Statistical bulletin

# Impact of the implementation of IRIS software for ICD-10 cause of death coding on stillbirth and neonatal death statistics: England and Wales

Impact of the implementation of IRIS cause of death coding software on stillbirths and neonatal deaths

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# 1. Main points

The main change introduced by the Office for National Statistics (ONS) from using IRIS software version 2013 to code stillbirth and neonatal causes of death is the move from coding maternal conditions mentioned on the certificate using codes from the "Pregnancy, childbirth and puerperium" chapter of the International Classification of Diseases Tenth Revision (ICD-10 codes O00 to O99) to using codes from the beginning of the "Certain conditions originating in the perinatal period" chapter (ICD-10 codes P00 to P04).

Dual coding of 1,808 stillbirths and 1,044 neonatal deaths registered in 2012 in England and Wales shows a significant impact on the ONS cause group of "Antepartum infections" when coded in ICD-10 v2013 (IRIS). The number of stillbirths allocated to this group increased by 11 and the number of neonatal deaths allocated to this group increased by 31. This is a result of changing the coding of maternal infections which means the infection is recognised as occurring before birth.

The number of neonatal deaths assigned to the ONS cause group "Immaturity related conditions" decreased by 22 when coded in ICD-10 v2013 (IRIS). The majority of the change was caused by deaths which also mentioned a maternal infection and therefore are allocated to "Antepartum infections" using ICD10 v2013 (IRIS).

There was no significant impact on the number of stillbirths and neonatal deaths assigned to any other ONS cause group.

# 2. Background

The Office for National Statistics (ONS) codes cause of death using the World Health Organization's (WHO) International Classification of Diseases, Tenth Revision (ICD-10). ICD-10 was introduced in England and Wales in January 2001. Since then various amendments have been authorised by WHO. Amendments may (for example) correct errors in the software supporting automatic coding, accommodate new codes in response to new conditions, such as the H1N1 virus (swine flu), or incorporate advances in medical knowledge of the relationship between conditions.

Until December 2010, we 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 a package called 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 in Cologne. IRIS software version 2013 incorporates all official updates to ICD-10 approved by WHO, which were timetabled for implementation before 2014. The impacts of these updates on deaths coding has already been described in the statistical bulletin Impact of the Implementation of IRIS Software for ICD-10 Cause of Death Coding on Mortality Statistics, England and Wales (8 August 2014).

This bulletin focuses on the impact of the implementation of IRIS cause of death coding software on stillbirths and neonatal deaths. The major change we introduced using IRIS software is that any maternal conditions previously coded to Chapter XV, the "O chapter" (maternal-specific "Pregnancy, childbirth and the puerperium") have now been assigned codes at the beginning of Chapter XVI, the "P chapter" (infant-specific "Certain conditions originating in the perinatal period").

# 3. Evaluating the impact of IRIS on stillbirth and neonatal statistics

To evaluate the impact of IRIS, 1,808 stillbirths and 1,044 neonatal deaths registered in 2012 in England and Wales, already coded using the ICD-10 version 2010 software and rules (NCHS) were recoded using ICD-10 version 2013 rules (IRIS). This bulletin focuses on the impact of the recoding on the ONS cause groups assigned to stillbirths and neonatal deaths to identify underlying cause of death.

Comparability ratios were calculated to measure the net impact of the changes. Where a comparability ratio is shown in the dataset but its confidence interval includes 1, this means that the difference between the categories is not statistically significant. Further information about comparability ratios is available on our website.

# 4. Results – stillbirths

Table 1 shows a summary of the impact of IRIS on the assigned ONS cause group for stillbirths. Results from both ICD-10 versions (ICD-10 v2010, NCHS and ICD-10 v2013, IRIS) are presented.

Dual coding showed a statistically significant impact on "Antepartum infections", all other ONS cause groups showed no statistically significant change.

**Table 1: IRIS implementation coding changes for stillbirths: England and Wales**

| Stillbirths | Percentages | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | Pre recoding | Post recoding | Net gain/ loss | Percentage net gain/loss | Comparability ratio | Lower confidence limit | Upper confidence limit |
| 0. Remaining Antepartum deaths | 947 | 931 | -16 | -1.70 | 0.98 | 0.97 | 1.00 |
| 1. Congenital anomalies | 260 | 263 | 3 | 1.20 | 1.01 | 0.99 | 1.04 |
| 2. Antepartum infections | 15 | 26 | 11 | 73.30 | 1.73 | 1.25 | 2.41 |
| 4 & 8a. Asphyxia, anoxia or trauma (intrapartum and antepartum) | 510 | 510 | 0 | 0.00 | 1.00 | 0.98 | 1.02 |
| 7. Other specific conditions | 76 | 78 | 2 | 2.60 | 1.03 | 0.90 | 1.17 |

Source: Office for National Statistics

0.Remaining Antepartum deaths is the most frequently assigned ONS cause group for stillbirths, accounting for just over 50% of all stillbirths in both ICD10 v2010 (NCHS) and ICD10 v2013 (IRIS). There were 947 stillbirths assigned to this group in ICD10 v2010 (NCHS), this decreased slightly by 1.7% to 931 in ICD10 v2013 (IRIS). This change was not statistically significant.

1.Congenital anomalies are the underlying cause of 14% of all stillbirths in both ICD10 v2010 (NCHS) and ICD10 v2013 (IRIS). There were 260 stillbirths assigned to this group in ICD10 v2010 (NCHS), this increased slightly by 1.2% to 263 in ICD10 v2013 (IRIS). This change was not statistically significant.

2.Antepartum infections are the underlying cause of 1% of all stillbirths. The number of stillbirths assigned to this group increased significantly by 73% following coding in ICD10 v2013 (IRIS) from 15 to 26. This is a result of changing the coding of maternal infections such as "infection of amniotic sac and membranes" from a maternal code to an infant/fetus code resulting in the infection being recognised as occurring before birth.

4.Asphyxia, anoxia or trauma is the underlying cause of 28% of all stillbirths. This group did not change in size in ICD10 v2013 (IRIS).

7.Other specific conditions are the underlying cause of 4% of all stillbirths. This group increased by 2.6% from 76 in both ICD10 v2010 (NCHS) to 78 in ICD10 v2013 (IRIS). This change was not statistically significant.

# 5. Results - neonatal deaths

Table 2 shows a summary of the impact of IRIS on the assigned ONS cause group for neonatal deaths. Results from both ICD-10 versions (ICD-10 v2010, NCHS and ICD-10 v2013, IRIS) are presented.

Dual coding showed a statistically significant impact on "Antepartum infections" and "Infections", all other ONS cause groups showed no statistically significant change.

**Table 2: IRIS implementation coding changes for neonatal deaths: England and Wales**

| Deaths | Percentages | | | | | | |
|---|---|---|---|---|---|---|---|
| | Pre recoding | Post recoding | Net gain/ loss | Percentage net gain/loss | Comparability ratio | Lower confidence limit | Upper confidence limit |
| 0. Other conditions | 17 | 17 | 0.00 | 0.00 | 1.00 | 0.85 | 1.18 |
| 1. Congenital anomalies | 291 | 289 | -2.00 | -0.69 | 0.99 | 0.97 | 1.02 |
| 2. Antepartum infections | 30 | 61 | 31.00 | 103.33 | 2.03 | 1.54 | 2.69 |
| 3. Immaturity related conditions | 571 | 549 | -22.00 | -3.85 | 0.96 | 0.94 | 0.99 |
| 4. Asphyxia, anoxia or trauma | 101 | 99 | -2.00 | -1.98 | 0.98 | 0.92 | 1.05 |
| 5. External conditions | 1 | 1 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| 6. Infections | 15 | 13 | -2.00 | -13.33 | 0.87 | 0.65 | 1.15 |
| 7. Other specific conditions | 9 | 7 | -2.00 | -22.22 | 0.78 | 0.47 | 1.27 |
| 9. Sudden infant deaths | 9 | 8 | -1.00 | -11.11 | 0.89 | 0.71 | 1.12 |

Source: Office for National Statistics

0.Other conditions account for 1.6% of all neonatal deaths in both ICD10 v2010 (NCHS) and ICD10 v2013 (IRIS). This group did not change in size in ICD10 v2013 (IRIS).

1.Congenital anomalies are the underlying cause of death for 28% of all neonatal deaths in both ICD10 v2010 (NCHS) and ICD10 v2013 (IRIS). This group decreased from 291 in ICD10 v2010 (NCHS) to 289 in ICD10 v2013 (IRIS). This change was not statistically significant.

2.Antepartum infections showed a statistically significant increase. In ICD-10 v2010 (NCHS) Antepartum infections were the underlying cause of death in 3% of cases; this increased to 6% in ICD-10 v2013 (IRIS). The number of neonatal deaths assigned to this group increased from 30 in ICD-10 v2010 (NCHS) to 61 in ICD10 v2013 (IRIS).

3.Immaturity related conditions were the underlying cause of death in over 50% of neonatal deaths in both ICD10 v2010 (NCHS) and ICD10 v2013 (IRIS). This group decreased by 22 from 571 in ICD10 v2010 (NCHS) to 549 in ICD10 v2013 (IRIS). The majority of the change was caused by deaths which also mentioned a maternal infection and therefore are allocated to Antepartum infections using ICD10 v2013 (IRIS). This change was statistically significant.

4.Asphyxia, anoxia or trauma were in the underlying cause of approximately 9% of all neonatal deaths in both ICD10 v2010 (NCHS) and ICD10 v2013 (IRIS). This group decreased slightly from 101 in ICD10 v2010 (NCHS) to 99 in ICD10 v2013 (IRIS). This change was not statistically significant.

5.External conditions are the underlying cause of death in less than 1% of neonatal deaths. This group did not change in size in ICD10 v2013 (IRIS).

6.Infections were in the underlying cause of approximately 1% of all neonatal deaths in both ICD10 v2010 (NCHS) and ICD10 v2013 (IRIS). This group decreased slightly from 15 in ICD10 v2010 (NCHS) to 13 in ICD10 v2013 (IRIS). This change was not statistically significant.

7.Other specific conditions were in the underlying cause of approximately 1% of all neonatal deaths in both ICD10 v2010 (NCHS) and ICD10 v2013 (IRIS). This group decreased slightly from 9 in ICD10 v2010 (NCHS) to 7 in ICD10 v2013 (IRIS). This change was not statistically significant.

9.Sudden infant deaths were in the underlying cause of approximately 1% of all neonatal deaths in both ICD10 v2010 (NCHS) and ICD10 v2013 (IRIS). This group decreased slightly from 9 in ICD10 v2010 (NCHS) to 8 in ICD10 v2013 (IRIS). This change was not statistically significant.

# 6. Downloadable datasets

Data from the dual coding study are available to download from our website.

Table 1 presents the dataset of dual coded data for stillbirths, including every mentioned condition on the certificate coded using both ICD10 v2010 (NCHS) and ICD10 v2013 (IRIS) and the associated ONS cause groupings.

Table 2 presents the dataset of dual coded data for neonatal deaths, including every mentioned condition on the certificate coded using both ICD10 v2010 (NCHS) and ICD10 v2013 (IRIS) and the associated ONS cause groupings.

# 7. Background notes

1. The Tenth Revision of the International Statistical Classification of Diseases and Related Health Problems (ICD–10) has been used to classify cause of death.

2. **Stillbirths and neonatal death definitions**

   Stillbirth – born after 24 or more weeks completed gestation and which did not, at any time, breathe or show signs of life.

   Neonatal deaths – deaths under 28 days.

3. We have developed a hierarchical classification in ICD–10 for statistics relating to stillbirths and neonatal deaths. These are derived from a special death certificate (instead of the standard death certificate), introduced in 1986. More information on neonatal and stillbirth cause of death certificates can be found in section 2.9 of Child mortality statistics metadata.

4. Table 3: ONS cause groupings for stillbirth and neonatal deaths

**Table 3: IRIS implementation coding changes for neonatal deaths: England and Wales**

| Wigglesworth group and description | Application |
|---|---|
| 1 Congenital anomalies | Stillbirth and neonate |
| 2 Antepartum infections | Stillbirth and neonate |
| 3 Immaturity related conditions | Neonate only |
| 4 /8a Asphyxia, anoxia or trauma | Neonate (8a stillbirths only) |
| 5 External conditions | Stillbirth and neonate |
| 6 Infections | Neonate only |
| 7 Other specific conditions | Stillbirth and neonate |
| 9 Sudden Infant Deaths | Neonate only |
| 0/ 8b Other conditions | Stillbirth and neonate<br><br>Note: From 2001 Other conditions category for stillbirths has been split into 2 groups for some publications:<br><br>8b - Other conditions (antepartum and unknown)<br><br>0 - Other conditions intrapartum. |

## 5. Deriving Wigglesworth codes from ICD-10 mentions

For each record in this extract, it is possible to allocate up to 15 ICD-10 codes (mentions), which describe all diseases or conditions in the fetus or infant, maternal diseases or conditions affecting the fetus or infant, or other relevant causes. For this study, each ICD-10 mention was replaced with its corresponding Wigglesworth code. The highest Wigglesworth code in each record was classified as the Wigglesworth code for that record, overall (1. Congenital anomalies being highest, and 9. Sudden Infant Deaths being lowest). An additional process is used for the Wigglesworth calculation in Childhood, Infant and Perinatal Mortality in England and Wales and is described in the Child mortality statistics metadata.

## 6. Comparability ratios

Comparability ratios (with confidence intervals) have been calculated using standard methods. These are the ratio of the number of deaths coded to a particular underlying cause in ICD-10 v2010 (NCHS), to the number coded to the same cause in ICD-10 v2013 (IRIS). 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 ICD-10 v2013 (NCHS), compared with ICD-10 v2010 (IRIS). 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 ICD-10 v2010 (NCHS) and ICD-10 v2013 (IRIS) was not statistically significant.

7.  Special extracts and tabulations of deaths data for England and Wales are available to order (subject to legal frameworks, disclosure control, resources and agreements of costs, where appropriate). Such enquiries should be made to:

    Mortality Analysis Team
    Office for National Statistics
    Government Buildings
    Cardiff Road
    Newport
    NP10 8XG
    Tel: +44 (0)1633 455867 Email: mortality@ons.gsi.gov.uk

    The ONS charging policy is available on our website.

    We would welcome feedback on the content, format and relevance of this release. Please send feedback to the postal or email address above.


8.  Details of the policy governing the release of new data are available from the UK Statistics Authority website.

# 8. Appendix

**Table 4: ONS classification of stillbirths and associated ICD-10 codes, 2014 onwards: England and Wales**

| Group | Description | ICD–10 codes |
|---|---|---|
| 1 | Congenital anomalies | Main or other infant conditions |
| | | D550–D589, D610, D640, D66–D682, D691–D694, D70–D721, D740, D750, D760–D761, D800–D899, E700–E859, E880–E889, G120–G129, G318, G600–G609, G700–G719, G800–G809, G900–G909, I340–I379, I420–I425, I440–I459, K740–K746, Q000–Q079, Q200–Q239, Q242–Q249, Q251–Q269, Q271–Q289, Q310–Q313, Q315, Q318–Q319, Q320–Q349, Q382–Q459, Q600–Q609, Q610–Q611, Q613–Q619, Q620–Q639, Q641–Q649, Q673–Q676, Q743, Q750–Q759, Q761–Q799, Q800–Q819, Q850–Q939, Q960–Q999 |
| | | Main or other maternal conditions: |
| | | Q048, Q249, Q777, Q999 |
| 2 | Antepartum infections | Main or other infant conditions: |
| | | A000–B99, E321, G000–G09, H650–H669, H700–H709, I300–I309, I330–I339, J00–J069, J09, J100–J189, J200–J22, J36, J370–J371, J47, J850–J869, K350–K359, K610–K614, K650–K659, N111, N12, N136, N300, N390, P002, P027, P230–P239, P350–P379, P38, P390–P399 |
| | | Main or other maternal conditions: |
| | | P002, P027, P351 |
| 4 and 8a | Asphyxia, anoxia or trauma (4=intrapartum and 8a=antepartum /unknown) | Main or other infant conditions |
| | | P000, P016–P017, P018, P020–P021, P022, P024–P026, P030–P039, P050–P059, P080–P082, P100–P159, P200–P219, P240–P241, P249, P292, P525–P529, P90, P910–P919, P524, Z352 |
| | | Main or other maternal conditions: |
| | | P000, P016-P017, P018, P020, P021, P022, P024, P036, P038, P059, Z352, Z369 |
| 5 | External conditions | Main or other infant conditions: |
| | | E40–E441, E46, J690, P242–P248, P800–P809, P830–P831, P833–P839, P920–P929, U509, V01–Y98 |
| 7 | Other specific conditions | Main or other infant conditions: |
| | | C000–C97, D100–D489, D600–D609, D684, E000–E320, E322–E349, I310-I319 P005–P006, P023, P028–P029, P293, P500–P519, P530–P549, P550–P570, P579, P580–P589, P591–P599, P60–P611, P613–P619, P700–P749, P760–P769, P780–P789, P810–P819, P832, P93, P961–P962 |
| | | Main or other maternal conditions: |
| | | C000–C97, D100–D489, D600–D609, D684, E000–E320, E322–E349, I310–I319, I470–I499, I710–I719, J450–J459, K529, P005-P006, P008, P023, P028-P029, P293, P500-P519, P530-P549, P613-P619, P700-P749, P760-P769, P832, P964 |
| 0 and 8b | Other conditions (0=intrapartum and 8b=antepartum /unknown) | All other codes |

Source: Office for National Statistics

**Table 5: ONS classification of neonatal deaths and associated ICD-10 codes, 2014 onwards: England and Wales**

| Group | Description | ICD-10 codes |
|---|---|---|
| 1 | Congenital anomalies | Main or other infant conditions<br><br>D550–D589, D610, D640, D66–D682, D691–D694, D70–D721, D740, D750, D760–D761, D800–D899, E700–E859, E880–E889, G120–G129, G318, G600–G609, G700–G719, G800–G809, G900–G909, I340–I379, I420–I425, I440–I459, K740–K746, Q000–Q079, Q200–Q239, Q242–Q249, Q251–Q269, Q271–Q289, Q310–Q313, Q315, Q318–Q319, Q320–Q349, Q382–Q459, Q600–Q609, Q610–Q611, Q613–Q619, Q620–Q639, Q641–Q649, Q673–Q676, Q743, Q750–Q759, Q761–Q799, Q800–Q819, Q850–Q939, Q960–Q999<br><br>Main or other maternal conditions:<br><br>Q048, Q249, Q777, Q999 |
| 2 | Antepartum infections | Main or other infant conditions:<br><br>A500–A509, P002, P027, P230–P239, P350–P359, P370–P379<br><br>Main or other maternal conditions:<br><br>O353 A500-A509, P002, P027, P230-P239, P350-P359 |
| 3 | Immaturity related conditions | Main or other infant conditions<br><br>P010–P011, P018, P070–P073, P220–P229, P250–P258, P270–P279, P280-P285, P288-P289, P520–P523, P578, P590, P77<br><br>Main or other maternal conditions:<br><br>P010-P011, P018, P070-P073, P220-P229, P250-P258, P270-P279, P280-P285, P288-P289, P520-P523, P77 |
| 4 | Asphyxia, anoxia or trauma (intrapartum) | Main or other infant conditions:<br><br>P000, P016–P017, P018, P020–P021, P022, P024–P026, P030–P039, P050–P059, P080–P082, P100–P159, P200–P219, P240–P241, P249, P292, P524,P525–P529, P90, P910–P919, Z352<br><br>Main or other maternal conditions:<br><br>P000, P016-P017, P018, P020, P021, P022, P024, P036, P038, P051, P059, Z352, Z369 |
| 5 | External conditions | Main or other infant conditions:<br><br>E40–E441, E46, J690, P242–P248, P800–P809, P830–P831, P833–P839, P920–P929, U509, V01–Y98 |
| 6 | Infections | Main or other infant conditions:<br><br>A000–A499, A510–B99, E321, G000–G09, H650–H669, H700–H709, I300–I309, I330–I339, J00–J069, J09, J100–J189, J200–J22, J36, J370–J371, J47, J850–J869, K350–K359, K610–K614, K650–K659, N111, N12, N136, N300, N390, P360–P369, P38, P390–P399 |
| 7 | Other specific conditions | Main or other infant conditions:<br><br>C000–C97, D100–D489, D600–D609, D684, E000–E320, E322–E349, P005–P006, P023, P028–P029, P293, P500–P519, P530–P549, P550–P570, P579, P580–P589, P591–P599, P60–P611, P613–P619, P700–P749, P760–P769, P780–P789, P819, P832, P93, P961–P962 |
| 9 | Sudden infant deaths | Main or other infant conditions: |

| | | R95-R99 |
|---|---|---|
| 0 | Other conditions | All other codes |

Source: Office for National Statistics