

# MORTALITY

## Introduction

The ONS Longitudinal Study (LS) is a 1% sample of the population of England and Wales. It contains linked census and vital events data, beginning with a sample from the 1971 Census. Members are selected if their birthday falls on one of four designated dates in any year. New LS sample members can enter the LS in one of three ways:

- At birth (a new birth on one of the four LS birthdays).
- If they register with an NHS doctor (and have one of the LS birthdays).
- If they are enumerated at a census, have one of the LS birthdays and have not entered the LS at a previous census.

Members are flagged in the NHS Central Registry (NHSCR) allowing the linkage of vital events occurring after the 1971 census (see the Events guide for more information on the vital events that are linked to the ONS LS).

This guide provides information relating to:

- Deaths of LS members.
- Widow(er)hoods.
- Infant deaths to LS sample mothers.
- Still births to LS sample mothers.

(See the DETH, WDW, IDMI and SBSM tables in the [Data Dictionary](#), respectively).

Its aims are to:

- Inform potential users of the LS of the scope of mortality data available.
- Describe these data and the system for coding causes of death, including changes over time (International Classification of Diseases (ICD) revisions 8, 9 and 10).
- Explain how underlying causes of death are selected and detail other variables that may be used, along with any restrictions.
- Give some simple examples of how LS mortality data can be recoded, described and analysed.

## Linkage

### Death of LS member

Deaths data for LS members are updated annually in July and cover Census Day 1971 to the current year minus two. Deaths of LS members are recorded in the DETH table in the [Data Dictionary](#).

There are two processes by which the deaths of LS members are linked to their other records in the LS:

- The ONS death files are searched for individuals with one of the LS birthdates. These records are isolated and an attempt is made to link them to actual LS sample members. Only those death records that match actual LS sample members are linked to their existing records.
- LS sample members are flagged (i.e. marked as LS members) at the NHS Central Register, and when a death is recorded at the NHS Central Register for one of the flagged individuals, the entry is sent to the LS Development Team to be added to the LS database. Since LS members are flagged in the NHSCR, their deaths should be added to the LS database automatically regardless of the date of birth recorded on the death certificate.

The linkage rate of deaths of LS members is very high and it is believed that very few deaths of LS members have been missed in the decades covered by the LS.

### Widowerhoods

The widow(er)hoods data for LS members cover Census Day 1971 to the current year minus two. The data is recorded in the WDOW table in the [Data Dictionary](#). Since LS members may have been widowed more than once they may have more than one record in the file. The variable EVENTORD can be used to establish date order and to generate a dataset with one record per LS member.

Linkage occurs through an annual search of the ONS death file to identify LS birthdays in the date of birth of the surviving spouse – thus showing that an LS sample member has been widowed.

### Infant deaths to LS sample mothers

Infant deaths to LS sample mothers cover Census Day 1971 to the end of 2013, because infant death records have not been processed since then. They are recorded in the IDMI table in the [Data Dictionary](#). Some LS mothers may have more than one infant death record in the file. In such cases, the variable EVENTORD can be used to establish the date order.

Linkage occurs through an annual date of birth search of the ONS Infant Death file for LS sample mothers. For the period 1971 – 1976 the linkage was carried out manually and as a result the quality of the data suffered. Caution should therefore be used if using data for this period. Until January 1993, only deaths of infants up to one-year old were included in the ONS Infant Death file, however, from January 1993 the death of any child born in 1993 or later was included. As most deaths occur

before the age of one, there are small numbers of child deaths after that age – only 167 for the period 1994-2013.

### **Still births to LS sample mothers**

Still births to LS sample mothers cover 1971 to the end of end of the current year minus two. They are recorded in the SBSM table in the [Data Dictionary](#). Some LS mothers may have more than one still birth record in the file. In such cases, the variable EVENTORD can be used to establish the date order.

Linkage occurs through an annual date of birth search of the ONS Still birth file for LS sample mothers.

## Date of death

Often only information on the date of death is needed. The information is simple and relatively easy to use and is primarily used for survival analysis purposes.

### Date of death of LS member

Three variables in the DETH table will need to be used to derive the date of death of an LS member:

- DEDYBDE: the day of the month on which the death occurred.
- DEMENTBDE: the month in which the death occurred.
- DEYRBDE: the year in which the death occurred.

Special permission (through an x-file application) is required to access the day of death variable, but the month and year of death variables do not require such permission. It may be necessary to disguise the actual date of death if unusual conditions create a category into which only one or two LS members fall.

The date of death in the format YYYYMMDD is also available (EDATEDE) but only through the DETHx table (i.e. restricted access and therefore needing special permission to use through an x-file application). However, it is a long integer variable and cannot be used directly as a date. It can be converted into a string variable (use the `-tostring-` command in Stata). However, it may be easier to concatenate the three separate variables (DEDYBDE, DEMENTBDE and DEYRBDE) to construct the date.

*[NB: While the exact date of death may be available for use, the full date of birth can never be used since this would enable the identification of the four designated dates in each year that are used to select LS sample members.]*

### Has the LS member been traced?

Researchers will need to consider the variable TRACE in the CORE1 table (see the [Data Dictionary](#)). The stored value indicates the time period when the LS member was traced in the NHSCR (e.g. 1=Traced at 1971 Census; 2=Traced between 1971 and 1981 Censuses). If an LS member has not been traced then their events (including death) will not be picked up. Such untraced LS members (TRACE=0) should be dropped from any analysis of mortality.

## Cause of death

All cause of death information comes from the Medical Certificate of Cause of Death (see figure 1 below), and is coded using the International Classification of Diseases (ICD) in operation at the time of the registration.

**[NB: Neo-natal deaths (deaths of infants <28 days old) have a separate range of variables, but still use the ICD codes.]**

Figure 1: Medical Certificate of Cause of Death

The image shows a 'DRAFT CERTIFICATE FOR CONSULTATION' for Coroners and Justice Act 2009. It is a 'MEDICAL CERTIFICATE OF CAUSE OF DEATH' prescribed by the Death Certification Regulations 2009. The form is divided into several sections:

- Counterfoil (AP 000000 S):** For use by the person completing the certificate. It includes fields for Name of deceased person, Gender, NHS No., Date of death, Date last seen alive by me, Age, Place of death, and Post-mortem/ additional information (1, 2, 3, 4).
- Registrar's Confirmation:** A box for the Registrar to enter the Date of Medical Examiner's Confirmation and the No. of Death Entry.
- Medical Certificate of Cause of Death:** For use only by a Registered Medical Practitioner. It includes fields for Name of deceased person, Gender, NHS No., Date of death as stated to me, Date last seen alive by me, Age as stated to me, and Place of death.
- CAUSE OF DEATH:** The main section where the cause of death is recorded. It is divided into Part I (Disease or condition directly leading to death) and Part II (Other significant conditions CONTRIBUTING TO THE DEATH). It includes a table for pregnancy-related questions and a section for certification.
- SPACE FOR BINDING:** A vertical section on the left side of the form.

The Underlying cause of death (UCD) is the variable that is most often used by researchers. Essentially, the UCD is the last one entered in Part I of the Medical Certificate of Cause of Death. The rules for determining the UCD are summarised in the next section of this guidance. The UCD variable is available for the whole time period of the LS (i.e. 1971 to the current year minus two).

In addition to the UCD, other significant conditions contributing to the death may be recorded (in Part II of the Medical Certificate of Cause of Death). The LS codes up to eight of these for any LS member. However, there is a gap in the data for these contributory cause variables from 03/12/1986 to 31/12/1992 (inclusive).

## **Rules for determining the underlying cause of death**

All cause of death information comes from the Medical Certificate of Cause of Death. The UCD is the lowest (last) of the causes of death entered into Part I of the certificate. For example, if the direct cause of death was 'Myocardial infarction (heart attack)' but the patient was known to have ischaemic heart disease, then 'Myocardial infarction' would be entered on line I(a) and 'Ischaemic heart disease' on line I(b). It would be 'Ischaemic heart disease' that would be taken as the 'Underlying cause of death' and appear as such in the LS DETH dataset. This is the general principle, but additional rules (Rules 1, 2 and 3 below) could over-ride this selection. Of these, Rule 3 is potentially the most significant.

### **General Principle**

*'Select the condition entered alone on the lowest used line of Part I of the Death Certificate only if it could have given rise to all the conditions mentioned above it.'*

#### **Rule 1**

*'If the general principle does not apply; is there a sequence terminating in the first condition entered? If so, the originating cause of the sequence is selected as the UCD. If there is more than one sequence, then the originating cause of the first named sequence is selected.'*

#### **Rule 2**

*'If there is no reported sequence leading to the first named condition, then the first named condition is selected as the UCD.'*

#### **Rule 3**

*'If the condition selected by any of the General Principle, or by Rule 1 or Rule 2 is clearly a direct consequence of another reported condition, whether stated in Part I or Part II of the certificate, then this primary condition should be selected as the UCD.'*

### **Rule changes for ICD 10**

Although the wording of Rules 1-3 in ICD10 is essentially similar to that of previous ICD versions, there are further explanatory notes in ICD10 that significantly widen the scope of Rule 3. Of greatest significance is the note referring to pneumonia and bronchopneumonia.

Readers are referred to the [WHO document on ICD-10](#), sections 4.1.4 – 4.1.7 (p.34-45) for examples of determining sequences and the application of the General Principle, and Rules 1, 2 and 3.

The originating cause may sometimes be superseded by a specific combination of conditions or for some overriding epidemiological reason. In such cases, consideration must be given to the five Modification rules (see section 4.1.9, p. 46-47 of the WHO document on ICD-10). These rules cover:

- Rule A: Senility and other ill-defined conditions

- Rule B: Trivial conditions
- Rule C: Linkage
- Rule D: Specificity
- Rule E: Early and late stages of disease
- Rule F: Sequelae

If the main cause is injury or an external cause, then the causal circumstances should be recorded as the UCD.

## **Underlying cause of death**

### **ICD codes**

The ICD coding system has gone through several revisions since the LS was set up:

- Census 1971 to 4<sup>th</sup> April 1981 - ICD8 was used.
- 1979 to 31 December 1992 - ICD9 was used. The variable UCDE3DDE, gives the first three digits of the code, and UCDEXDDE the fourth.
- 1<sup>st</sup> January 1993-December 2000 - a different variable was used (ICD9UDE) holding all four digits in a single variable.
- January 2001 onwards – ICD10 coding came into use. To give an idea of how the change from ICD9 to ICD10 affected coding, a study was performed by Statistics Canada<sup>1</sup>, where deaths were coded to both ICD9 and ICD10 using the appropriate rules (see table 1 in the associated Mortality Excel file).

Dual-code tables can also be found for ICD8 to ICD9.

*[NB: ICD11 was launched in June 2018, but it is not due to come into use for reporting cause of death until 1 January 2022. The ICD11 includes spreadsheets to assist with mapping ICD10 to 11, and can be accessed through the [WHO website](#).]*

### **Final underlying cause of death**

From January 1993 a second 'Underlying Cause of Death' variable was added called 'Final Underlying Cause of Death' (ICD9UFDE), however this variable only contains a value if the original Underlying Cause of Death was changed at a later date, perhaps following a post-mortem or inquest. In such cases, any real value contained in ICD9UFDE should be used in preference to that in ICD9UDE when assigning the Underlying Cause of Death.

Similarly, there is a separate 'Final Underlying Cause of Death' variable (IC10UFDE) using ICD10 coding. As an example, of the 104962 deaths with a valid ICD10 code for Underlying Cause of Death

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<sup>1</sup> Leslie Geran, Patricia Tully, Patricia Wood, Brad Thomas (2005) Comparability of ICD9 and ICD10 for Mortality Statistics in Canada; Ottawa, Statistics Canada. Accessed from: <https://www150.statcan.gc.ca/n1/pub/84-548-x/84-548-x2005001-eng.htm> [date: 18/11/2019]

recorded in IC10UDE, only 273 cases have a real value in IC10UFDE as a result of a change from the originally assigned Underlying Cause of Death.

### Variables to use for Underlying Cause of Death

The table below, shows the Cause of Death variables by ICD version (versions 8-10). See the DETH table in the [Data Dictionary](#) for further information on these variables.

	ICD8	ICD9		ICD10
	1971-4/4/1981	1/1/1979-31/12/1992		1/1/2001 onwards
<b>Underlying Cause of Death - 1st 3 digits</b>	UCDE3CDE	UCDE3DDE	<b>ICD10 code - Underlying Cause of Death</b>	IC10UDE
<b>Underlying Cause of Death - 4th digit</b>	UCDEXCDE	UCDEEXDDE	<b>ICD10 code - Final Underlying Cause of Death</b>	IC10UFDE
		<b>1/1/1993-2001</b>		
<b>Underlying Cause of Death – 4 digit code</b>		ICD9UDE		
<b>Final Underlying Cause of Death - 4 digit code</b>		ICD9UFDE		

Stata code has been written to derive a variable (UDCOD 'Underlying cause of death (20 categories)' that combines the following variables to create 20 Underlying Cause of Death categories [see Appendix 1]:

- IC10UDE
- IC10UFDE
- UCDE3DDE
- ICD9UDE
- ICD9UFDE
- UCDE3CDE
- DEYRBDE

(See the DETH table in the [Data Dictionary](#) for further information on these variables.)

The derived variable, called 'Underlying Cause of Death (20 categories)', groups the Underlying Cause of Death into 20 categories using the ICD coding in use at the time the death was recorded:

- 1: Ischaemic heart disease
- 2: Stroke
- 3: Pulmonary disease
- 4: Lung cancer
- 5: Other cancers
- 6: Infectious or parasitic disease
- 7: Diabetes mellitus



- 8: Gastro-intestinal tract disease
- 9: Liver disease
- 10: Mental or behavioural
- 11: Abnormalities or lab results
- 12: Other circulatory disease
- 13: Accidents or self-harm
- 14: Muscular disease
- 15: Benign neoplasms
- 16: Nervous system diseases
- 17: Genito-urinary
- 18: Other endocrine
- 19: Skin disease
- 20: Other cause

LS Users will need to be aware that ICD coding changes with each new ICD version, however, the 20 categories used in this derived variable are sufficiently broad that there is no need for Stata code to take account of these changes.

*[NB: This is not the only way of grouping causes of death, for instance not all liver diseases appear under 'Liver disease'. The most appropriate coding will depend on the research question.*

*Users may wish to group these 20 categories further, possibly by adding codes 6-19 to code 20 ('Other cause'); alternatively, codes 1,2 and 12 could be grouped to form a 'Circulatory disease' category, and 8 and 9 could be grouped as 'Digestive diseases']*

This derived variable represents underlying cause of death (the most commonly used category), but the same principle could be used to group values for contributory cause of death.

Table 2 and figure 2 show the distribution of the derived variable for people who have died since 1971 to December 2017, i.e. all cases in the DETH table for LSLOAD17. If living people are included in the sample, they will be coded 0, which means "Still alive" (see table 2 and figure 2 in the associated Mortality Excel file).

### **Trends in ICD-10**

The introduction of ICD10 virtually doubled the number of codes available for assigning causes of death. One of the effects of this is to cause a *discontinuity in trends* such that "cause of death" data using ICD10 is not directly comparable with that from previous years.

The impact of these changes is considered in the following papers:

- Brock A, Griffiths C, Rooney C. (2006) The impact of introducing ICD-10 on analysis of respiratory mortality trends in England and Wales. Health Statistics Quarterly 2006 Spring;(29):9-17.

Brock A, Griffiths C, Rooney C. (2004) The impact of introducing ICD-10 on trends in mortality from circulatory diseases in England and Wales. Health Statistics Quarterly 2004 Summer;(22):14-20.

- Brock A, Griffiths C, Rooney C. (2004) The effect of the introduction of ICD-10 on cancer mortality trends in England and Wales (pdf). Health Statistics Quarterly 2004 Autumn;(23):7-17.
- For an American viewpoint the following paper may be of interest: Center for Health Statistics (2004) Guide to Presenting and Using ICD-10 Mortality Data, Washington State Department of Health (<https://www.doh.wa.gov/Portals/1/Documents/5400/ICD10Gud.pdf> accessed on 18/11/2019).

## Contributory causes of death

In many cases additional causes of death will have been recorded in Part II of the Death Certificate. Up to eight contributory causes of death may be indicated in the data for any LS member (except for the period 3<sup>rd</sup> December 1986 to 31<sup>st</sup> December 1992, when these were not coded for the LS). The Data Dictionary refers to these contributory causes as ‘multiple’ causes.

Slightly more than 60% of the LS members who died between 1971 and 2017 have three or more contributory causes of death recorded, about a quarter has four or more, and around one-tenth has 5-8 or more.

### Data format

As with the underlying cause of death, multiple causes are coded to the ICD version in use at the time. The variables that hold the codes for ICD8 and ICD9 are ‘strings’ with a length of 4 (length of 5 for ICD9 from 1993). These are all left-justified. The fourth character may indicate a subdivision of the condition coded by the previous three digits, e.g. 4171 is subdivision ‘.1’ of ICD9 code 417, the ‘Other diseases of pulmonary circulation’ and refers to Aneurysm of the pulmonary artery. Note that the decimal point is not part of the stored code. The fourth character may also be blank (a space) or “-“ and these characters must be taken into account when specifying codes to be grouped for a given aggregate of conditions.

From 1993 the ICD9 variable is a five-character string holding 4-character codes as above, except where the cause is one of those classified as ‘External’ when the ‘E’ prefix is included before the code numbers. Note that the ‘E’ prefix is not used at any time to define the UCD.

ICD10 is again a string variable where any decimal points have been omitted and the stored code may also contain trailing blanks.

### Variables to use for Contributory causes of death (Multiple causes)

The table below, shows the Contributory causes of death variables by ICD version (versions 8-10).

See the DETH table in the [Data Dictionary](#) for further information on these variables.

	ICD8	ICD9		ICD10
	1971-4/4/1981	1/1/1979-31/12/1992		1/1/2001 onwards
<b>Multiple cause of death code for 1<sup>st</sup> – 8<sup>th</sup> cause of death</b>	MLC841DE – MLC848DE	MLC941DE – MLC948DE	<b>ICD10 code - Multiple cause of death code for 1<sup>st</sup> – 8<sup>th</sup> cause of death</b>	IC101DE – IC108DE
			<b>ICD10 code - Final Multiple cause of death for 1<sup>st</sup> – 8<sup>th</sup> final multiple cause of death</b>	IC10F1DE – IC10F8DE

		<b>1/1/1993-2001</b>		
<b>Multiple cause of death code for 1<sup>st</sup> – 8<sup>th</sup> cause of death</b>		ICD91DE – ICD98DE		
<b>Final Multiple cause of death code for 1<sup>st</sup> – 8<sup>th</sup> cause of death</b>		ICD91FDE – ICD98FDE		

There are also variables for 'Final Multiple Cause of Death' associated with the second set of ICD9 codes and ICD10 codes (see table above), but as with the Underlying Cause of Death these will only contain a value if the code was altered after the original entry, perhaps due to a post mortem or inquest.

## Deaths of LS member: examples of cause

Refer to the Events guide for further information on data of LS member deaths, including:

- Time period that the data are available for, whether there are multiple records, what the unique identifier is, how the data are linked and the source of the data.
- A brief description of the data, including important variables.
- Analytic issues and the quality of the data, using tables from ONS.
- Number of events that occur each year.

The LS holds details of around 6000 deaths per year from 1972 onwards (fewer for 1971 because the LS only started after Census Day). These data are held in the DETH table. Table 3 shows the number of deaths in each year by sex (see table 3 and figure 3 in the associated Mortality Excel file).

As there are many thousands of ICD codes for cause of death, researchers will often want to group them. The main groups are shown below (figures represent the Underlying Cause of Death unless otherwise stated).

### Ischaemic Heart Disease

- ICD8 Codes '410' to '414'
- ICD9 Codes '410 ' to '4149'
- ICD10 Codes 'I20 ' to 'I259'

This is recorded as the underlying cause of death on 63,783 LS member death certificates between 1971 and 2017. Table 4 and figure 4 show the number of deaths each year, by sex, where the underlying cause is IHD (see table 4 and figure 4 in the associated Mortality Excel file).

Box 1 below provides an example of Stata code that can be used to derive a variable that creates an IHD group.

*Box 1: Example Stata code to create IHD group (using ICD8, ICD9 and ICD10 underlying cause of death variables)*

```
/*Derive a variable that holds any ICD10 code in the Underlying Cause of
Death variable for ICD10*/
gen icd10 = ic10ude

/*Derive a variable that holds any ICD10 code in the Final Underlying Cause
of Death variable for ICD10*/
gen icd10a = ic10ufde

/*Derive a variable that holds any ICD9 code in the Underlying Cause of
Death variable for ICD9 (1981-1992)*/
gen icd9 = ucde3dde

/*Derive a variable that holds any ICD9 code in the Underlying Cause of
Death variable for ICD9 (1993-2001)*/
gen icd9b = icd9ude
```

```

/*Derive a variable that holds any ICD9 code in the Final Underlying Cause
of Death variable for ICD9 (1993-2001)*/
gen icd9c = icd9ufde
/*Derive a variable that holds any ICD8 code in the Underlying Cause of
Death variable for ICD8*/
gen icd8 = ucde3cde

/*If final cause of death set post 1993, set cause of death to final cause
if it exists*/
gen finalflag = real(icd9c)
replace icd9b=icd9c if finalflag >0 & finalflag != .
drop finalflag

gen final10 = trim(icd10a)
replace icd10 = icd10a if final10 != "" & final10 != "-9" & final10 != "-8"

drop final10 icd10a icd9c

/*Code to split cause of death into Ischaemic Heart Disease [Note default
value 0 = still alive; Other causes of death should set udcod to a value >
1 leaving value at 0 if subject is still alive.] */
gen byte udcod = 0

*Derive IHD variable
replace udcod = 1 if inrange(icd9,"410","414")
replace udcod = 1 if inrange(icd9b,"410 ","4149")
replace udcod = 1 if inrange(icd8,"410","414")
replace udcod = 1 if inrange(icd10,"I20 ","I259")

```

### Diabetes

- ICD8 Code '250'
- ICD9 Codes '250 ' to '2509'
- ICD10 Codes 'E10 ' to 'E149'

This is recorded as the underlying cause of death on 3,257 LS member death certificates. Table 5 and figure 5 show the number of deaths each year, by sex, where the underlying cause is diabetes (see table 5 and figure 5 in the associated Mortality Excel file).

The Stata code in Box 1 can be adapted to derive a variable that creates a diabetes group.

### Respiratory System (Excluding Pneumonia)

- ICD8 Codes '460' to '474', '490' to '519' and '783'
- ICD9 Codes '4600' to '4799', '487 ' to 4969, '500 ' to '5199'
- ICD10 Codes 'J40 ' to 'J479'

Diseases of the respiratory system (excluding pneumonia) are recorded as the underlying cause of death on 19,389 LS member death certificates. Table 6 and figure 6 show the number of deaths per year, by sex, where the underlying cause is a disease of the respiratory system (excluding pneumonia) (see table 6 and figure 6 in the associated Mortality Excel file).

The Stata code in Box 1 can be adapted to derive a variable that creates a Respiratory System (excluding pneumonia) group.

### **Malignant neoplasms (Cancers)**

- ICD8 Codes '140' to '161', '163' to '209'
- ICD9 Codes '140 ' to '2029'
- ICD10 Codes 'C\*\*\*' where \*\*\* is any number in range 000 - 999 (although the last character may be a space as in the example Stata code in Box 1 above).

Malignant neoplasms are recorded as the underlying cause of death on 72,579 LS member death certificates. Table 7 and figure 7 show the number of deaths per year, by sex, where the underlying cause is a malignant neoplasm (see table 7 and figure 7 in the associated Mortality Excel file).

The Stata code in Box 1 can be adapted to derive a variable that creates a malignant neoplasm group.

### **Other Conditions**

Other common conditions listed as contributing to the cause of death (multiple cause of death codes) include: Infectious & Parasitic, Intestinal Disease, Liver Disease, Cerebro-Vascular, Mental & Behavioural, Muscular Disease, Accident & Violence, Suicide/Self Harm, Benign Neoplasms, Undetermined Intent, Nervous System, Genito-Urinary and Skin Disease.

These are recorded as the underlying cause of death on 114,923 LS member death certificates. Table 8 and figure 8 show the number of deaths per year, by sex, where the underlying causes are other conditions (see table 8 and figure 8 in the associated Mortality Excel file).

## **Widow(er)hoods (WDOW)**

The death of a (legal) spouse of an LS member is recorded in a specific table (file) called WDOW. Users need to be aware that an LS member can have more than one record in the WDOW file since they may be widow(er)ed more than once. Necessary steps should be taken when merging data from this table with data from one of the member Census files to ensure matching occurs correctly and produces the required dataset.

The Events guide provides further information on data on widow(er)hoods of LS members, including:

- Time period that the data are available for, whether there are multiple records, what the unique identifier is, how the data are linked and the source of the data.
- A brief description of the data, including important variables.
- Analytic issues and the quality of the data, using tables from ONS.
- Number of events that occur each year.

Previous research on widow(er)hood in the LS has included studies on the effect of widow(er)hood on mortality (see: Jones D R (1987) Heart disease mortality following widow(er)hood: some results from the OPCS Longitudinal Study; *Journal of Psychosomatic Research* 1987; 31(3), p.325-333), and research on the effects of widow(er)hood on changes in circumstances of the surviving spouse. Information on other projects that have focussed on widow(er)hood can be found on the [CeLSIUS website](#). New research could focus on the length of time the widow(er) survives, and their circumstances at the next census (still single, remarried, social class etc.) could also be determined.



## Useful variables

Variable name	Label and comments
CORENO	Unique identifier
DEYRBWI	Year of death of LS member's spouse
DEMTBWI	Month of death of LS member's spouse
DEDYBWI	Day of death of LS member's spouse
BIYRCDWI	Year of birth of the LS member's spouse
BIMTCDWI	Month of birth of the LS member's spouse
BIDYCDWI	Day of birth of the LS member's spouse
AGDC3DWI	Age at death of LS member's spouse (years)
AGS03FWI	Age of LS member at death of spouse (years) (1 <sup>st</sup> widow(er)hood)
<i>Cause of death: Underlying cause of death variables</i>	
IC10UWI	ICD10 Underlying COD of spouse of LS member (not before 2001)
ICD9UWI	ICD9 Underlying COD of spouse of LS member (1993 - 2001)
UCDE3DWI	ICD9 Underlying COD of spouse of LS member (1979 - 1992) 3 digit
UCDE3CWI	ICD8 Underlying COD of spouse of LS member (1971 - 1981) 3 digit
<i>Cause of death: Other Cause of Death Variables:</i>	
IC101WI - IC108WI	ICD10 codes for multiple cause of death (not before 2001)
ICD91WI - ICD98WI	ICD9 codes for multiple cause of death (1993-2001)
MLC941WI - MLC948WI	ICD9 codes for multiple cause of death (1981-1986)
MLC841WI - MLC848WI	ICD8 codes for multiple cause of death (4/1971-4/1981)

[see the WIDOW table in the Data Dictionary for more information on these variables and a full list of the variables available]

## Widow(er)hood examples

### Widow(er)hoods by year of death of spouse

Table 9 and figure 9 show widow(er)hood by year of death of the LS member's spouse (see the associated Mortality Excel file). Since 1972, when full years have been recorded, the number of deaths of spouses of LS members has been fairly consistent.

### Widow(er)hoods by year of birth of LS member's deceased spouse

Table 10 and figure 10 show widow(er)hood by year of birth of the LS member's spouse (see the associated Mortality Excel file). The number of deaths of spouses of LS members depends on current mortality patterns and also on numbers of marriages (and age differences between spouses) in the past. These in turn are influenced by the size of particular birth cohorts. For example, past deficits in numbers of births during war time and immediate post-war baby bulges are evident.

### Widow(er)hoods by age of LS member's deceased spouse

Table 11 and figure 11 show widow(er)hood by age of the LS member's spouse (see the associated Mortality Excel file). The age range of spouses at death is from under 20 to over 100, peaking in the mid-70s. The peak for age of death of spouses is approximately the same for wives and husbands.

Husbands begin to die in greater numbers once past the age of 50, and numbers in the two sexes do not converge again until age reaches the lower 90s. Part of this difference can be explained by the longer life expectancy of women and the fact that women tend to marry men older than themselves.

#### **Widow(er)hoods by age of LS member**

Table 12 and figure 12 show widow(er)hood by age of the LS member (see the associated Mortality Excel file). At all ages to the age of 89, more wives are recorded in the WIDOW table as losing their husbands than husbands their wives. The peak age for loss of a husband or wife is similar.

#### **Widow(er)hoods by underlying cause of spouse's death**

Table 13 and figure 13 show widow(er)hood by the underlying cause of death of the LS member's spouse (see the associated Mortality Excel file). Circulatory diseases (IHD, stroke and other circulatory), cancer and pulmonary diseases predominate for both sexes, with the numbers of male deaths being greater than female deaths for all causes. However, if the percentage of each sex by underlying cause of death category is examined then it would appear that of those who die, a greater proportion of wives succumb to cancer or stroke than husbands, while Ischaemic heart disease (IHD) and pulmonary disease are more associated with husbands.

*[NB: Care should be taken in interpreting these data; they come from a 1.1% sample of the population, these are numbers of deaths and not rates, and no adjustment for age at death or other potential confounding factors has been made. The numbers are shown to help potential LS users in planning their analyses.]*

## Infant deaths to sample mothers (IDMI)

A national database was set up for infant deaths in England and Wales in 1976. Although information on infant deaths to sample mothers is available from 1971, the linkage to an LS member's record was carried out manually until 1976 and therefore the quality of the data suffered. Infant deaths to LS sample mothers have been recorded to 2013, since infant death records have not been processed since then.

The death of an infant to a sample mother is recorded in a specific table (file) called IDMI. Users need to be aware that an LS member can have more than one record in the IDMI file since they may have more than one child that has died in infancy. Necessary steps need to be taken when merging data from this table with data from one of the member Census files to ensure that matching occurs correctly and produces the required dataset.

Information is also available for sample fathers, but only for 1976-78.

Until January 1993, only deaths of infants up to one-year old were included in the ONS database, and therefore recorded in the LS. From January 1993, the death of any child born in 1993 or later was included, so that by 2013 the maximum age of a child death that was included was 15. The LS data follows this change in the national database. As most deaths to children occur before the age of one, there are small numbers of child deaths over that age - only 167 for the period 1994 to 2013. However, numbers will increase as more children are added to the ONS database.

The Events guide gives further information on data on infant deaths to LS mothers:

- Time period that the data are available for, whether there are multiple records, what the unique identifier is, how the data are linked and the source of the data.
- A brief description of the data, including important variables.
- Analytic issues and the quality of the data, using tables from ONS.
- Number of events that occur each year.

Deaths of infants are referred to as 'neonatal' (i.e. occurring before the child is aged 28 days) or 'non-neonatal' (occurring at 28 days or older). Neonatal deaths have separate cause of death variables in the LS, e.g. ORITMODE (condition of the mother contributing to the neonatal death). Other variables hold single digit codes that further define the cause of neonatal death. There is little research on neonatal deaths in the LS, and the quantity and quality of this data is unclear. Some references to previous studies are:

- Bethune, A, H Filakti, S Harding, I MacDonald-Davies. Fertility and infant mortality in the OPCS Longitudinal Study. Population Trends 1992; 68 (Summer 1992)
- Botting, B, M Rosato, R Wood. Teenage mothers and the health of their children. Population Trends 1998; 93 (Autumn): 19-28

- Leon, D A, S Macran. Infant Mortality and Maternal Circumstances in Childhood: the OPCS Longitudinal Study of England and Wales, 1971-87. LS working paper 75. 1995

Information on other projects that have focussed on infant deaths to sample mothers can be found on the [CeLSIUS website](#).

### **Infant deaths to sample mothers examples**

The following variables were used to produce the tables and charts referenced below:

- IC10UFIM – ICD10 code for final underlying cause of death.
- IC10UIM – ICD10 code for underlying cause of death.
- IC9UFIM – ICD9 code (1993 onwards) for final underlying cause of death.
- IC9UIM – ICD9 code (1993 onwards) for underlying cause of death.
- UCDE3DIM – ICD9 code (1979-1992) 1<sup>st</sup> 3 digits for underlying cause of death.
- UCDEXDIM – ICD9 code (1979-1992) 4<sup>th</sup> digit for underlying cause of death.
- UCD3CIM – ICD8 code (1971-1981) 1<sup>st</sup> 3 digits for underlying cause of death.
- UCDCIM – ICD8 code (1971-1981) 4<sup>th</sup> digit for underlying cause of death.

### **Deaths of infants and children to sample mothers by sex and year (1971-2013<sup>2</sup>)**

Table 14 shows deaths of LS members' infants/ children by sex and year. The IDMI table has had over 2,000 cases since it began in 1971.

Changes in the number of infant deaths reflect changes in the risk of death and/or the size of the population exposed (number of infants). The maximum number of infant deaths recorded in any one year was 96 in 1975 with a minimum of 29 in 2013. The average number of recorded infant deaths to sample mothers over the period 1972 (first full year of data collection) to 2013 was 53. There were 12% more deaths of male children than female children (283 more male than female deaths recorded).

### **Age and sex of infants at death, for deaths between 1971 and 1992**

Table 15a and figure 15a show the age and sex of infant at death for deaths to sample mothers between 1971 and 1992, after which deaths to children (i.e. more than 1 year old) of sample mothers were included. The data indicate that the first day of life is the most critical.

### **Age and sex of infants and children at death, for deaths between 1993 and 2013**

Table 15b and figure 15b show the age and sex of infant at death for deaths to sample mothers between 1993 and 2013, when the death of any child was recorded, so that by 2013 the maximum age of a death recorded in the LS was 15. Again, the data indicate that the first day of life is the most critical.

---

<sup>2</sup> Infant deaths have not been recorded since 2013.

Also, in 1993 the coding system was changed such that two variables are required to show the age of the child at death:

- First, AGCUTIM which shows the time unit ([1] days, [2] weeks, [3] months or [4] years) which apply to this death;
- Second, AGDC3DIM which records how many of these units apply to this death.

Thus, a child who dies aged 4 months will have a value of 3 in AGCUTIM, indicating the number in AGDC3DIM is a number of months, and a value of 4 in AGDC3DIM giving the number of months.

### **Main underlying cause of death of infants and children 1971-2013**

Table 16a shows the underlying cause of death (UCD) for infant and child deaths. The UCD for infant and child deaths is usually reported according to the Wigglesworth classification introduced to the LS in 1993<sup>3</sup>. However, this doesn't seem to have been coded correctly in ICD10, and researchers will generally have to recode the cause of death themselves (see Appendix 2 for code to derive this variable). The chart shows that of the nine categories, four predominate, while most fall under the 'Other' category. It will be for researchers to decide if they want to break this group down further.

### **Main underlying cause of death of infants and children, excluding 'Other' (1971-2013)**

Table 16b and figure 16 show the UCD for infant and child deaths excluding the 'Other' category. If these deaths are charted without including the 'Other' category after 'Other specific conditions', the predominant cause of death is 'Congenital malformations' followed by 'Sudden infant death syndrome' and 'Immaturity related conditions'. However, it should be remembered that deaths prior to the introduction of ICD9 have been categorised by 'bridge coding' from ICD9 to ICD8 as ICD8 was more limited in its categorisation and some groups overlap. Researchers will have to make their own categorisation decisions when examining this earlier data.

---

<sup>3</sup> The Wigglesworth classification groupings for infant deaths are as follows:  
0 – Other conditions; 1 – Congenital anomalies; 2 – Antepartum infections; 3 – Immaturity and related conditions; 4 – Asphyxia, anoxia or trauma; 5 – External conditions; 6 – Infections; 7 – Other specific conditions; 9 – Sudden infant death.

## **Still births to sample mothers (SBSM)**

A still birth is the birth of a dead baby. Before October 1992, a still birth had to follow at least 28 weeks' gestation, but this was reduced to 24 weeks or more from October 1992. Still births account for less than 1% of births and therefore numbers in the LS are very low.

Still births to a sample mother are recorded in a specific table (file) called SBSM. Users need to be aware that an LS member can have more than one record in the SBSM file since they may have more than one still birth. Necessary steps need to be taken when merging data from this table with data from one of the member Census files to ensure that matching occurs correctly and produces the required dataset.

Information is also available for still births to sample fathers, but only for still births in the years 1971-1978 and 1981, and only if the father's information was recorded on the still birth registration form and certificate.

Refer to the Events guide for further information on infant deaths to LS mothers, including the following:

- Time period that the data are available for, whether there are multiple records, what the unique identifier is, how the data are linked and the source of the data.
- A brief description of the data, including important variables.
- Analytic issues and the quality of the data, using tables from ONS.
- Number of events that occur each year.

## **Still births to sample mothers examples**

The following variables were used to produce the tables and charts referenced below:

- CADE2EBM – ICD8 1<sup>st</sup> 2 digits of the cause of death code (1971-1981)
- CADEXBM – ICD8 3<sup>rd</sup> digit of the cause of death code (1971-1981)
- CADE3EBM – ICD9 1<sup>st</sup> 3 digits of the cause of death code (1979-1992)
- CADEXEBM – ICD9 4<sup>th</sup> digit of the cause of death code (1979-1992)
- ORIFO3BM – ICD9 3-digit final cause of death code (1993-2001)
- ORIFOXBM – ICD9 4-digit cause of death code (1993-2001)
- IC10F1BM – final ICD10 code for first cause of death (2001 onwards)
- IC10P1BM – ICD10 code for first cause of death (2001 onwards)

## **Number of still births to LS sample mothers by year and sex**

Table 17 shows the number of still births to sample mothers in each year and according to sex. The total number of cases recorded to the end of 2017 was approximately 1800, an average of 38 per year.

### **Number of still births to LS sample mothers by underlying cause of death**

Table 18a shows the number of still births to sample mothers according to the underlying cause of death. Similarly to infant deaths, the Wigglesworth classification groupings<sup>4</sup> are used in this table (see Appendix 2 for code to derive this variable). Again, the majority of cases fall into the 'All other causes' group, with significant contributions from 'Other specific cause', 'Asphyxia, anoxia and trauma' and 'Congenital abnormalities'.

### **Number of still births to LS sample mothers by underlying cause of death (excluding 'All other causes')**

Table 18b and Figure 18 show the number of still births to sample mothers according to the underlying cause of death but excluding the 'Other' category. 'Other specific cause', 'Asphyxia, anoxia and trauma' and 'Immaturity related conditions' are the main categorised causes.

---

<sup>4</sup> The Wigglesworth classification groupings for still births are as follows:  
0 – Other conditions (intrapartum); 1 – Congenital anomalies; 2 – Antepartum infections; 4 – Asphyxia, anoxia or trauma; 5 – External conditions; 7 – Other specific conditions; 8b – Other conditions (antepartum and unknown).

## **Opportunities and limitations**

Possible procedures or projects with the LS mortality data could include analysis of mortality by cause; estimation of life expectancy and further life expectancy; and survival analysis. With the longitudinal aspect of the LS it is possible to calculate person years/person months/person days at risk as required.

### **Disclosure control**

The codes for the multiple cause of death and underlying cause of death variables cover the complete range of the ICD codes; the researcher has the freedom to select and group the causes of death to their own specification, provided that the groupings do not produce potentially disclosive cells with cross-tabulations or aggregated datasets.

The data in all these tables can be linked to the main tables holding data from the censuses of 1971, 1981, 1991, 2001 and 2011. This gives the opportunity to study geographic, social and economic factors – including environmental factors – which may be associated with mortality. Clearly, the more of these that are put together the more likely it is that the analysis will generate cells with small counts, which cannot therefore be published. Disclosure control is extremely important for the continuance of the LS; no result can be released that may make identification of an individual person possible, either on its own or by comparing it with other results which are in the public domain. When designing an analysis, researchers should consider this restriction, so that the generation of low cell counts in any cross-tabulation or aggregated dataset is minimised.



## Appendix 1: Code to derive underlying cause of death in 20 categories.

```
/*Derive 20 category underlying cause of death variable using ICD8, 9 and
10 UCD vars*/

gen icd10 = ic10ude
gen icd10a = ic10ufde
gen icd9 = ucde3dde
gen icd9b = icd9ude
gen icd9c = icd9ufde
gen icd8 = ucde3cde

* If final cause of death set post 1993 set cause of death to final cause
*ICD9
gen finalflag = real(icd9c)
replace icd9b=icd9c if finalflag >0 & finalflag != .
drop finalflag
*ICD10
gen final10 = trim(icd10a)
replace icd10 = icd10a if final10 != "" & final10 != "-9" & final10 != "-8"
drop final10

/* Code to split cause of death into 20 categories
1: Ischaemic Heart Disease, 2: Stroke, 3: Pulmonary Disease, 4: Lung
Cancer
5: Other Cancers, 6: Infectious or parasitic diseases, 7: Diabetes
mellitus,
8: Gastro-intestinal tract disease, 9: Liver disease, 10: Mental or
behavioural
11: Abnormalities or lab results, 12: Other circulatory disease,
13: Accidents or self-harm, 14: Muscular disease, 15: Benign
neoplasms
16: Nervous system diseases, 17: Genito-urinary, 18: Other endocrine
19: Skin disease, 20: Other cause*/

* Note default value 0 = still alive
gen byte udcod = 0

*1 IHD
replace udcod = 1 if inrange(icd9,"410","414")
replace udcod = 1 if inrange(icd9b,"410 ","4149")
replace udcod = 1 if inrange(icd8,"410","414")
replace udcod = 1 if inrange(icd10,"I20 ","I259")

*2 Stroke
replace udcod = 2 if inrange(icd9,"430","439")
replace udcod = 2 if inrange(icd9b,"4300","4399")
replace udcod = 2 if inrange(icd8,"430","438")
replace udcod = 2 if inrange(icd10,"I60","I639")
replace udcod = 2 if icd10 == "G464" | icd10 == "G463"
replace udcod = 2 if udcod ==0 & match(icd9,"674")
replace udcod = 2 if udcod ==0 & inrange(icd9b,"674 ","6749")

*3 Pulmonary Disease
replace udcod = 3 if inrange(icd9,"490","496")
replace udcod = 3 if inrange(icd9b,"4900","4969")
replace udcod = 3 if inrange(icd8,"490","493")
replace udcod = 3 if inrange(icd8,"480","486")
replace udcod = 3 if inrange(icd8,"500","519")

replace udcod = 3 if icd8 == "516" | icd8 == "518" | icd8 == "783"
```

```

replace udcod = 3 if match(icd10,"J*")
replace udcod = 3 if inrange(icd9,"460","489")
replace udcod = 3 if inrange(icd9b,"4600","4899")
replace udcod = 3 if inrange(icd9,"500","519")
replace udcod = 3 if inrange(icd9b,"500 ","5199")

*4 Lung Cancer
replace udcod = 4 if icd9 == "162"
replace udcod = 4 if inrange(icd9b,"1620","1629")
replace udcod = 4 if icd8 == "162"
replace udcod = 4 if icd10 == "D022"
replace udcod = 4 if match(icd10,"C34*")

* 5 Other Cancers
* All malignant neoplasms
replace udcod = 5 if match(icd10,"C*") & udcod ==0
replace udcod = 5 if inrange(icd9,"140","161")
replace udcod = 5 if inrange(icd9,"163","208")
replace udcod = 5 if inrange(icd9b,"1400","1619")
replace udcod = 5 if inrange(icd9b,"1630","2089")
replace udcod = 5 if inrange(icd8,"140","161")
replace udcod = 5 if inrange(icd8,"163","209")

* 6 Infectious and Parasitic Diseases
replace udcod=6 if match(icd10,"A*")
replace udcod=6 if match(icd10,"B*")
replace udcod=6 if match(icd10,"H6*")
replace udcod=6 if inrange(icd9,"001","139")
replace udcod=6 if inrange(icd9b,"001 ","1399")
replace udcod=6 if inrange(icd8,"000","136")
replace udcod=6 if inrange(icd8,"460","474")

* 7 "Diabetes mellitus"
replace udcod = 7 if inrange(icd10,"E10 ","E149")
replace udcod = 7 if match(icd9,"250")
replace udcod = 7 if inrange(icd9b,"250 ","2509")
replace udcod = 7 if match(icd8,"250")

* 8 Intestinal disease
replace udcod = 8 if inrange(icd10,"K1 ","K699")
replace udcod = 8 if match(icd10,"K9*")
replace udcod=8 if inrange(icd9,"530","569")
replace udcod=8 if inrange(icd9b,"530 ","5699")
replace udcod=8 if inrange(icd9,"570","576")
replace udcod=8 if inrange(icd9b,"570 ","5769")
replace udcod=8 if inrange(icd9,"577","579")
replace udcod=8 if inrange(icd9b,"577 ","5799")
replace udcod=8 if inrange(icd8,"784","785")
replace udcod=8 if inrange(icd8,"530","569")
replace udcod=8 if inrange(icd8,"750","751")

* 9 Liver Disease
replace udcod = 9 if inrange(icd10,"K7 ","K899")
replace udcod=9 if inrange(icd9,"570","576")
replace udcod=9 if inrange(icd9b,"570 ","5769")
replace udcod=9 if inrange(icd8,"570","576")

*10 Mental and behavioural
replace udcod = 10 if match(icd10,"F*")
replace udcod=10 if inrange(icd9,"290","319")
replace udcod=10 if inrange(icd9b,"290 ","3199")

```

```

replace udcod=10 if inrange(icd8,"290","315")
replace udcod=10 if match(icd8,"794")

*11 Abnormalities & Lab Results
replace udcod = 11 if match(icd10,"R*")
replace udcod = 11 if match(icd10,"Q*")
replace udcod=11 if inrange(icd9,"740","759")
replace udcod=11 if inrange(icd9b,"740 ","7599")
replace udcod=11 if inrange(icd9,"780","799")
replace udcod=11 if inrange(icd9b,"780 ","7999")
replace udcod = 11 if icd8 == "788" | icd8 == "792" | icd8 == "796"

* Other Circulatory diseases
replace udcod = 12 if udcod ==0 & match(icd10,"I*")
replace udcod = 12 if udcod ==0 & inrange(icd9,"390","409")
replace udcod = 12 if udcod ==0 & inrange(icd9,"415","429")
replace udcod = 12 if udcod ==0 & inrange(icd9,"439","459")
replace udcod = 12 if udcod ==0 & inrange(icd9b,"390 ","4099")
replace udcod = 12 if udcod ==0 & inrange(icd9b,"415 ","4299")
replace udcod = 12 if udcod ==0 & inrange(icd9b,"439 ","4599")
replace udcod = 12 if udcod ==0 & inrange(icd9,"671","673")
replace udcod = 12 if udcod ==0 & inrange(icd9b,"671 ","6739")
replace udcod = 12 if udcod ==0 & icd8 == "782"
replace udcod = 12 if udcod ==0 & inrange(icd8,"393","404")
replace udcod = 12 if udcod ==0 & inrange(icd8,"420","429")
replace udcod = 12 if udcod ==0 & inrange(icd8,"440","458")

* Accidents & Self Harm
replace udcod = 13 if udcod ==0 & match(icd10,"X*")
replace udcod = 13 if udcod ==0 & match(icd10,"V*")
replace udcod = 13 if udcod ==0 & inrange(icd10,"Y600","Y699")
replace udcod = 13 if udcod ==0 & inrange(icd10,"Y40 ","Y599")
replace udcod = 13 if udcod ==0 & match(icd10,"S72*")
*replace udcod = 13 if inrange(icd9b,"8000","9999") // not for this time
period
replace udcod = 13 if inrange(icd9,"800","999")
replace udcod = 13 if udcod ==0 & match(icd10,"W*")
replace udcod = 13 if udcod ==0 & match(icd9,"E*")
replace udcod = 13 if udcod ==0 & match(icd9b,"E*")
replace udcod = 13 if inrange(icd8,"800","999")

* Muscular Disease
replace udcod= 14 if match(icd10,"M*")
replace udcod = 14 if inrange(icd9b,"710 ","7399")
replace udcod = 14 if inrange(icd9,"710","739")
replace udcod = 14 if inrange(icd8,"732","734")

* Benign Neoplasms
replace udcod =15 if match(icd10,"D*")
replace udcod = 15 if inrange(icd9b,"210 ","2399")
replace udcod = 15 if inrange(icd9,"210","239")
replace udcod = 15 if inrange(icd8,"210","239")

* Nervous System Diseases
replace udcod =16 if match(icd10,"G*")
replace udcod = 16 if inrange(icd9b,"320 ","3899")
replace udcod = 16 if inrange(icd9,"320","389")
replace udcod = 16 if (icd8 == "781" | icd8 == "780" | icd8 == "794" | icd8
== "790")
replace udcod = 16 if inrange(icd8,"320","359")

```

```

* Genito-Urinary
replace udcod =17 if match(icd10,"N*")
replace udcod = 17 if inrange(icd9b,"580 ","6299")
replace udcod = 17 if inrange(icd9,"580","629")
replace udcod = 17 if icd8 == "786" | icd8 == "789" | icd8 == "580"
replace udcod = 17 if inrange(icd8,"580","629")

* Other Endocrine (Excludes Diabetes)
replace udcod =18 if inrange(icd10,"E00 ","E099")
replace udcod =18 if inrange(icd10,"E15 ","E999")
replace udcod = 18 if inrange(icd9b,"240 ","2499")
replace udcod = 18 if inrange(icd9,"240","249")
replace udcod = 18 if inrange(icd9b,"251 ","2599")
replace udcod = 18 if inrange(icd9,"251","259")
replace udcod = 18 if inrange(icd8,"251","259")
replace udcod = 18 if inrange(icd8,"240","249")

* Skin
replace udcod=19 if match(icd10,"L*")
replace udcod=19 if inrange(icd9,"680","709")
replace udcod=19 if inrange(icd9b,"680 ","7099")
replace udcod=19 if inrange(icd8,"680","709")

* Remains
replace udcod = 20 if udcod == 0 & deyrbde != .

label define cause 0 "Alive" 1 "IHD" 2 "Stroke" 3 "Pulmonary Disease" 4
"Lung Cancer" 5 "Other Cancers" /*
*/ 6 " Infectious&Parasitic" 7 "Diabetes" 8 "Intestinal Disease" 9 "Liver
Disease" 10 "Mental & Behavioural" /*
*/11 "Abnormalities & Lab results" 12 "Other Circulatory Disease" 13
"Accidents etc" 14 "Muscular Diseases" /*
*/ 15 "Benign Neoplasms" 16 "Nervous System" 17 "Genito-Urinary" 18 "Other
Endocrine" 19 "Skin disease" /*
*/ 20 "Other Cause"

label values udcod cause

```

## Appendix 2: Code to derive Wigglesworth cause of death categories for infant deaths and still births

```

/* Commands to create cause of death variables for infant mortality and still
births:
Wigglesworth classification
Using ICD8, ICD9 and ICD10 underlying cause of death variables
- NB: LS ICD codes are all string variables and therefore need to be in "" to be
recognised.
- ICD10 codes comprise a capital letter and 3 numbers.
- ICD8 and ICD9 codes do not contain any prefix letters i.e. 4-digit numerical
codes.
- In LS the 4th digit is in a different variable for ICD8 and ICD9 (1979-1992).
Therefore will need to concatenate them.

*Variables to use:
- ICD8 = ucd3cim + ucdxcim
- ICD9 (1979-1992) = ucde3dim + ucdexdim
- ICD9 (1993+) = icd9uim and icd9ufim (icd9ufim is the final code. Replace icd9uim
with icd9ufim if icd9ufim !=.)
- ICD10 = icl0uim and icl0ufim (icl0ufim is the final code. Replace icl0uim with
icl0ufim if icl0ufim !=.)*/
*****
*****

*IDMI
*Generate vars to use for recoding to Wigglesworth codes
gen icd10 = icl0uim
gen icd10a = icl0ufim
label var icd10 "ICD10 underlying cause of death"

gen icd9a = ucde3dim + ucdexdim
label var icd9a "ICD9 (1979-1992) underlying cause of death"

gen icd9b = icd9uim
gen icd9c = icd9ufim
label var icd9b "ICD9 (1993+) underlying cause of death"

gen icd8 = ucd3cim + ucdxcim
label var icd8 "ICD8 underlying cause of death"

/*If final cause of death exists (1993 onwards only), set cause of death to
final cause*/
gen finalflag = real(icd9c)
replace icd9b=icd9c if finalflag >0 & finalflag != .
drop finalflag

gen final10 = trim(icd10a)
replace icd10 = icd10a if final10 != "" & final10 != "-9" & final10 != "-8"
drop final10 icd10a icd9c

tab icd10
tab icd9b
tab icd9a
tab icd8
*****

/* Code to split cause of death into the Wigglesworth categories:
1: Congenital malformation or defect
2: Antepartum infection
3: Immaturity related conditions
4: Asphyxia, anoxia or trauma
5: External conditions
6: Infections
7: Other specific conditions
8: N/A
9: Sudden Infant Death Syndrome

```

```

10: Other
Note default value 0 = still alive (this will have no cases if only data from
the deaths record are being used)*/

gen byte udcod = 0

*1. Congenital malformation or defect
*ICD9 (1993+)
replace udcod = 1 if icd9b=="2440" | icd9b=="2441" | icd9b=="2513" | icd9b=="2537"
///
| icd9b=="2562" | icd9b=="2571"
replace udcod = 1 if inrange(icd9b,"270*","273*")
replace udcod = 1 if icd9b=="275*" | icd9b=="276*" | icd9b=="2773" | icd9b=="2776"
replace udcod = 1 if inrange(icd9b,"2790","2798")
replace udcod = 1 if icd9b=="2789" | icd9b=="2799" | icd9b=="282*" | icd9b=="284*"
///
| icd9b=="285*"
replace udcod = 1 if inrange(icd9b,"2860","2864")
replace udcod = 1 if inrange(icd9b,"2871","2873")
replace udcod = 1 if inrange(icd9b,"2880","2884")
replace udcod = 1 if inrange(icd9b,"2896","2898")
replace udcod = 1 if inrange(icd9b,"3300","3309")
replace udcod = 1 if inrange(icd9b,"3350","3359")
replace udcod = 1 if inrange(icd9b,"3370","3379")
replace udcod = 1 if inrange(icd9b,"3430","3439")
replace udcod = 1 if inrange(icd9b,"3560","3569")
replace udcod = 1 if inrange(icd9b,"3580","3599")
replace udcod = 1 if inrange(icd9b,"4240","4249")
replace udcod = 1 if inrange(icd9b,"4260","4269")
replace udcod = 1 if inrange(icd9b,"5710","5719")
replace udcod = 1 if inrange(icd9b,"5730","5739")
replace udcod = 1 if inrange(icd9b,"7500","7519")
replace udcod = 1 if icd9b=="6868" | icd9b=="9979"
replace udcod = 1 if inrange(icd9b,"4250","4254")
replace udcod = 1 if inrange(icd9b,"6600","6652")
replace udcod = 1 if inrange(icd9b,"7400","7429")
replace udcod = 1 if inrange(icd9b,"7450","7489")
replace udcod = 1 if inrange(icd9b,"7530","7609")

*ICD9a (early)
replace udcod = 1 if icd9a=="244 0" | icd9a=="244 1" | icd9a=="251 3" ///
| icd9a=="253 7" | icd9a=="256 2" | icd9a=="257 1"
replace udcod = 1 if inrange(icd9a,"270 0","273 9")
replace udcod = 1 if inrange(icd9a,"275 0","277 9")
replace udcod = 1 if inrange(icd9a,"279 0","279 5")
replace udcod = 1 if inrange(icd9a,"282 0","282 9")
replace udcod = 1 if icd9a=="278 9" | icd9a=="279 9" | icd9a=="284 0" | icd9a=="285
0"
replace udcod = 1 if inrange(icd9a,"286 0","286 4")
replace udcod = 1 if inrange(icd9a,"287 1","287 3")
replace udcod = 1 if inrange(icd9a,"288 0","288 4")
replace udcod = 1 if inrange(icd9a,"289 6","289 8")
replace udcod = 1 if inrange(icd9a,"330 0","330 9")
replace udcod = 1 if inrange(icd9a,"337 0","337 9")
replace udcod = 1 if inrange(icd9a,"343 0","343 9")
replace udcod = 1 if inrange(icd9a,"356 0","356 9")
replace udcod = 1 if inrange(icd9a,"358 0","358 9")
replace udcod = 1 if inrange(icd9a,"359 0","359 9")
replace udcod = 1 if inrange(icd9a,"424 0","424 9")
replace udcod = 1 if inrange(icd9a,"425 0","425 4")
replace udcod = 1 if inrange(icd9a,"426 0","426 9")
replace udcod = 1 if inrange(icd9a,"571 0","571 9")
replace udcod = 1 if inrange(icd9a,"573 0","573 9")
replace udcod = 1 if inrange(icd9a,"571 0","571 9")
replace udcod = 1 if icd9a=="686 8" | icd9a=="997 9"
replace udcod = 1 if inrange(icd9a,"660 0","665 2")
replace udcod = 1 if inrange(icd9a,"750 0","751 9")
replace udcod = 1 if inrange(icd9a,"740 0","742 9")

```

```

replace udcod = 1 if inrange(icd9a,"745 0 ","748 9")
replace udcod = 1 if icd9a=="745 0" | icd9a=="753 0"
replace udcod = 1 if inrange(icd9a,"753 0","760 9")

*ICD8
replace udcod = 1 if icd8=="244 0" | icd8=="244 1" | icd8=="251 3" | icd8=="253 7"
///
| icd8=="256 2" | icd8=="257 1"
replace udcod = 1 if inrange(icd8,"270 0","273 9")
replace udcod = 1 if inrange(icd8,"275 0","277 9")
replace udcod = 1 if inrange(icd8,"279 0","279 5")
replace udcod = 1 if icd8=="278 9" | icd8=="279 9" | icd8=="284 0" | icd8=="285 0"
replace udcod = 1 if inrange(icd8, "282 0", "282 9")
replace udcod = 1 if inrange(icd8,"286 0","286 4")
replace udcod = 1 if inrange(icd8,"287 1","287 3")
replace udcod = 1 if inrange(icd8,"288 0","288 4")
replace udcod = 1 if inrange(icd8,"289 6","289 8")
replace udcod = 1 if inrange(icd8,"330 0", "330 9")
replace udcod = 1 if inrange(icd8,"335 0", "335 9")
replace udcod = 1 if inrange(icd8,"337 0", "337 9")
replace udcod = 1 if inrange(icd8,"343 0", "343 9")
replace udcod = 1 if inrange(icd8,"356 0", "356 9")
replace udcod = 1 if inrange(icd8,"358 0", "359 9")
replace udcod = 1 if inrange(icd8,"424 0", "424 9")
replace udcod = 1 if inrange(icd8,"426 0", "426 9")
replace udcod = 1 if inrange(icd8,"571 0", "571 9")
replace udcod = 1 if inrange(icd8,"573 0", "573 9")
replace udcod = 1 if icd8=="573 -" | icd8=="686 8" | icd8=="740 -" | icd8=="742 -"
| icd8=="997 9"
replace udcod = 1 if inrange(icd8,"750 9", "751 9")
replace udcod = 1 if inrange(icd8,"425 0","425 4")
replace udcod = 1 if inrange(icd8,"660 0","665 2")
replace udcod = 1 if inrange(icd8,"740 0","742 9")
replace udcod = 1 if inrange(icd8,"745 0 ","748 9")
replace udcod = 1 if inrange(icd8,"753 0","760 9")

*ICD10
replace udcod = 1 if inrange(icd10,"D550","D589")
replace udcod = 1 if icd10=="D610" | icd10=="D640"
replace udcod = 1 if inrange(icd10,"D660","D682")
replace udcod = 1 if inrange(icd10,"D691","D694")
replace udcod = 1 if inrange(icd10,"D70 ", "D721")
replace udcod = 1 if icd10=="D740" | icd10=="D750" | icd10=="D760"" | icd10=="D761"
replace udcod = 1 if inrange(icd10,"D800","D899")
replace udcod = 1 if inrange(icd10,"E700","E859")
replace udcod = 1 if inrange(icd10,"E880","E889")
replace udcod = 1 if inrange(icd10,"G120","G129")
replace udcod = 1 if inrange(icd10,"G600","G609")
replace udcod = 1 if inrange(icd10,"G700","G719")
replace udcod = 1 if inrange(icd10,"G800","G809")
replace udcod = 1 if inrange(icd10,"G900","G909")
replace udcod = 1 if inrange(icd10,"I340","I379")
replace udcod = 1 if inrange(icd10,"I420","I425")
replace udcod = 1 if inrange(icd10,"I440","I459")
replace udcod = 1 if inrange(icd10,"K740","K746")
replace udcod = 1 if inrange(icd10,"O350","O352")
replace udcod = 1 if inrange(icd10,"Q000","Q079")
replace udcod = 1 if inrange(icd10,"Q200","Q239")
replace udcod = 1 if inrange(icd10,"Q242","Q249")
replace udcod = 1 if inrange(icd10,"Q251","Q269")
replace udcod = 1 if inrange(icd10,"Q271","Q289")
replace udcod = 1 if inrange(icd10,"Q310","Q313")
replace udcod = 1 if inrange(icd10,"Q318","Q319")
replace udcod = 1 if inrange(icd10,"Q320","Q349")
replace udcod = 1 if inrange(icd10,"Q382","Q459")
replace udcod = 1 if inrange(icd10,"Q600","Q613")
replace udcod = 1 if inrange(icd10,"Q613","Q619")
replace udcod = 1 if inrange(icd10,"Q620","Q639")

```

```

replace udcod = 1 if inrange(icd10,"Q641","Q649")
replace udcod = 1 if inrange(icd10,"Q673","Q676")
replace udcod = 1 if icd10=="Q743"
replace udcod = 1 if inrange(icd10,"Q750","Q759")
replace udcod = 1 if inrange(icd10,"Q761","Q799")
replace udcod = 1 if inrange(icd10,"Q800","Q819")
replace udcod = 1 if inrange(icd10,"Q850","Q939")
replace udcod = 1 if inrange(icd10,"Q960","Q999")
*****

```

\*2. Antepartum infection

```

*ICD9 (late)
replace udcod = 2 if inrange(icd9b,"0900","0909")
replace udcod = 2 if icd9b== "6553" | icd9b== "7627" | icd9b== "7700"
replace udcod = 2 if inrange(icd9b,"7710","7719")

*ICD9 (early)
replace udcod = 2 if inrange(icd9a,"090 0","090 9")
replace udcod = 2 if icd9a == "655 3" | icd9a == "762 7" | icd9a == "770 0"
replace udcod = 2 if inrange(icd9a,"771 0","771 9")

```

```

*ICD8
replace udcod = 2 if inrange(icd8,"090 0","090 9")
replace udcod = 2 if icd8 == "655 3" | icd8 == "762 7" | icd8 == "770 0"
replace udcod = 2 if inrange(icd8,"771 0","771 9")

```

```

*ICD10
replace udcod = 2 if inrange(icd10,"A500","A509")
replace udcod = 2 if inrange(icd10,"P230","P239")
replace udcod = 2 if inrange(icd10,"P350","P359")
replace udcod = 2 if inrange(icd10,"P370","P379")
replace udcod = 2 if icd10 == "O353" | icd10 == "P027"
*****

```

\*3. Immaturity related conditions

```

*ICD9b (late)
replace udcod = 3 if inrange(icd9b,"7610","7611")
replace udcod = 3 if inrange(icd9b,"7704","7709")
replace udcod = 3 if icd9b=="7618" | icd9b=="7702" | icd9b == "7721" | ///
    icd9b == "7742" | icd9b == "7747" | icd9b == "7775" | icd9b == "7923" | ///
    icd9b == "7965" | icd9b == "v213"
replace udcod = 3 if inrange(icd9b,"7650","7699")

```

```

*ICD9 (early)
replace udcod = 3 if inrange(icd9a,"761 0","761 1")
replace udcod = 3 if inrange(icd9a,"770 4","770 9")
replace udcod = 3 if icd9a=="761 8" | icd9a=="770 2" | icd9a == "772 1" | ///
    icd9a == "774 2" | icd9a == "774 7" | icd9a == "777 5" | icd9a == "792 3" |
///
    icd9a == "796 5" | icd9a == "v213"
replace udcod = 3 if inrange(icd9a,"765 0","769 9")

```

```

*ICD8
replace udcod = 3 if inrange(icd8,"761 0","761 1")
replace udcod = 3 if inrange(icd8,"770 4","770 9")
replace udcod = 3 if icd8=="761 8" | icd8=="770 2" | icd8 == "772 1" | ///
    icd8 == "774 2" | icd8 == "774 7" | icd8 == "777 -" | icd8 == "792 3" | ///
    icd8 == "796 5" | icd8 == "v213"
replace udcod = 3 if inrange(icd8,"765 0","769 9")

```

```

*ICD10
replace udcod = 3 if inrange(icd10,"P010","P011")
replace udcod = 3 if inrange(icd10,"P070","P073")
replace udcod = 3 if inrange(icd10,"P220","P229")
replace udcod = 3 if inrange(icd10,"P370","P379")
replace udcod = 3 if inrange(icd10,"P770","P779")
replace udcod = 3 if inrange(icd10,"P960","P969")
replace udcod = 3 if icd10 == "O289" | icd10 == "P018" | icd10 == "P578" | ///

```



```

        icd10 == "P590" | icd10 == "P77 "
*****

*4. Asphyxia, anoxia and trauma
  *ICD9 (late)
replace udcod = 4 if inrange(icd9b,"6410","6413")
replace udcod = 4 if inrange(icd9b,"6630","6636")
replace udcod = 4 if icd9b== "6418" | icd9b== "6419" | icd9b== "6451" | ///
        icd9b== "6563" | icd9b== "6565" | icd9b== "6567" | icd9b== "6568" | ///
        icd9b== "6638" | icd9b== "6639" | icd9b== "6660"
replace udcod = 4 if inrange(icd9b,"6420", "6429")
replace udcod = 4 if inrange(icd9b,"6460", "6469")
replace udcod = 4 if inrange(icd9b,"6600", "6629")
replace udcod = 4 if inrange(icd9b,"6690", "6669")
replace udcod = 4 if inrange(icd9b,"7600","7619")
replace udcod = 4 if inrange(icd9b,"7620","7626")
replace udcod = 4 if inrange(icd9b,"7640","7642")
replace udcod = 4 if inrange(icd9b,"7660","7662")
replace udcod = 4 if inrange(icd9b,"7670","7679")
replace udcod = 4 if inrange(icd9b,"7630","7639")
replace udcod = 4 if icd9b == "7687" | icd9b == "7701" | icd9b == "7708" | ///
        icd9b == "7722" | icd9b == "7790" | icd9b == "7791" | icd9b == "7792" | ///
        icd9b == "V29"

        *ICD9 (early)
replace udcod = 4 if inrange(icd9a,"641 0","641 3")
replace udcod = 4 if inrange(icd9a,"663 0","663 6")
replace udcod = 4 if icd9a== "641 8" | icd9a== "641 9" | icd9a== "645 1" | ///
        icd9a== "656 3" | icd9a== "6565 " | icd9a== "656 7" | icd9a== "656 8" | ///
        icd9a== "663 8" | icd9a== "663 9" | icd9a== "666 0"
replace udcod = 4 if inrange(icd9a,"642 0", "642 9")
replace udcod = 4 if inrange(icd9a,"646 0", "646 9")
replace udcod = 4 if inrange(icd9a,"660 0", "662 9")
replace udcod = 4 if inrange(icd9a,"669 0", "666 9")
replace udcod = 4 if inrange(icd9a,"760 0","761 9")
replace udcod = 4 if inrange(icd9a,"762 0","762 6")
replace udcod = 4 if inrange(icd9a,"764 0","764 2")
replace udcod = 4 if inrange(icd9a,"766 0","766 2")
replace udcod = 4 if inrange(icd9a,"767 0","767 9")
replace udcod = 4 if inrange(icd9a,"763 0","763 9")
replace udcod = 4 if icd9a == "768 7" | icd9a == "770 1" | icd9a == "770 8" | ///
        icd9a == "772 2" | icd9a == "779 0" | icd9a == "779 1" | icd9a == "779 2" |
///
        icd9a == "V29 "

        *ICD8
replace udcod = 4 if inrange(icd8,"641 0","641 3")
replace udcod = 4 if inrange(icd8,"663 0","663 6")
replace udcod = 4 if icd8== "641 8" | icd8== "641 9" | icd8== "645 1" | ///
        icd8== "656 3" | icd8== "6565 " | icd8== "656 7" | icd8== "656 8" | ///
        icd8== "663 8" | icd8== "663 9" | icd8== "666 0"
replace udcod = 4 if inrange(icd8,"642 0", "642 9")
replace udcod = 4 if inrange(icd8,"646 0", "646 9")
replace udcod = 4 if inrange(icd8,"660 0", "662 9")
replace udcod = 4 if inrange(icd8,"669 0", "666 9")
replace udcod = 4 if inrange(icd8,"760 0","761 9")
replace udcod = 4 if inrange(icd8,"762 0","762 6")
replace udcod = 4 if inrange(icd8,"764 0","764 2")
replace udcod = 4 if inrange(icd8,"766 0","766 2")
replace udcod = 4 if inrange(icd8,"767 0","767 9")
replace udcod = 4 if inrange(icd8,"763 0","763 9")
replace udcod = 4 if icd8 == "768 7" | icd8 == "770 1" | icd8 == "770 8" | ///
        icd8 == "772 2" | icd8 == "779 0" | icd8 == "779 1" | icd8 == "779 2" | ///
        icd8 == "V29 "

        *ICD10
replace udcod = 4 if inrange(icd10,"O100","O16*")
replace udcod = 4 if inrange(icd10,"O430","O439")

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```

replace udcod = 4 if inrange(icd10,"O440","O469")
replace udcod = 4 if inrange(icd10,"O620","O689")
replace udcod = 4 if inrange(icd10,"O690","O699")
replace udcod = 4 if icd10 == "O363" | icd10 == "O365" | icd10 == "O480"
replace udcod = 4 if inrange(icd10,"P016","P017")
replace udcod = 4 if inrange(icd10,"P020","P021")
replace udcod = 4 if inrange(icd10,"P024","P026")
replace udcod = 4 if inrange(icd10,"P030","P039")
replace udcod = 4 if inrange(icd10,"P050","P059")
replace udcod = 4 if inrange(icd10,"P080","P082")
replace udcod = 4 if inrange(icd10,"P100","P159")
replace udcod = 4 if inrange(icd10,"P200","P219")
replace udcod = 4 if inrange(icd10,"P240","P241")
replace udcod = 4 if inrange(icd10,"P525","P529")
replace udcod = 4 if inrange(icd10,"P910","P919")
replace udcod = 4 if icd10 == "P000" | icd10 == "P022" | icd10 == "P249" | ///
      icd10 == "P90"
*****

*5. External conditions
  *ICD9 (late)
replace udcod = 5 if inrange(icd9b,"2600","2639")
replace udcod = 5 if inrange(icd9b,"E800","E999")
replace udcod = 5 if icd9b== "5070" | icd9b== "7701" | icd9b== "7708" | icd9b==
"7793"
replace udcod = 5 if inrange(icd9b,"7780", "7789")

  *ICD9 (early)
replace udcod = 5 if inrange(icd9a,"260 0","263 9")
replace udcod = 5 if inrange(icd9a,"E800 ","E999 ")
replace udcod = 5 if icd9a== "507 0" | icd9a== "770 1" | icd9a== "770 8" | ///
      icd9a== "779 3"
replace udcod = 5 if inrange(icd9a,"778 0", "778 9")

  *ICD8
replace udcod = 5 if inrange(icd8,"260 0","263 9")
replace udcod = 5 if inrange(icd8,"E800 ","E999 ")
replace udcod = 5 if icd8== "507 0" | icd8== "770 1" | icd8== "770 8" | ///
      icd8== "779 3"
replace udcod = 5 if inrange(icd8,"778 0", "778 9")

  *ICD10
replace udcod = 5 if inrange(icd10,"E400","E441")
replace udcod = 5 if inrange(icd10,"E460","E469")
replace udcod = 5 if icd10=="J690"
replace udcod = 5 if inrange(icd10,"P242","P248")
replace udcod = 5 if inrange(icd10,"P800","P810")
replace udcod = 5 if inrange(icd10,"P830","P831")
replace udcod = 5 if inrange(icd10,"P833","P839")
replace udcod = 5 if inrange(icd10,"P920","P929")
replace udcod = 5 if icd10 == "U509"
replace udcod = 5 if inrange(icd10,"V000","V999")
replace udcod = 5 if icd10 == "Y098"
*****

*6. Infections
  *ICD9 (late)
replace udcod = 6 if inrange(icd9b,"0000","0136")
replace udcod = 6 if icd9b == "2541"
replace udcod = 6 if inrange(icd9b,"3200","3269")
replace udcod = 6 if inrange(icd9b,"3810","3839")
replace udcod = 6 if inrange(icd9b,"4600","4669")
replace udcod = 6 if inrange(icd9b,"4800","4889")
replace udcod = 6 if inrange(icd9b,"4200","4219")
replace udcod = 6 if inrange(icd9b,"4760","4769")
replace udcod = 6 if inrange(icd9b,"4940","4949")
replace udcod = 6 if inrange(icd9b,"5100","5119")
replace udcod = 6 if inrange(icd9b,"5130","5149")

```

```

replace udcod = 6 if inrange(icd9b,"5170","5179")
replace udcod = 6 if inrange(icd9b,"5300","5309")
replace udcod = 6 if inrange(icd9b,"5400","5409")
replace udcod = 6 if inrange(icd9b,"5660","5679")
replace udcod = 6 if inrange(icd9b,"5900","5909")
replace udcod = 6 if inrange(icd9b,"5930","5939")
replace udcod = 6 if inrange(icd9b,"5590","5599")
replace udcod = 6 if inrange(icd9b,"5990","5999")
replace udcod = 6 if inrange(icd9b,"7710","7719")
replace udcod = 6 if inrange(icd9b,"9970","9979")

*ICD9 (early)
replace udcod = 6 if inrange(icd9a,"000 0","013 6")
replace udcod = 6 if icd9a == "254 1"
replace udcod = 6 if inrange(icd9a,"320 0","326 9")
replace udcod = 6 if inrange(icd9a,"381 0","383 9")
replace udcod = 6 if inrange(icd9a,"460 0","466 9")
replace udcod = 6 if inrange(icd9a,"480 0","488 9")
replace udcod = 6 if inrange(icd9a,"420 0","421 9")
replace udcod = 6 if inrange(icd9a,"476 0","476 9")
replace udcod = 6 if inrange(icd9a,"494 0","494 9")
replace udcod = 6 if inrange(icd9a,"510 0","511 9")
replace udcod = 6 if inrange(icd9a,"513 0","514 9")
replace udcod = 6 if inrange(icd9a,"517 0","517 9")
replace udcod = 6 if inrange(icd9a,"530 0","530 9")
replace udcod = 6 if inrange(icd9a,"540 0","540 9")
replace udcod = 6 if inrange(icd9a,"566 0","567 9")
replace udcod = 6 if inrange(icd9a,"590 0","590 9")
replace udcod = 6 if inrange(icd9a,"593 0","593 9")
replace udcod = 6 if inrange(icd9a,"559 0","595 9")
replace udcod = 6 if inrange(icd9a,"599 0","599 9")
replace udcod = 6 if inrange(icd9a,"771 0","771 9")
replace udcod = 6 if inrange(icd9a,"997 0","997 9")

*ICD8
replace udcod = 6 if inrange(icd8,"000 0","013 6")
replace udcod = 6 if icd8 == "254 1"
replace udcod = 6 if inrange(icd8,"320 0","326 9")
replace udcod = 6 if inrange(icd8,"381 0","383 9")
replace udcod = 6 if inrange(icd8,"460 0","466 9")
replace udcod = 6 if inrange(icd8,"480 0","488 9")
replace udcod = 6 if inrange(icd8,"420 0","421 9")
replace udcod = 6 if inrange(icd8,"476 0","476 9")
replace udcod = 6 if inrange(icd8,"494 0","494 9")
replace udcod = 6 if inrange(icd8,"510 0","511 9")
replace udcod = 6 if inrange(icd8,"513 0","514 9")
replace udcod = 6 if inrange(icd8,"517 0","517 9")
replace udcod = 6 if inrange(icd8,"530 0","530 9")
replace udcod = 6 if inrange(icd8,"540 0","540 9")
replace udcod = 6 if inrange(icd8,"566 0","567 9")
replace udcod = 6 if inrange(icd8,"590 0","590 9")
replace udcod = 6 if inrange(icd8,"593 0","593 9")
replace udcod = 6 if inrange(icd8,"559 0","595 9")
replace udcod = 6 if inrange(icd8,"599 0","599 9")
replace udcod = 6 if inrange(icd8,"771 0","771 9")
replace udcod = 6 if inrange(icd8,"997 0","997 9")

*ICD10
replace udcod = 6 if inrange(icd10,"A000","A499")
replace udcod = 6 if inrange(icd10,"A510","B999")
replace udcod = 6 if icd10 == "E321"

replace udcod = 6 if inrange(icd10,"G000","G099")
replace udcod = 6 if inrange(icd10,"H650","H669")
replace udcod = 6 if inrange(icd10,"H700","H709")
replace udcod = 6 if inrange(icd10,"I300","I309")
replace udcod = 6 if inrange(icd10,"I330","I339")
replace udcod = 6 if inrange(icd10,"J000","J069")

```

```

replace udcod = 6 if inrange(icd10,"J100","J189")
replace udcod = 6 if inrange(icd10,"J200","J220")
replace udcod = 6 if inrange(icd10,"J850","J869")
replace udcod = 6 if inrange(icd10,"J360","J369")
replace udcod = 6 if inrange(icd10,"J470","J479")
replace udcod = 6 if icd10 == "J370" | icd10 == "J731"
replace udcod = 6 if inrange(icd10,"K350","K359")
replace udcod = 6 if inrange(icd10,"K610","K614")
replace udcod = 6 if icd10 == "N111" | icd10 == "N136" | icd10 == "N300" | ///
    icd10 == "N390"
replace udcod = 6 if inrange(icd10,"N120","N129")
replace udcod = 6 if inrange(icd10,"P360","P369")
replace udcod = 6 if inrange(icd10,"P380","P389")
replace udcod = 6 if inrange(icd10,"P390","P399")
*****

```

\*7. Other specific conditions

\*ICD9 (late)

```

replace udcod = 7 if inrange(icd9b,"1400","2399")
replace udcod = 7 if inrange(icd9b,"2400","3159")
replace udcod = 7 if inrange(icd9b,"3200","4589")
replace udcod = 7 if inrange(icd9b,"4600","5779")
replace udcod = 7 if inrange(icd9b,"5800","6299")
replace udcod = 7 if inrange(icd9b,"6480","6489")
replace udcod = 7 if inrange(icd9b,"6800","7389")
replace udcod = 7 if inrange(icd9b,"7470","7479")
replace udcod = 7 if inrange(icd9b,"7600","7602")
replace udcod = 7 if icd9b == "7605" | icd9b == "7606" | icd9b == "7623" ///
    | icd9b == "7628" | icd9b == "7629" | icd9b == "7670" | icd9b == "7720" ///
    | icd9b == "7723" | icd9b == "7724" | icd9b == "7725" | icd9b == "7726" ///
    | icd9b == "7728" | icd9b == "7729"
replace udcod = 7 if inrange(icd9b,"7730","7735")
replace udcod = 7 if inrange(icd9b,"7740","7747")
replace udcod = 7 if icd9b == "7750" | icd9b == "7751"
replace udcod = 7 if inrange(icd9b,"7753","7759")
replace udcod = 7 if icd9b == "7760"
replace udcod = 7 if inrange(icd9b,"7762","7765")
replace udcod = 7 if inrange(icd9b,"7767","7769")
replace udcod = 7 if inrange(icd9b,"7771","7776")
replace udcod = 7 if icd9b == "7778" | icd9b == "7779" | icd9b == "7780" | ///
    icd9b == "7779" | icd9b == "7780" | icd9b == "7784" | icd9b == "7794" | ///
    icd9b == "7795" | icd9b == "V29"

```

\*ICD9 (early)

```

replace udcod = 7 if inrange(icd9a,"140 0","239 9")
replace udcod = 7 if inrange(icd9a,"240 0","315 9")
replace udcod = 7 if inrange(icd9a,"320 0","458 9")
replace udcod = 7 if inrange(icd9a,"460 0","577 9")
replace udcod = 7 if inrange(icd9a,"580 0","629 9")
replace udcod = 7 if inrange(icd9a,"648 0","648 9")
replace udcod = 7 if inrange(icd9a,"680 0","738 9")
replace udcod = 7 if inrange(icd9a,"747 0","747 9")
replace udcod = 7 if inrange(icd9a,"760 0","760 2")
replace udcod = 7 if icd9a == "760 5" | icd9a == "760 6" | icd9a == "762 3" ///
    | icd9a == "762 8" | icd9a == "762 9" | icd9a == "767 0" | icd9a == "772 0"
///
    | icd9a == "772 3" | icd9a == "772 4" | icd9a == "772 5" | icd9a == "772 6"
///
    | icd9a == "772 8" | icd9a == "772 9"
replace udcod = 7 if inrange(icd9a,"773 0","773 5")
replace udcod = 7 if inrange(icd9a,"774 0","774 7")
replace udcod = 7 if icd9a == "775 0" | icd9a == "775 1"
replace udcod = 7 if inrange(icd9a,"775 3","775 9")
replace udcod = 7 if icd9a == "776 0"
replace udcod = 7 if inrange(icd9a,"776 2","776 5")
replace udcod = 7 if inrange(icd9a,"776 7","776 9")
replace udcod = 7 if inrange(icd9a,"777 1","777 6")
replace udcod = 7 if icd9a == "777 8" | icd9a == "777 9" | icd9a == "778 0" | ///

```

```

icd9a == "777 9" | icd9a == "778 0" | icd9a == "778 4" | icd9a == "779 4" |
///  

icd9a == "779 5" | icd9a == "v29 "  

*ICD8  

replace udcod = 7 if inrange(icd8,"140 0","239 9")  

replace udcod = 7 if inrange(icd8,"240 0","315 9")  

replace udcod = 7 if inrange(icd8,"320 0","458 9")  

replace udcod = 7 if inrange(icd8,"460 0","577 9")  

replace udcod = 7 if inrange(icd8,"580 0","629 9")  

replace udcod = 7 if inrange(icd8,"648 0","648 9")  

replace udcod = 7 if inrange(icd8,"680 0","738 9")  

replace udcod = 7 if inrange(icd8,"747 0","747 9")  

replace udcod = 7 if inrange(icd8,"760 0","760 2")  

replace udcod = 7 if icd8 == "760 5" | icd8 == "760 6" | icd8 == "762 3" ///  

| icd8 == "762 8" | icd8 == "762 9" | icd8 == "767 0" | icd8 == "772 0" ///  

| icd8 == "772 3" | icd8 == "772 4" | icd8 == "772 5" | icd8 == "772 6" ///  

| icd8 == "772 8" | icd8 == "772 9"  

replace udcod = 7 if inrange(icd8,"773 0","773 5")  

replace udcod = 7 if inrange(icd8,"774 0","774 7")  

replace udcod = 7 if icd8 == "775 0" | icd8 == "775 1"  

replace udcod = 7 if inrange(icd8,"775 3","775 9")  

replace udcod = 7 if icd8 == "776 0"  

replace udcod = 7 if inrange(icd8,"776 2","776 5")  

replace udcod = 7 if inrange(icd9a,"776 7","776 9")  

replace udcod = 7 if inrange(icd8,"777 1","777 6")  

replace udcod = 7 if icd8 == "777 8" | icd8 == "777 9" | icd8 == "778 0" | ///  

icd8 == "777 9" | icd8 == "778 0" | icd8 == "778 4" | icd8 == "779 4" | ///  

icd8 == "779 5" | icd8 == "v29 "  

*ICD10  

replace udcod = 7 if inrange(icd10,"C000","C979")  

replace udcod = 7 if inrange(icd10,"D100","D489")  

replace udcod = 7 if inrange(icd10,"D600","D609")  

replace udcod = 7 if icd10 == "D684"  

replace udcod = 7 if inrange(icd10,"E300","E320")  

replace udcod = 7 if inrange(icd10,"E322","E349")  

replace udcod = 7 if inrange(icd10,"I310","I319")  

replace udcod = 7 if inrange(icd10,"I470","I499")  

replace udcod = 7 if inrange(icd10,"I710","I719")  

replace udcod = 7 if icd10 == "I270" | icd10 == "I514"  

replace udcod = 7 if inrange(icd10,"J450","J459")  

replace udcod = 7 if icd10 == "J849" | icd10 == "K529"  

replace udcod = 7 if inrange(icd10,"O240","O249")  

replace udcod = 7 if inrange(icd10,"P500","P519")  

replace udcod = 7 if inrange(icd10,"P530","P549")  

replace udcod = 7 if inrange(icd10,"P550","P570")  

replace udcod = 7 if inrange(icd10,"P580","P589")  

replace udcod = 7 if inrange(icd10,"P591","P599")  

replace udcod = 7 if inrange(icd10,"P60*","P611")  

replace udcod = 7 if inrange(icd10,"P613","P619")  

replace udcod = 7 if inrange(icd10,"P700","P749")  

replace udcod = 7 if inrange(icd10,"P760","P769")  

replace udcod = 7 if inrange(icd10,"P780","P789")  

replace udcod = 7 if inrange(icd10,"P810","P819")  

replace udcod = 7 if inrange(icd10,"P930","P939")  

replace udcod = 7 if icd10 == "P002" | icd10 == "P005" | icd10 == "P006" | ///  

icd10 == "P023" | icd10 == "P028" | icd10 == "P029" | icd10 == "P293" | ///  

icd10 == "P524" | icd10 == "P579" | icd10 == "P832"  

*****  

*9. Sudden Infant Death Syndrome  

*ICD9 (late)  

replace udcod = 9 if icd9b == "7980"  

*ICD9 (early)  

replace udcod = 9 if icd9a == "798 0"

```

```

*ICD8
replace udcod = 9 if icd8 == "795 -"

*ICD10
replace udcod = 9 if icd10 == "R95 " | icd10 == "R98 "
*****
*****

*10. Other (any remaining udcod=0 and infant death has happened (ie have a date of
death)
replace udcod = 10 if udcod == 0 & biyrctdim != .
*****
*****

label define wigglesworth 1 "Congenital malformations or defect" ///
2 "Antepartum infection" 3 "Immaturity related conditions" ///
4 "Asphyxia, anoxia, trauma" 5 "External conditions" ///
6 "Infections" 7 "Other specific conditions" 8 "Still births only" ///
9 "Sudden Infant Death Syndrome" 10 "Other"

label values udcod wigglesworth

tab udcod
tab udcod sexabim
*****
*****

*SBSM
"P:\0300411\Working\Aly\Training-modules\Data\Mortality\Stillbirth-Anal-
dataset.dta", replace

/*Variables to use:
- ICD8 = cade2ebm cadexbm (3rd and 4th digits-need to be concatenated)
- ICD9 (1979-92) = cade3bm cadexebm(3rd and 4th digits-need to be
concatenated)
- ICD9 (1993+) = orifo3bm orifoxbm (3rd and 4th digits-need to be
concatenated)
- ICD10 = ic10plbm */

*Generate vars to use for recoding to Wigglesworth codes
gen icd10 = ic10plbm
label var icd10 "ICD10 underlying cause of death"

gen icd9a = cade3bm + cadexebm
label var icd9a "ICD9 (1979-1992) underlying cause of death"

gen icd9b = orifo3bm + orifoxbm
label var icd9b "ICD9 (1993+) underlying cause of death"

gen icd8 = cade2ebm + cadexbm
label var icd8 "ICD8 underlying cause of death"

tab icd10
tab icd9b
tab icd9a
tab icd8
*****

/* Code to split cause of death into the Wigglesworth categories:
1: Congenital malformation or defect
2: Antepartum infection
3: Immaturity related conditions
4: Asphyxia, anoxia or trauma
5: External conditions
6: Infections
7: Other specific conditions
8: N/A
9: Sudden Infant Death Syndrome

```

10: Other

Note default value 0 = still alive (this will have no cases if only data from the deaths record are being used)\*/

gen byte udcod = 0

\*1. Congenital malformation or defect

\*ICD9 (1993+)

```
replace udcod = 1 if icd9b=="244 0" | icd9b=="244 1" | icd9b=="251 3" | icd9b=="253
7" ///
| icd9b=="256 2" | icd9b=="257 1"
replace udcod = 1 if inrange(icd9b,"270 0","273 9")
replace udcod = 1 if inrange(icd9b,"275 0","276 9")
replace udcod = 1 if icd9b=="277 3" | icd9b=="277 6"
replace udcod = 1 if inrange(icd9b,"279 0","279 8")
replace udcod = 1 if icd9b=="278 9" | icd9b=="279 9"
replace udcod = 1 if inrange(icd9b,"282 0","282 9")
replace udcod = 1 if inrange(icd9b,"284 0","285 9")
replace udcod = 1 if inrange(icd9b,"286 0","286 4")
replace udcod = 1 if inrange(icd9b,"287 1","287 3")
replace udcod = 1 if inrange(icd9b,"288 0","288 4")
replace udcod = 1 if inrange(icd9b,"289 6","289 8")
replace udcod = 1 if inrange(icd9b,"330 0","330 9")
replace udcod = 1 if inrange(icd9b,"335 0","335 9")
replace udcod = 1 if inrange(icd9b,"337 0","337 9")
replace udcod = 1 if inrange(icd9b,"343 0","343 9")
replace udcod = 1 if inrange(icd9b,"356 0","356 9")
replace udcod = 1 if inrange(icd9b,"358 0","359 9")
replace udcod = 1 if inrange(icd9b,"424 0","424 9")
replace udcod = 1 if inrange(icd9b,"426 0","426 9")
replace udcod = 1 if inrange(icd9b,"571 0","571 9")
replace udcod = 1 if inrange(icd9b,"573 0","573 9")
replace udcod = 1 if inrange(icd9b,"750 0","751 9")
replace udcod = 1 if icd9b=="686 8" | icd9b=="997 9"
replace udcod = 1 if inrange(icd9b,"425 0","425 4")
replace udcod = 1 if inrange(icd9b,"660 0","665 2")
replace udcod = 1 if inrange(icd9b,"740 0","742 9")
replace udcod = 1 if inrange(icd9b,"745 0","748 9")
replace udcod = 1 if inrange(icd9b,"753 0","760 9")
```

\*ICD9a (early)

```
replace udcod = 1 if icd9a=="244 0" | icd9a=="244 1" | icd9a=="251 3" ///
| icd9a=="253 7" | icd9a=="256 2" | icd9a=="257 1"
replace udcod = 1 if inrange(icd9a,"270 0","273 9")
replace udcod = 1 if inrange(icd9a,"275 0","277 9")
replace udcod = 1 if inrange(icd9a,"279 0","279 5")
replace udcod = 1 if inrange(icd9a,"282 0","282 9")
replace udcod = 1 if icd9a=="278 9" | icd9a=="279 9" | icd9a=="284 0" | icd9a=="285
0"
replace udcod = 1 if inrange(icd9a,"286 0","286 4")
replace udcod = 1 if inrange(icd9a,"287 1","287 3")
replace udcod = 1 if inrange(icd9a,"288 0","288 4")
replace udcod = 1 if inrange(icd9a,"289 6","289 8")
replace udcod = 1 if inrange(icd9a,"330 0","330 9")
replace udcod = 1 if inrange(icd9a,"337 0","337 9")
replace udcod = 1 if inrange(icd9a,"343 0","343 9")
replace udcod = 1 if inrange(icd9a,"356 0","356 9")
replace udcod = 1 if inrange(icd9a,"358 0","358 9")
replace udcod = 1 if inrange(icd9a,"359 0","359 9")
replace udcod = 1 if inrange(icd9a,"424 0","424 9")
replace udcod = 1 if inrange(icd9a,"425 0","425 4")
replace udcod = 1 if inrange(icd9a,"426 0","426 9")
replace udcod = 1 if inrange(icd9a,"571 0","571 9")
replace udcod = 1 if inrange(icd9a,"573 0","573 9")
replace udcod = 1 if inrange(icd9a,"571 0","571 9")
replace udcod = 1 if icd9a=="686 8" | icd9a=="997 9"
replace udcod = 1 if inrange(icd9a,"660 0","665 2")
replace udcod = 1 if inrange(icd9a,"750 0","751 9")
```

```

replace udcod = 1 if inrange(icd9a,"740 0","742 9")
replace udcod = 1 if inrange(icd9a,"745 0 ","748 9")
replace udcod = 1 if icd9a=="745 0" | icd9a=="753 0"
replace udcod = 1 if inrange(icd9a,"753 0","760 9")

*ICD8
replace udcod = 1 if icd8=="244 0" | icd8=="244 1" | icd8=="251 3" | icd8=="253 7"
///
| icd8=="256 2" | icd8=="257 1"
replace udcod = 1 if inrange(icd8,"270 0","273 9")
replace udcod = 1 if inrange(icd8,"275 0","277 9")
replace udcod = 1 if inrange(icd8,"279 0","279 5")
replace udcod = 1 if icd8=="278 9" | icd8=="279 9" | icd8=="284 0" | icd8=="285 0"
replace udcod = 1 if inrange(icd8, "282 0", "282 9")
replace udcod = 1 if inrange(icd8,"286 0","286 4")
replace udcod = 1 if inrange(icd8,"287 1","287 3")
replace udcod = 1 if inrange(icd8,"288 0","288 4")
replace udcod = 1 if inrange(icd8,"289 6","289 8")
replace udcod = 1 if inrange(icd8,"330 0", "330 9")
replace udcod = 1 if inrange(icd8,"335 0", "335 9")
replace udcod = 1 if inrange(icd8,"337 0", "337 9")
replace udcod = 1 if inrange(icd8,"343 0", "343 9")
replace udcod = 1 if inrange(icd8,"356 0", "356 9")
replace udcod = 1 if inrange(icd8,"358 0", "359 9")
replace udcod = 1 if inrange(icd8,"424 0", "424 9")
replace udcod = 1 if inrange(icd8,"426 0", "426 9")
replace udcod = 1 if inrange(icd8,"571 0", "571 9")
replace udcod = 1 if inrange(icd8,"573 0", "573 9")
replace udcod = 1 if icd8=="573 -" | icd8=="686 8" | icd8=="740 -" | icd8=="742 -"
| icd8=="997 9"
replace udcod = 1 if inrange(icd8,"750 9", "751 9")
replace udcod = 1 if inrange(icd8,"425 0","425 4")
replace udcod = 1 if inrange(icd8,"660 0","665 2")
replace udcod = 1 if inrange(icd8,"740 0","742 9")
replace udcod = 1 if inrange(icd8,"745 0 ","748 9")
replace udcod = 1 if inrange(icd8,"753 0","760 9")

*ICD10
replace udcod = 1 if inrange(icd10,"D550","D589")
replace udcod = 1 if icd10=="D610" | icd10=="D640"
replace udcod = 1 if inrange(icd10,"D660","D682")
replace udcod = 1 if inrange(icd10,"D691","D694")
replace udcod = 1 if inrange(icd10,"D70 ", "D721")
replace udcod = 1 if icd10=="D740" | icd10=="D750" | icd10=="D760"" | icd10=="D761"
replace udcod = 1 if inrange(icd10,"D800","D899")
replace udcod = 1 if inrange(icd10,"E700","E859")
replace udcod = 1 if inrange(icd10,"E880","E889")
replace udcod = 1 if inrange(icd10,"G120","G129")
replace udcod = 1 if inrange(icd10,"G600","G609")
replace udcod = 1 if inrange(icd10,"G700","G719")
replace udcod = 1 if inrange(icd10,"G800","G809")
replace udcod = 1 if inrange(icd10,"G900","G909")
replace udcod = 1 if inrange(icd10,"I340","I379")
replace udcod = 1 if inrange(icd10,"I420","I425")
replace udcod = 1 if inrange(icd10,"I440","I459")
replace udcod = 1 if inrange(icd10,"K740","K746")
replace udcod = 1 if inrange(icd10,"O350","O352")
replace udcod = 1 if inrange(icd10,"Q000","Q079")
replace udcod = 1 if inrange(icd10,"Q200","Q239")
replace udcod = 1 if inrange(icd10,"Q242","Q249")
replace udcod = 1 if inrange(icd10,"Q251","Q269")
replace udcod = 1 if inrange(icd10,"Q271","Q289")
replace udcod = 1 if inrange(icd10,"Q310","Q313")
replace udcod = 1 if inrange(icd10,"Q318","Q319")
replace udcod = 1 if inrange(icd10,"Q320","Q349")
replace udcod = 1 if inrange(icd10,"Q382","Q459")
replace udcod = 1 if inrange(icd10,"Q600","Q613")
replace udcod = 1 if inrange(icd10,"Q613","Q619")

```



```

replace udcod = 1 if inrange(icd10,"Q620","Q639")
replace udcod = 1 if inrange(icd10,"Q641","Q649")
replace udcod = 1 if inrange(icd10,"Q673","Q676")
replace udcod = 1 if icd10=="Q743"
replace udcod = 1 if inrange(icd10,"Q750","Q759")
replace udcod = 1 if inrange(icd10,"Q761","Q799")
replace udcod = 1 if inrange(icd10,"Q800","Q819")
replace udcod = 1 if inrange(icd10,"Q850","Q939")
replace udcod = 1 if inrange(icd10,"Q960","Q999")
*****

```

\*2. Antepartum infection

```

*ICD9 (late)
replace udcod = 2 if inrange(icd9b,"090 0","090 9")
replace udcod = 2 if icd9b=="655 3" | icd9b=="762 7" | icd9b=="770 0"
replace udcod = 2 if inrange(icd9b,"7710","7719")

*ICD9 (early)
replace udcod = 2 if inrange(icd9a,"090 0","090 9")
replace udcod = 2 if icd9a=="655 3" | icd9a=="762 7" | icd9a=="770 0"
replace udcod = 2 if inrange(icd9a,"771 0","771 9")

```

```

*ICD8
replace udcod = 2 if inrange(icd8,"090 0","090 9")
replace udcod = 2 if icd8=="655 3" | icd8=="762 7" | icd8=="770 0"
replace udcod = 2 if inrange(icd8,"771 0","771 9")

```

```

*ICD10
replace udcod = 2 if inrange(icd10,"A500","A509")
replace udcod = 2 if inrange(icd10,"P230","P239")
replace udcod = 2 if inrange(icd10,"P350","P359")
replace udcod = 2 if inrange(icd10,"P370","P379")
replace udcod = 2 if icd10=="O353" | icd10=="P027"
*****

```

\*3. Immaturity related conditions

```

*ICD9b (late)
replace udcod = 3 if inrange(icd9b,"761 0","761 1")
replace udcod = 3 if inrange(icd9b,"770 4","770 9")
replace udcod = 3 if icd9b=="761 8" | icd9b=="770 2" | icd9b=="772 1" | ///
    icd9b=="774 2" | icd9b=="774 7" | icd9b=="777 5" | icd9b=="792 3" |
///
    icd9b=="796 5" | icd9b=="V213"
replace udcod = 3 if inrange(icd9b,"765 0","769 9")

```

```

*ICD9 (early)
replace udcod = 3 if inrange(icd9a,"761 0","761 1")
replace udcod = 3 if inrange(icd9a,"770 4","770 9")
replace udcod = 3 if icd9a=="761 8" | icd9a=="770 2" | icd9a=="772 1" | ///
    icd9a=="774 2" | icd9a=="774 7" | icd9a=="777 5" | icd9a=="792 3" |
///
    icd9a=="796 5" | icd9a=="V213"
replace udcod = 3 if inrange(icd9a,"765 0","769 9")

```

```

*ICD8
replace udcod = 3 if inrange(icd8,"761 0","761 1")
replace udcod = 3 if inrange(icd8,"770 4","770 9")
replace udcod = 3 if icd8=="761 8" | icd8=="770 2" | icd8=="772 1" | ///
    icd8=="774 2" | icd8=="774 7" | icd8=="777 -" | icd8=="792 3" | ///
    icd8=="796 5" | icd8=="V213"
replace udcod = 3 if inrange(icd8,"765 0","769 9")

```

```

*ICD10
replace udcod = 3 if inrange(icd10,"P010","P011")
replace udcod = 3 if inrange(icd10,"P070","P073")
replace udcod = 3 if inrange(icd10,"P220","P229")
replace udcod = 3 if inrange(icd10,"P370","P379")
replace udcod = 3 if inrange(icd10,"P770","P779")

```

```

replace udcod = 3 if inrange(icd10,"P960","P969")
replace udcod = 3 if icd10 == "O289" | icd10 == "P018" | icd10 == "P578" | ///
    icd10 == "P590" | icd10 == "P77 "
*****
*4. Asphyxia, anoxia and trauma
  *ICD9 (late)
replace udcod = 4 if inrange(icd9b,"641 0","641 3")
replace udcod = 4 if inrange(icd9b,"663 0","663 6")
replace udcod = 4 if icd9b== "641 8" | icd9b== "641 9" | icd9b== "645 1" | ///
    icd9b== "656 3" | icd9b== "656 5" | icd9b== "656 7" | icd9b== "656 8" | ///
    icd9b== "663 8" | icd9b== "663 9" | icd9b== "666 0"
replace udcod = 4 if inrange(icd9b,"642 0", "642 9")
replace udcod = 4 if inrange(icd9b,"646 0", "646 9")
replace udcod = 4 if inrange(icd9b,"660 0", "662 9")
replace udcod = 4 if inrange(icd9b,"669 0", "666 9")
replace udcod = 4 if inrange(icd9b,"760 0","761 9")
replace udcod = 4 if inrange(icd9b,"762 0","762 6")
replace udcod = 4 if inrange(icd9b,"764 0","764 2")
replace udcod = 4 if inrange(icd9b,"766 0","766 2")
replace udcod = 4 if inrange(icd9b,"767 0","767 9")
replace udcod = 4 if inrange(icd9b,"763 0","763 9")
replace udcod = 4 if icd9b == "768 7" | icd9b == "770 1" | icd9b == "770 8" | ///
    icd9b == "772 2" | icd9b == "779 0" | icd9b == "779 1" | icd9b == "779 2" |
///
    icd9b == "V29"

  *ICD9 (early)
replace udcod = 4 if inrange(icd9a,"641 0","641 3")
replace udcod = 4 if inrange(icd9a,"663 0","663 6")
replace udcod = 4 if icd9a== "641 8" | icd9a== "641 9" | icd9a== "645 1" | ///
    icd9a== "656 3" | icd9a== "6565 " | icd9a== "656 7" | icd9a== "656 8" | ///
    icd9a== "663 8" | icd9a== "663 9" | icd9a== "666 0"
replace udcod = 4 if inrange(icd9a,"642 0", "642 9")
replace udcod = 4 if inrange(icd9a,"646 0", "646 9")
replace udcod = 4 if inrange(icd9a,"660 0", "662 9")
replace udcod = 4 if inrange(icd9a,"669 0", "666 9")
replace udcod = 4 if inrange(icd9a,"760 0","761 9")
replace udcod = 4 if inrange(icd9a,"762 0","762 6")
replace udcod = 4 if inrange(icd9a,"764 0","764 2")
replace udcod = 4 if inrange(icd9a,"766 0","766 2")
replace udcod = 4 if inrange(icd9a,"767 0","767 9")
replace udcod = 4 if inrange(icd9a,"763 0","763 9")
replace udcod = 4 if icd9a == "768 7" | icd9a == "770 1" | icd9a == "770 8" | ///
    icd9a == "772 2" | icd9a == "779 0" | icd9a == "779 1" | icd9a == "779 2" |
///
    icd9a == "V29 "

  *ICD8
replace udcod = 4 if inrange(icd8,"641 0","641 3")
replace udcod = 4 if inrange(icd8,"663 0","663 6")
replace udcod = 4 if icd8== "641 8" | icd8== "641 9" | icd8== "645 1" | ///
    icd8== "656 3" | icd8== "6565 " | icd8== "656 7" | icd8== "656 8" | ///
    icd8== "663 8" | icd8== "663 9" | icd8== "666 0"
replace udcod = 4 if inrange(icd8,"642 0", "642 9")
replace udcod = 4 if inrange(icd8,"646 0", "646 9")
replace udcod = 4 if inrange(icd8,"660 0", "662 9")
replace udcod = 4 if inrange(icd8,"669 0", "666 9")
replace udcod = 4 if inrange(icd8,"760 0","761 9")
replace udcod = 4 if inrange(icd8,"762 0","762 6")
replace udcod = 4 if inrange(icd8,"764 0","764 2")
replace udcod = 4 if inrange(icd8,"766 0","766 2")
replace udcod = 4 if inrange(icd8,"767 0","767 9")
replace udcod = 4 if inrange(icd8,"763 0","763 9")
replace udcod = 4 if icd8 == "768 7" | icd8 == "770 1" | icd8 == "770 8" | ///
    icd8 == "772 2" | icd8 == "779 0" | icd8 == "779 1" | icd8 == "779 2" | ///
    icd8 == "V29 "

```

```

*ICD10
replace udcod = 4 if inrange(icd10,"O100","O16*")
replace udcod = 4 if inrange(icd10,"O430","O439")
replace udcod = 4 if inrange(icd10,"O440","O469")
replace udcod = 4 if inrange(icd10,"O620","O689")
replace udcod = 4 if inrange(icd10,"O690","O699")
replace udcod = 4 if icd10 == "O363" | icd10 == "O365" | icd10 == "O480"
replace udcod = 4 if inrange(icd10,"P016","P017")
replace udcod = 4 if inrange(icd10,"P020","P021")
replace udcod = 4 if inrange(icd10,"P024","P026")
replace udcod = 4 if inrange(icd10,"P030","P039")
replace udcod = 4 if inrange(icd10,"P050","P059")
replace udcod = 4 if inrange(icd10,"P080","P082")
replace udcod = 4 if inrange(icd10,"P100","P159")
replace udcod = 4 if inrange(icd10,"P200","P219")
replace udcod = 4 if inrange(icd10,"P240","P241")
replace udcod = 4 if inrange(icd10,"P525","P529")
replace udcod = 4 if inrange(icd10,"P910","P919")
replace udcod = 4 if icd10 == "P000" | icd10 == "P022" | icd10 == "P249" | ///
    icd10 == "P90"
*****

*5. External conditions
*ICD9 (late)
replace udcod = 5 if inrange(icd9b,"260 0","263 9")
replace udcod = 5 if inrange(icd9b,"E800","E999")
replace udcod = 5 if icd9b== "507 0" | icd9b== "770 1" | icd9b== "770 8" | icd9b==
"779 3"
replace udcod = 5 if inrange(icd9b,"778 0", "778 9")

*ICD9 (early)
replace udcod = 5 if inrange(icd9a,"260 0","263 9")
replace udcod = 5 if inrange(icd9a,"E800 ","E999 ")
replace udcod = 5 if icd9a== "507 0" | icd9a== "770 1" | icd9a== "770 8" | ///
    icd9a== "779 3"
replace udcod = 5 if inrange(icd9a,"778 0", "778 9")

*ICD8
replace udcod = 5 if inrange(icd8,"260 0","263 9")
replace udcod = 5 if inrange(icd8,"E800 ","E999 ")
replace udcod = 5 if icd8== "507 0" | icd8== "770 1" | icd8== "770 8" | ///
    icd8== "779 3"
replace udcod = 5 if inrange(icd8,"778 0", "778 9")

*ICD10
replace udcod = 5 if inrange(icd10,"E400","E441")
replace udcod = 5 if inrange(icd10,"E460","E469")
replace udcod = 5 if icd10=="J690"
replace udcod = 5 if inrange(icd10,"P242","P248")
replace udcod = 5 if inrange(icd10,"P800","P810")
replace udcod = 5 if inrange(icd10,"P830","P831")
replace udcod = 5 if inrange(icd10,"P833","P839")
replace udcod = 5 if inrange(icd10,"P920","P929")
replace udcod = 5 if icd10 == "U509"
replace udcod = 5 if inrange(icd10,"V000","V999")
replace udcod = 5 if icd10 == "Y098"
*****

*6. Infections
*ICD9 (late)
replace udcod = 6 if inrange(icd9b,"000 0","013 6")
replace udcod = 6 if icd9b == "254 1"
replace udcod = 6 if inrange(icd9b,"320 0","326 9")
replace udcod = 6 if inrange(icd9b,"381 0","383 9")
replace udcod = 6 if inrange(icd9b,"460 0","466 9")
replace udcod = 6 if inrange(icd9b,"480 0","488 9")
replace udcod = 6 if inrange(icd9b,"420 0","421 9")
replace udcod = 6 if inrange(icd9b,"476 0","476 9")

```

```

replace udcod = 6 if inrange(icd9b,"494 0","494 9")
replace udcod = 6 if inrange(icd9b,"510 0","511 9")
replace udcod = 6 if inrange(icd9b,"513 0","514 9")
replace udcod = 6 if inrange(icd9b,"517 0","517 9")
replace udcod = 6 if inrange(icd9b,"530 0","530 9")
replace udcod = 6 if inrange(icd9b,"540 0","540 9")
replace udcod = 6 if inrange(icd9b,"566 0","567 9")
replace udcod = 6 if inrange(icd9b,"590 0","590 9")
replace udcod = 6 if inrange(icd9b,"593 0","593 9")
replace udcod = 6 if inrange(icd9b,"559 0","595 9")
replace udcod = 6 if inrange(icd9b,"599 0","599 9")
replace udcod = 6 if inrange(icd9b,"771 0","771 9")
replace udcod = 6 if inrange(icd9b,"997 0","997 9")

```

\*ICD9 (early)

```

replace udcod = 6 if inrange(icd9a,"000 0","013 6")
replace udcod = 6 if icd9a == "254 1"
replace udcod = 6 if inrange(icd9a,"320 0","326 9")
replace udcod = 6 if inrange(icd9a,"381 0","383 9")
replace udcod = 6 if inrange(icd9a,"460 0","466 9")
replace udcod = 6 if inrange(icd9a,"480 0","488 9")
replace udcod = 6 if inrange(icd9a,"420 0","421 9")
replace udcod = 6 if inrange(icd9a,"476 0","476 9")
replace udcod = 6 if inrange(icd9a,"494 0","494 9")
replace udcod = 6 if inrange(icd9a,"510 0","511 9")
replace udcod = 6 if inrange(icd9a,"513 0","514 9")
replace udcod = 6 if inrange(icd9a,"517 0","517 9")
replace udcod = 6 if inrange(icd9a,"530 0","530 9")
replace udcod = 6 if inrange(icd9a,"540 0","540 9")
replace udcod = 6 if inrange(icd9a,"566 0","567 9")
replace udcod = 6 if inrange(icd9a,"590 0","590 9")
replace udcod = 6 if inrange(icd9a,"593 0","593 9")
replace udcod = 6 if inrange(icd9a,"559 0","595 9")
replace udcod = 6 if inrange(icd9a,"599 0","599 9")
replace udcod = 6 if inrange(icd9a,"771 0","771 9")
replace udcod = 6 if inrange(icd9a,"997 0","997 9")

```

\*ICD8

```

replace udcod = 6 if inrange(icd8,"000 0","013 6")
replace udcod = 6 if icd8 == "254 1"
replace udcod = 6 if inrange(icd8,"320 0","326 9")
replace udcod = 6 if inrange(icd8,"381 0","383 9")
replace udcod = 6 if inrange(icd8,"460 0","466 9")
replace udcod = 6 if inrange(icd8,"480 0","488 9")
replace udcod = 6 if inrange(icd8,"420 0","421 9")
replace udcod = 6 if inrange(icd8,"476 0","476 9")
replace udcod = 6 if inrange(icd8,"494 0","494 9")
replace udcod = 6 if inrange(icd8,"510 0","511 9")
replace udcod = 6 if inrange(icd8,"513 0","514 9")
replace udcod = 6 if inrange(icd8,"517 0","517 9")
replace udcod = 6 if inrange(icd8,"530 0","530 9")
replace udcod = 6 if inrange(icd8,"540 0","540 9")
replace udcod = 6 if inrange(icd8,"566 0","567 9")
replace udcod = 6 if inrange(icd8,"590 0","590 9")
replace udcod = 6 if inrange(icd8,"593 0","593 9")
replace udcod = 6 if inrange(icd8,"559 0","595 9")
replace udcod = 6 if inrange(icd8,"599 0","599 9")
replace udcod = 6 if inrange(icd8,"771 0","771 9")
replace udcod = 6 if inrange(icd8,"997 0","997 9")

```

\*ICD10

```

replace udcod = 6 if inrange(icd10,"A000","A499")
replace udcod = 6 if inrange(icd10,"A510","B999")
replace udcod = 6 if icd10 == "E321"

replace udcod = 6 if inrange(icd10,"G000","G099")
replace udcod = 6 if inrange(icd10,"H650","H669")
replace udcod = 6 if inrange(icd10,"H700","H709")

```

```

replace udcod = 6 if inrange(icd10,"I300","I309")
replace udcod = 6 if inrange(icd10,"I330","I339")
replace udcod = 6 if inrange(icd10,"J000","J069")
replace udcod = 6 if inrange(icd10,"J100","J189")
replace udcod = 6 if inrange(icd10,"J200","J220")
replace udcod = 6 if inrange(icd10,"J850","J869")
replace udcod = 6 if inrange(icd10,"J360","J369")
replace udcod = 6 if inrange(icd10,"J470","J479")
replace udcod = 6 if icd10 == "J370" | icd10 == "J731"
replace udcod = 6 if inrange(icd10,"K350","K359")
replace udcod = 6 if inrange(icd10,"K610","K614")
replace udcod = 6 if icd10 == "N111" | icd10 == "N136" | icd10 == "N300" | ///
    icd10 == "N390"
replace udcod = 6 if inrange(icd10,"N120","N129")
replace udcod = 6 if inrange(icd10,"P360","P369")
replace udcod = 6 if inrange(icd10,"P380","P389")
replace udcod = 6 if inrange(icd10,"P390","P399")
*****

```

\*7. Other specific conditions

```

    *ICD9 (late)
replace udcod = 7 if inrange(icd9b,"140 0","239 9")
replace udcod = 7 if inrange(icd9b,"240 0","315 9")
replace udcod = 7 if inrange(icd9b,"320 0","458 9")
replace udcod = 7 if inrange(icd9b,"460 0","577 9")
replace udcod = 7 if inrange(icd9b,"580 0","629 9")
replace udcod = 7 if inrange(icd9b,"648 0","648 9")
replace udcod = 7 if inrange(icd9b,"680 0","738 9")
replace udcod = 7 if inrange(icd9b,"747 0","747 9")
replace udcod = 7 if inrange(icd9b,"760 0","760 2")
replace udcod = 7 if icd9b == "760 5" | icd9b == "760 6" | icd9b == "762 3" ///
    | icd9b == "762 8" | icd9b == "762 9" | icd9b == "767 0" | icd9b == "772 0"
///
    | icd9b == "772 3" | icd9b == "772 4" | icd9b == "772 5" | icd9b == "772 6"
///
    | icd9b == "772 8" | icd9b == "772 9"
replace udcod = 7 if inrange(icd9b,"773 0","773 5")
replace udcod = 7 if inrange(icd9b,"774 0","774 7")
replace udcod = 7 if icd9b == "775 0" | icd9b == "775 1"
replace udcod = 7 if inrange(icd9b,"775 3","775 9")
replace udcod = 7 if icd9b == "776 0"
replace udcod = 7 if inrange(icd9b,"776 2","776 5")
replace udcod = 7 if inrange(icd9b,"776 7","776 9")
replace udcod = 7 if inrange(icd9b,"777 1","777 6")
replace udcod = 7 if icd9b == "777 8" | icd9b == "777 9" | icd9b == "778 0" | ///
    icd9b == "777 9" | icd9b == "778 0" | icd9b == "778 4" | icd9b == "779 4" |
///
    icd9b == "779 5" | icd9b == "V29"

```

```

    *ICD9 (early)
replace udcod = 7 if inrange(icd9a,"140 0","239 9")
replace udcod = 7 if inrange(icd9a,"240 0","315 9")
replace udcod = 7 if inrange(icd9a,"320 0","458 9")
replace udcod = 7 if inrange(icd9a,"460 0","577 9")
replace udcod = 7 if inrange(icd9a,"580 0","629 9")
replace udcod = 7 if inrange(icd9a,"648 0","648 9")
replace udcod = 7 if inrange(icd9a,"680 0","738 9")
replace udcod = 7 if inrange(icd9a,"747 0","747 9")
replace udcod = 7 if inrange(icd9a,"760 0","760 2")
replace udcod = 7 if icd9a == "760 5" | icd9a == "760 6" | icd9a == "762 3" ///
    | icd9a == "762 8" | icd9a == "762 9" | icd9a == "767 0" | icd9a == "772 0"
///
    | icd9a == "772 3" | icd9a == "772 4" | icd9a == "772 5" | icd9a == "772 6"
///
    | icd9a == "772 8" | icd9a == "772 9"
replace udcod = 7 if inrange(icd9a,"773 0","773 5")
replace udcod = 7 if inrange(icd9a,"774 0","774 7")
replace udcod = 7 if icd9a == "775 0" | icd9a == "775 1"

```

```

replace udcod = 7 if inrange(icd9a,"775 3","775 9")
replace udcod = 7 if icd9a == "776 0"
replace udcod = 7 if inrange(icd9a,"776 2","776 5")
replace udcod = 7 if inrange(icd9a,"776 7","776 9")
replace udcod = 7 if inrange(icd9a,"777 1","777 6")
replace udcod = 7 if icd9a == "777 8" | icd9a == "777 9" | icd9a == "778 0" | ///
    icd9a == "777 9" | icd9a == "778 0" | icd9a == "778 4" | icd9a == "779 4" |
///
    icd9a == "779 5" | icd9a == "v29 "

*ICD8
replace udcod = 7 if inrange(icd8,"140 0","239 9")
replace udcod = 7 if inrange(icd8,"240 0","315 9")
replace udcod = 7 if inrange(icd8,"320 0","458 9")
replace udcod = 7 if inrange(icd8,"460 0","577 9")
replace udcod = 7 if inrange(icd8,"580 0","629 9")
replace udcod = 7 if inrange(icd8,"648 0","648 9")
replace udcod = 7 if inrange(icd8,"680 0","738 9")
replace udcod = 7 if inrange(icd8,"747 0","747 9")
replace udcod = 7 if inrange(icd8,"760 0","760 2")
replace udcod = 7 if icd8 == "760 5" | icd8 == "760 6" | icd8 == "762 3" ///
    | icd8 == "762 8" | icd8 == "762 9" | icd8 == "767 0" | icd8 == "772 0" ///
    | icd8 == "772 3" | icd8 == "772 4" | icd8 == "772 5" | icd8 == "772 6" ///
    | icd8 == "772 8" | icd8 == "772 9"
replace udcod = 7 if inrange(icd8,"773 0","773 5")
replace udcod = 7 if inrange(icd8,"774 0","774 7")
replace udcod = 7 if icd8 == "775 0" | icd8 == "775 1"
replace udcod = 7 if inrange(icd8,"775 3","775 9")
replace udcod = 7 if icd8 == "776 0"
replace udcod = 7 if inrange(icd8,"776 2","776 5")
replace udcod = 7 if inrange(icd9a,"776 7","776 9")
replace udcod = 7 if inrange(icd8,"777 1","777 6")
replace udcod = 7 if icd8 == "777 8" | icd8 == "777 9" | icd8 == "778 0" | ///
    icd8 == "777 9" | icd8 == "778 0" | icd8 == "778 4" | icd8 == "779 4" | ///
    icd8 == "779 5" | icd8 == "v29 "

*ICD10
replace udcod = 7 if inrange(icd10,"C000","C979")
replace udcod = 7 if inrange(icd10,"D100","D489")
replace udcod = 7 if inrange(icd10,"D600","D609")
replace udcod = 7 if icd10 == "D684"
replace udcod = 7 if inrange(icd10,"E300","E320")
replace udcod = 7 if inrange(icd10,"E322","E349")
replace udcod = 7 if inrange(icd10,"I310","I319")
replace udcod = 7 if inrange(icd10,"I470","I499")
replace udcod = 7 if inrange(icd10,"I710","I719")
replace udcod = 7 if icd10 == "I270" | icd10 == "I514"
replace udcod = 7 if inrange(icd10,"J450","J459")
replace udcod = 7 if icd10 == "J849" | icd10 == "K529"
replace udcod = 7 if inrange(icd10,"O240","O249")
replace udcod = 7 if inrange(icd10,"P500","P519")
replace udcod = 7 if inrange(icd10,"P530","P549")
replace udcod = 7 if inrange(icd10,"P550","P570")
replace udcod = 7 if inrange(icd10,"P580","P589")
replace udcod = 7 if inrange(icd10,"P591","P599")
replace udcod = 7 if inrange(icd10,"P60*","P611")
replace udcod = 7 if inrange(icd10,"P613","P619")
replace udcod = 7 if inrange(icd10,"P700","P749")
replace udcod = 7 if inrange(icd10,"P760","P769")
replace udcod = 7 if inrange(icd10,"P780","P789")
replace udcod = 7 if inrange(icd10,"P810","P819")
replace udcod = 7 if inrange(icd10,"P930","P939")
replace udcod = 7 if icd10 == "P002" | icd10 == "P005" | icd10 == "P006" | ///
    icd10 == "P023" | icd10 == "P028" | icd10 == "P029" | icd10 == "P293" | ///
    icd10 == "P524" | icd10 == "P579" | icd10 == "P832"
*****

```

\*9. Sudden Infant Death Syndrome

```

*ICD9 (late)
replace udcod = 9 if icd9b == "798 0"

*ICD9 (early)
replace udcod = 9 if icd9a == "798 0"

*ICD8
replace udcod = 9 if icd8 == "795 -"

*ICD10
replace udcod = 9 if icd10 == "R95 " | icd10 == "R98 "
*****
*****

*10. Other (any remaining udcod=0 and still birth happened (ie have a date of
death)
replace udcod = 10 if udcod == 0 & biyrabm != .
*****
*****

label define wigglesworth 1 "Congenital malformations or defect" ///
2 "Antepartum infection" 3 "Immaturity related conditions" ///
4 "Asphyxia, anoxia, trauma" 5 "External conditions" ///
6 "Infections" 7 "Other specific conditions" 8 "Still births only" ///
9 "Sudden Infant Death Syndrome" 10 "Other"

label values udcod wigglesworth

tab udcod
tab udcod sexabm

```