So, with some death certificates, two or more causes may be given that, when linked together, point to another cause (not explicitly mentioned on the certificate) as the underlying cause.

The rules for selection of the underlying cause of death are described in detail in the [ICD-10 reference guide](#) published by the WHO.

For stillbirths and deaths under 28 days (neonatal deaths), there are different [death certificates \(PDF, 1.31MB\)](#), which separate causes that relate to the mother's health and those that are direct health problems of the baby. No single ICD-10 code is selected as an underlying cause of death. Instead, in some of our publications, stillbirths and neonatal deaths are classified using a set of broad cause groups, which are explained in [Causes of neonatal deaths and stillbirths: a new hierarchical classification in ICD-10 \(PDF, 73KB\)](#).

A cause group code is derived for each ICD-10 cause mentioned on the stillbirth or neonatal death certificate. For each record, it is possible to allocate up to 15 ICD-10 codes (mentions), which describe all diseases or conditions in the foetus or infant, maternal diseases or conditions affecting the foetus or infant, or other relevant causes. For the data used in this analysis, each ICD-10 code was replaced with its corresponding cause group code. The highest priority cause group code in each record was classified as the cause group for that record, overall (1. Congenital anomalies being highest and 9. Sudden infant deaths being lowest). An additional process is used for the calculation in [Childhood and infant mortality in England and Wales](#) and is described in the [User guide to child and infant mortality statistics](#).

5 . Approach to evaluating the impact of introducing MUSE

5.5 on mortality statistics

We carried out a dual-coding study in which a sample of deaths registered throughout 2017, already coded using IRIS 4.2.3 software and the International Classification of Diseases, Tenth Revision (ICD-10) version 2016 rules, were recoded using the Multicausal and Unicausal Selection Engine (MUSE) 5.5 and the ICD-10 version 2018 rules.

Sample

To avoid seasonal influences on causes of death affecting the analysis, records were selected from one week in each quarter of 2017. Weeks containing or immediately following a bank holiday were excluded because of the atypical number of death registrations in those weeks. Stillbirths and neonatal deaths were excluded from the main sample, and the impact of the change on these deaths is described separately.

In total, 42,413 deaths over 28 days registered in four weeks (one week in each of January, April, July and October 2017) were dual coded, comprising 7.98% of all non-neonatal deaths registered in 2017. In addition, 257 stillbirths and 937 neonatal deaths were dual coded.

Analysis and interpretation

The results reported here are based on the underlying cause of death for deaths over 28 days. This is defined by the World Health Organization (WHO) as the disease or injury that initiated the train of morbid events leading directly to death or the circumstances of the accident or violence that produced the fatal injury.

As the code representing the underlying cause of death changes because of new codes being introduced or because of changes in the rules for assigning a code or selecting which is the underlying cause of death, the deaths that were previously tabulated in one chapter may appear in a different chapter. Therefore, we report relative increases and decreases in the deaths tabulated by ICD-10 chapter and indicate the main cases where deaths from a specific cause have “moved” from one chapter to another. For stillbirths and neonatal deaths, we report where deaths “moved” from one cause group to another.

Comparability ratios (with 95% confidence intervals) have been calculated using standard methods. These are the ratio of the number of deaths coded to a particular underlying cause in IRIS 4.2.3, to the number coded to the same cause in MUSE 5.5. These ratios reflect the net effect of the change. If the ratio is 1, the number of deaths coded to that cause is the same in both versions. If the comparability ratio is 0.5, half as many deaths have been coded to that cause using IRIS 4.2.3, compared with MUSE 5.5. Confidence intervals indicate the reliability of the comparability ratio. Where a comparability ratio is given but its confidence interval includes 1, this means that the difference between the number of deaths allocated to that underlying cause using IRIS 4.2.3 and MUSE 5.5 was not statistically significant.

Limitations

The sample size of 42,413 deaths does not give enough statistical power to analyse the impact of changing from IRIS 4.2.3 to MUSE 5.5 for less common categories of cause of death, such as diseases of the skin and subcutaneous tissue, or very specific causes of death, such as malignant neoplasm of the palate, as there are very few deaths from these causes in the sample. The small sample size is also a limitation in those cases where the changes between the ICD-10 versions are relatively small.

6 . Results

The accompanying [Dataset 1: Underlying cause of death by ICD-10 chapter in IRIS 4.2.3 and MUSE 5.5](#) groups deaths by the International Classification of Diseases, Tenth Revision (ICD-10) chapter of the underlying cause of death, presenting results from both software. The table shows that more than 98% of underlying causes of death in this sample remained in the same chapter. However, there were movements in and out of some chapters, reflecting the changes in the selection of the underlying cause of death from the combination of conditions recorded on the death certificate. The impact of these movements on specific chapters is examined in the individual chapter sections that follow. A summary of the chapter-level moves, their percentage changes and corresponding comparability ratios can be found in Table 1.

Table 1: Underlying cause of death by ICD-10 chapter in IRIS 4.2.3 and MUSE 5.51

ICD chapter	IRIS 4.2.3 Total	MUSE 5.5 Total	Net gain /loss	Percentage net gain /loss	Comparability ratio	Lower confidence limit	Upper confidence limit
I Infections	430	345	-85	-19.8	0.8	0.8	0.8
II Neoplasms	11,625	11,681	56	0.5	1.0	1.0	1.0
III Blood and Immune diseases	83	85	2	2.4	1.0	0.9	1.1
IV Endocrine	667	666	-1	-0.1	1.0	1.0	1.0
V Mental and Behavioural disorders	4,037	4,004	-33	-0.8	1.0	1.0	1.0
VI Nervous system	2,625	2,776	151	5.8	1.1	1.0	1.1
VII Eye	0	0	0	0.0	0.0	0.0	0.0
VIII Ear	1	1	0	0.0	1.0	1.0	1.0
IX Circulatory	10,718	10,632	-86	-0.8	1.0	1.0	1.0
X Respiratory	6,220	6,181	-39	-0.6	1.0	1.0	1.0
XI Digestive system	2,007	2,072	65	3.2	1.0	1.0	1.0
XII Skin	158	154	-4	-2.5	1.0	0.9	1.0
XIII Musculoskeletal system	307	316	9	2.9	1.0	1.0	1.1
XIV Genitourinary system	747	726	-21	-2.8	1.0	1.0	1.0
XV Pregnancy	2	2	0	0.0	1.0	1.0	1.0
XVI Perinatal period	20	20	0	0.0	1.0	0.9	1.1
XVII Congenital malformations	128	134	6	4.7	1.0	1.0	1.1
XVIII NEC	1,000	1,004	4	0.4	1.0	1.0	1.0
XX External causes	1,638	1,614	-24	-1.5	1.0	1.0	1.0
Total	42,413	42,413					

Source: Office for National Statistics – Cause of death coding in mortality statistics

Notes

1. Dual-coded data is sampled from 2017 death registrations for England and Wales. [Back to table](#)

The dataset of sampled anonymised records, including codes for every condition mentioned on the death certificate and the underlying cause of death coded using both IRIS 4.2.3 and MUSE 5.5, is available in the accompanying [Dataset 2: All causes of death recorded on the death certificate coded in IRIS 4.2.3 and MUSE 5.5](#).

I Certain infectious and parasitic diseases (ICD-10 codes A00 to B99)

Overall, the number of deaths assigned to the infections chapter decreased by 19.8%; this is a statistically significant change. The biggest decrease was in deaths from sepsis or septicaemia (ICD-10 code A41.9 (Sepsis, unspecified organism) and A41.5 (Sepsis due to other Gram-negative organisms). These deaths were re-coded in MUSE 5.5 to codes mainly in the “Neoplasms”, “Diseases of the respiratory system” and “Diseases of the circulatory system” ICD-10 chapters. This was because of a change in the coding rules to count more deaths with an immediate cause of sepsis as resulting from a serious health condition that preceded the infection.

There were few within-chapter coding changes. Where the underlying cause of death was assigned to the infectious disease chapter in both IRIS 4.2.3 and MUSE 5.5, the code remained the same in the majority of cases.

II Neoplasms (ICD-10 codes C00 to D48)

The number of deaths assigned an underlying cause of neoplasms increased very slightly by 0.5%. While in absolute terms this was not a big increase, the increase was statistically significant because many people die from neoplasms.

The re-coding of some infections to “Neoplasms” was one of the main drivers behind the changes, specifically deaths previously coded to an underlying cause of A41.9 (Sepsis, unspecified organism). Also contributing to the increase was some re-coding from IRIS 4.2.3 of underlying causes of death to other ICD-10 chapters (“Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism”; “Mental and behavioural disorders”; “Diseases of the nervous system”; “Diseases of the circulatory system”; “Diseases of the respiratory system”; “Diseases of the digestive system”; “Diseases of the skin and subcutaneous tissue”; “Diseases of the genitourinary system”; “Congenital malformations, deformations and chromosomal abnormalities”; and “External causes of morbidity and mortality”) when coded in MUSE 5.5.

There were also a number of specific changes to ICD-10 coding practices that affected the coding of deaths within the “Neoplasms” chapter. Specifically, within the block C44, the codes C44.3 (Skin of other and unspecified parts of face), C44.4 (Skin of scalp and neck) and C44.9 (Malignant neoplasm of skin, unspecified) were coded to other “Neoplasm” codes. Code C44 (Other malignant neoplasms of skin) contains skin cancers that are often poorly documented and are less likely to be the cause of death than most other types of cancer.

III Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (ICD-10 codes D50 to D89)

The number of deaths assigned to this chapter increased by 2.4%, which was not a statistically significant change. However, the sample of dual-coded data only contained a small number of deaths with an underlying cause assigned to this chapter. These findings should therefore be treated with caution because the change may not be generalisable to the whole dataset.

IV Endocrine, nutritional and metabolic diseases (ICD-10 codes E00 to E90)

There was a decrease of 0.1% in the number of deaths assigned to the chapter, “Endocrine, nutritional and metabolic diseases”, in MUSE 5.5. This was not a statistically significant change. This small decrease was caused by some re-coding to seven other chapters (Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism”; “Mental and behavioural disorders”; “Diseases of the nervous system”; “Diseases of the circulatory system”; “Diseases of the respiratory system”; “Diseases of the musculoskeletal system and connective tissue”; and “External causes of morbidity and mortality”).

There were few within-chapter changes for “Endocrine, nutritional and metabolic diseases”. The biggest change was deaths with an underlying cause of E14.9 (Unspecified diabetes mellitus without complications), which were re-coded to E14.6 (Unspecified diabetes mellitus with other specified complications) at 37% (of the 68 coded in IRIS 4.2.3 to E14.9, 25 were coded in MUSE 5.5 to E14.6). The next biggest within-chapter change was deaths with an underlying cause of E11.9 (Non-insulin-dependent (Type 2) diabetes mellitus without complications), now coded to E11.6 (Non-insulin-dependent (Type 2) diabetes mellitus with other specified complications); this was a change of 27% (of the 104 coded in IRIS 4.2.3 to E11.9, 28 were coded in MUSE 5.5 to E11.6). This suggests that reported conditions that could be complications of diabetes are being more consistently taken into account.

V Mental and behavioural disorders (ICD-10 codes F00 to F99)

The number of deaths with an underlying cause of “Mental and behavioural disorders” decreased by 0.8%; this is a statistically significant change. This decrease was largely a result of deaths that were previously assigned an underlying cause of F03 (Unspecified dementia) being assigned to J44.0 (Chronic obstructive pulmonary disease with acute lower respiratory infection) in the “Diseases of the respiratory system” chapter.

This change represents a small “rebound” from the changes in 2014 reported in the publication, [Impact of the Implementation of IRIS Software for ICD-10 2010 Cause of Death Coding on Mortality Statistics, England and Wales](#). Then, the number of deaths allocated to “Mental and behavioural disorders” increased by 7.0% (this is a statistically significant change), largely because of deaths that were previously assigned an underlying cause of respiratory disease being assigned to the “Mental and behavioural disorders” chapter (mainly the F01 and F03 dementia codes).

There were very few within-chapter changes for “Mental and behavioural disorders”.

VI Diseases of the nervous system (ICD-10 codes G00 to G99)

There have been a number of coding changes that affected whether a death is assigned an underlying cause in the “Diseases of the nervous system” chapter. The net effect was a statistically significant increase of 5.8% in the number of deaths assigned to this chapter.

The main coding changes are spread across the chapter, seeing deaths with an underlying cause of respiratory diseases such as J18.0 (Bronchopneumonia, unspecified organism) and J18.9 (Pneumonia, unspecified organism) reassigned to mainly “G” codes (“Diseases of the nervous system”), with the majority (40%) to G20.0 (Parkinson’s disease).

This is a continuation of the changes seen in the 2014 [Impact of the Implementation of IRIS Software for ICD-10 Cause of Death Coding on Mortality Statistics, England and Wales](#) where pneumonia was selected as the underlying cause, because of changes with respect to which diseases are now considered to be a consequence of another condition. It follows the rationale that death from pneumonia can be a direct result of a preceding degenerative disease such as Parkinson’s.

VII Diseases of the eye and adnexa (ICD-10 codes H00 to H59)

The number of deaths classified to this chapter in the annual mortality statistics is extremely small, and we expect to see no significant change in the reported statistics.

VIII Diseases of the ear and mastoid process (ICD-10 codes H60 to H95)

The number of deaths classified to this chapter in the annual mortality statistics is extremely small, and we expect to see no significant change in the reported statistics.

IX Diseases of the circulatory system (ICD-10 codes I00 to I99)

The number of deaths with an underlying cause in the “Diseases of the circulatory system” chapter showed a 0.8% decrease between IRIS 4.2.3 to MUSE 5.5. Although in absolute terms this was a relatively small drop, it was a statistically significant decrease owing to the large number of people who die from circulatory diseases.

This decrease is caused by an update to the selection rules where many deaths that were coded as having an underlying cause of death in the “Diseases of the circulatory system” chapter are now being coded as having an underlying cause in another chapter. These deaths were re-coded to 13 other chapters (“Certain infectious and parasitic diseases”; “Neoplasms”; “Endocrine, nutritional and metabolic diseases”; “Mental and behavioural disorders”; “Diseases of the nervous system”; “Diseases of the respiratory system”; “Diseases of the digestive system”; “Diseases of the skin and subcutaneous tissue”; “Diseases of the musculoskeletal system and connective tissue”; “Diseases of the genitourinary system”; “Congenital malformations, deformations and chromosomal abnormalities”; “Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified”; and “External causes of morbidity and mortality”).

The largest change was from deaths being coded to an underlying cause of death in the “External causes of morbidity and mortality” chapter, specifically to code X59.9 (Exposure to unspecified factor causing other and unspecified injury) in MUSE 5.5, which were coded to an “I” code in IRIS 4.2.3. This follows a change by the World Health Organization (WHO) in the default coding of subdural haemorrhage from non-traumatic (I62.0) to traumatic where there is an indication on the certificate of an external event such as a fall.

X Diseases of the respiratory system (ICD-10 codes J00 to J99)

The dual-coded data show a decrease of around 0.6% of deaths with an underlying cause assigned to this chapter between IRIS 4.2.3 and MUSE 5.5; this change is not statistically significant. This decrease is largely because of deaths that were previously assigned to the “Diseases of the respiratory system” chapter (mostly J18, Pneumonia, organism unspecified) now being assigned to “Diseases of the nervous system” G20 (Parkinson’s disease), which is a continuation of the trend in the 2014 coding changes.

The biggest within-chapter changes were more IRIS 4.2.3 underlying causes coded to J44.0 (Chronic obstructive pulmonary disease with acute lower respiratory infection). More deaths were coded in MUSE as having an underlying cause of death of J44.0 than were coded in IRIS 4.2.3.

XI Diseases of the digestive system (ICD-10 codes K00 to K93)

There was a statistically significant increase of 3.2% of deaths with an underlying cause assigned to this chapter between IRIS 4.2.3 and MUSE 5.5. The main reason for this is that some deaths that were previously assigned to “Certain infectious and parasitic diseases” A41.9 (Sepsis, unspecified organism) or “Diseases of the respiratory system” J18.9 (Pneumonia, unspecified) underlying cause are now assigned to a digestive system cause of death.

XII Diseases of the skin and subcutaneous tissue (ICD-10 codes L00 to L99)

There was a 2.5% decrease in the number of deaths allocated to this chapter using MUSE 5.5. However, there are relatively few deaths from diseases of the skin and subcutaneous tissue, so this increase was not statistically significant.

XIII Diseases of the musculoskeletal system and connective tissue (ICD-10 codes M00 to M99)

There was a 2.9% increase in the number of deaths assigned to this chapter using MUSE 5.5, which was not statistically significant.

The increase comes from a spread of re-coded items from 11 different ICD-10 chapters (“Certain infectious and parasitic diseases”; “Neoplasms”; “Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism”; “Endocrine, nutritional and metabolic diseases”; “Mental and behavioural disorders”; “Diseases of the nervous system”; “Diseases of the circulatory system”; “Diseases of the respiratory system”; “Diseases of the digestive system”; “Diseases of the genitourinary system”; and “External causes of morbidity and mortality”). No one specific code change accounted for the majority of changes.

XIV Diseases of the genitourinary system (ICD-10 codes N00 to N99)

There has been a statistically significant 2.8% decrease in the number of deaths coded to “Diseases of the genitourinary system” using MUSE 5.5. The majority of the decrease is explained by deaths that were previously assigned an underlying cause in the genitourinary system, mainly codes N18.5 (Chronic kidney disease, stage 5) and N18.9 (Chronic kidney disease, unspecified) now being assigned to the “Mental and behavioural disorders” chapter, specifically F01.9 (Vascular dementia, unspecified) and to the “Diseases of the circulatory system” chapter, specially I67.9 (Cerebrovascular disease, unspecified). This reflects a change in the priority given to different health problems where several have been listed on the death certificate.

XV Pregnancy, childbirth and the puerperium (ICD-10 codes O00 to O99)

The number of deaths classified to this chapter in the annual mortality statistics is small, and we expect to see no significant change. There were two deaths assigned to this chapter in the sample and, the coding remained the same between IRIS 4.2.3 and MUSE 5.5.

XVI Certain conditions originating in the perinatal period (ICD-10 codes P00 to P96)

Chapter XVI has not been examined in this report, as there were less than 20 deaths assigned to this chapter in the sample. These deaths occurred in the post-neonatal period (over 28 days), while a substantial proportion of deaths assigned to this chapter via the routine cause of death coding processes occur in the neonatal period (under 28 days).

XVII Congenital malformations, deformations and chromosomal abnormalities (ICD-10 codes Q00 to Q99)

The number of deaths coded to this chapter increased by 4.7% using MUSE 5.5; this change is not statistically significant. The main reason for this increase is that a small number of deaths that were previously coded as having an underlying cause in seven different ICD-10 chapters (“Certain infectious and parasitic diseases”; “Neoplasms”; “Diseases of the circulatory system”; “Diseases of the respiratory system”; “Diseases of the digestive system”; “Diseases of the genitourinary system”; and “External causes of morbidity and mortality”) are now coded in the “Congenital malformations, deformations and chromosomal abnormalities” chapter. This means that more congenital conditions are being counted as the original cause for health conditions that are likely to be their manifestations.

XVIII Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (ICD-10 codes R00 to R99)

There has been a small (0.4%) but not statistically significant increase in the number of deaths assigned to this chapter using MUSE 5.5.

XX External causes of mortality (ICD-10 codes U50.9, V01 to Y89)

There has been a non-statistically significant decrease of 1.5% in the number of deaths from external causes using MUSE 5.5. The largest decrease has come from deaths previously assigned to codes X59.0 (Exposure to unspecified factor causing fracture) and Y83.1 (Surgical operation with implant of artificial internal device) in IRIS 4.2.3, which are now being assigned to other cause codes in MUSE 5.5, for example J18.9 (Pneumonia, unspecified) being one of the more common ones.

7 . Stillbirths and neonatal deaths

Table 2 lists the cause groups for stillbirths and neonatal deaths. For further information on the cause groups, see [Causes of neonatal deaths and stillbirths: a new hierarchical classification in ICD-10 \(PDF, 73KB\)](#).

Table 2: Office for National Statistics cause groups for stillbirths and neonatal deaths

Group and description	Application	Application
1 Congenital anomalies	Stillbirths	Neonate
2 Antepartum infections	Stillbirths	Neonate
3 Immaturity related conditions		Neonate
4 /8a Asphyxia, anoxia or trauma		Neonate (8a stillbirths only)
5 External conditions	Stillbirths	Neonate
6 Infections		Neonate
7 Other specific conditions	Stillbirths	Neonate
9 Sudden Infant Deaths		Neonate
0 /8b Other conditions	Stillbirths	Neonate

Source: Office for National Statistics – Cause of death coding in mortality statistics

Notes

1. From 2001. [Back to table](#)
2. The “Other conditions category” for stillbirths has been split into two groups for some publications: 8b – Other conditions (antepartum and unknown) and 0 – Other conditions intrapartum. [Back to table](#)

Stillbirths

A stillbirth is a child born after 24 or more weeks’ completed gestation who did not, at any time, breathe or show signs of life.

A sample of 256 stillbirths was taken for 2017 and a comparison by Office for National Statistics (ONS) cause groups for stillbirths was conducted to gain more detail behind the changes. The changes between IRIS 4.2.3 and MUSE 5.5 are shown in Table 3. The biggest percentage change is in group 7 (29% decrease).

Table 3: Comparison by ONS cause groupings for stillbirths

ONS cause groupings	MUSE 5.5	IRIS 4.2.3
0	3	3
1	48	50
2	10	8
4	6	6
5	1	0
7	15	21
8A	45	37
8B	128	131
IRIS Total	256	256

Source: Office for National Statistics

Neonatal deaths

Neonatal deaths are infants who have died within the first 28 days of life.

A sample of 937 neonatal deaths was taken for the time period 2017. As a result of using the MUSE 5.5 coding, there was no difference from the IRIS 4.2.3 coding for ONS cause groups for neonates.

8 . Impact on existing ONS publications

The Office for National Statistics (ONS) does not routinely use comparability ratios, except in time series. We use the latest method of coding as a baseline. The implementation of the automatic cause of death coding software Multicausal and Unicausal Selection Engine (MUSE) 5.5 in January 2020 will impact all ONS publications using mortality data from 2020 onwards that analyse deaths by underlying cause of death. These will mostly be published in 2021. The biggest impact will be on time series analyses. Comparability ratios by International Classification of Diseases, Tenth Revision (ICD-10) chapter are available in the accompanying datasets. When doing a time series, the usual rule is to apply the ratios to the older data to bring them into line with the current data.

The following ONS publications will be affected by this coding change:

- [Deaths registered in England and Wales for 2020](#)
- [Mortality statistics - underlying cause, sex and age](#) – NOMIS official labour market statistics
- [Avoidable mortality in the UK](#) for 2020
- [Excess winter mortality in England and Wales](#) for 2019 to 2020 (provisional) and 2018 to 2019 (final)
- [Child and infant mortality in England and Wales](#) for 2020
- [Quarterly mortality report, England](#) from January to March 2020 onwards
- [Socioeconomic inequalities in avoidable mortality, England and Wales](#) from 2001 to 2021
- [Suicides in the UK](#) for 2020 registrations
- [Alcohol-specific deaths in the UK](#) registered in 2020
- [Deaths related to drug poisoning in England and Wales](#) 2020 registrations