

Statistical bulletin

# Deaths involving *Clostridium difficile* or MRSA, Wales: 2015

Deaths where *Clostridium difficile* or MRSA infections were mentioned on the death certificate by sex, age group and whether the death occurred in hospital or elsewhere.



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# 1. Main points

In 2015, there were 108 deaths involving *Clostridium difficile* (*C. difficile*) and 22 deaths involving Meticillin-resistant *Staphylococcus aureus* (MRSA) in Wales.

The *C. difficile* age-standardised death rate in 2015 is not statistically different to the lowest that was recorded in 1999 (34.3 deaths per 1 million persons in 2015).

The age-standardised death rate for MRSA has also dropped since its peak in the mid-2000s, to 7.0 deaths per 1 million persons in 2015.

Age-specific death rates for *C. difficile* and MRSA are highest in those aged 85 years and above. For MRSA, age-specific rates in males are higher than those in females.

The majority of deaths involving *C. difficile* or MRSA occur in NHS hospitals.

## 2. Statistician's quote

“The number of deaths involving *C. difficile* and MRSA continue to fall in Wales, most likely due to a greater awareness of antibiotic resistance and more effective measures to prevent the spread of these infections. However the elderly are still most likely to be affected by these diseases, due to their weaker immune systems.”

Dr. Ben Windsor-Shellard, Health Analysis and Life Events, Office for National Statistics

## 3. Things you need to know

This bulletin presents the latest figures for deaths where either *Clostridium difficile* or Meticillin-resistant *Staphylococcus aureus* were mentioned or were identified as the underlying cause of death on death certificates. Figures are presented for Wales and are broken down by sex, age group and place of death. Comparisons are made between data for 2015, the latest year, and previously published data.

Figures are based on deaths registered in each calendar year rather than those occurring in each year. Since the majority of deaths involving *Clostridium difficile* or Meticillin-resistant *Staphylococcus aureus* registered in 2015 also occurred in the same year, registration delays are unlikely to affect our findings. Please see the section on registration delays for further information.

### Clostridium difficile

*Clostridium difficile* (*C. difficile*) is a type of bacteria which is naturally present in the intestine of 2 in 3 children and 3 in 100 adults, but causes no harm to healthy people. This is because its growth is controlled by other bacteria in the body. However, certain antibiotics can interfere with the natural balance of the intestine by [destroying the bacteria that usually prevent C.difficile from multiplying](#) (Bupa, 2014). If this happens, *C.difficile* bacteria can grow to unusually high levels and produce toxins which attack the intestines. Some people affected by *C. difficile* show no symptoms; while others go on to have diarrhoea, high temperature and abdominal cramping. In extreme cases, it may cause [potentially life-threatening inflammation of the bowel](#) (NHS, 2016).

## Meticillin-resistant Staphylococcus aureus

Meticillin-resistant Staphylococcus aureus (MRSA) is a type of Staphylococcus bacteria that is resistant to antibiotics known as beta-lactams. The MRSA figures presented here are a subset of the Staphylococcus aureus (*S. aureus*) figures. *S. aureus* bacteria can cause mild to life-threatening disease if there is an opportunity for it to enter the body through broken skin or a procedure requiring the use of an invasive medical device.

The concern about MRSA is in part due to the fact that it shows a higher degree of drug resistance than other types of *S. aureus* and also because it has become [particularly associated with hospital acquired infections](#) (Public Health Wales, 2011). There is also growing concern about community-acquired MRSA in some parts of the world, with studies ([Herold et al. 1998](#); [Salmenlinna S, Lyytikäinen O and Vuopio-Varkila J. 2002](#)) suggesting that this type of MRSA can be found in otherwise healthy people with no previous contact with healthcare facilities or hospitalised persons.

## Time coverage

In this bulletin figures for *C. difficile* are presented from 2001 onwards whereas figures on MRSA are presented from 1993 onwards. Since 2001, the Office for National Statistics (ONS) has been coding deaths in Wales using the Tenth Revision of the International Classification of Diseases (ICD-10; World Health Organisation). In this revision, there is a code for deaths involving *C. difficile*, something which was not available in the previous revision (ICD-9). For deaths involving MRSA, there are comparable codes in both revisions of the ICD, meaning that the time series for MRSA is longer. When we were testing the use of ICD-10, deaths in 1999 were dual coded using both revisions of the ICD. As such, this means that we also have figures on *C. difficile* for deaths registered in 1999. For further information, please see the Quality and methodology section.

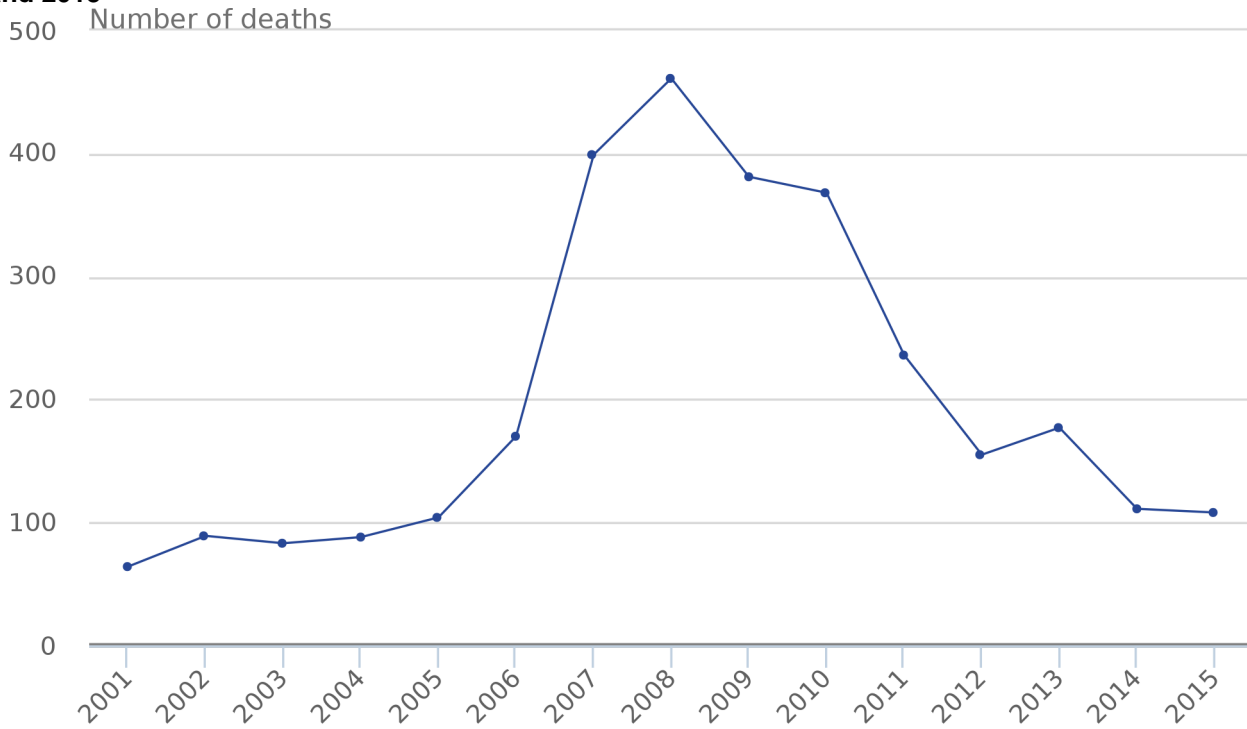
## 4. The total number of deaths involving *C. difficile* is the lowest observed for a decade

In 2015, there were 108 deaths involving *C. difficile* in Wales, the lowest number of deaths since 2005. The number of male deaths fell from 52 in 2014 to 39 in 2015, while the number of female deaths rose somewhat from 59 in 2014 to 69 in 2015.

While *C. difficile* may contribute to a death, sometimes it directly causes death. In 2015, of the 108 death certificates mentioning *C. difficile*, 50 (46%) also identified it as the underlying cause. This represents a 19% increase from the previous year.

*C. difficile* caused more deaths in females than males in 2015. Among females, 37 deaths recorded *C. difficile* as the underlying cause. For males, 13 deaths recorded *C. difficile* as the underlying cause.

**Figure 1: Number of deaths involving C. difficile, all persons, deaths registered in Wales between 2001 and 2015**



Source: Office for National Statistics

**Notes:**

1. Figures are based on postcode boundaries as of May 2016 and exclude deaths of non-residents.
2. Figures are for deaths registered in each calendar year.
3. Data are only available where cause of death has been coded using the Tenth Revision of the International Classification of Diseases. Deaths registered in 1999 were coded to both ICD-9 and ICD-10 as part of a special study to compare the two ICD revisions. The data for deaths registered in 1999 can be found in the respective data set which accompanies this release.
4. In 2015 the average number of days between date of death and death registration was 4 days for C. difficile, MRSA and S. aureus.

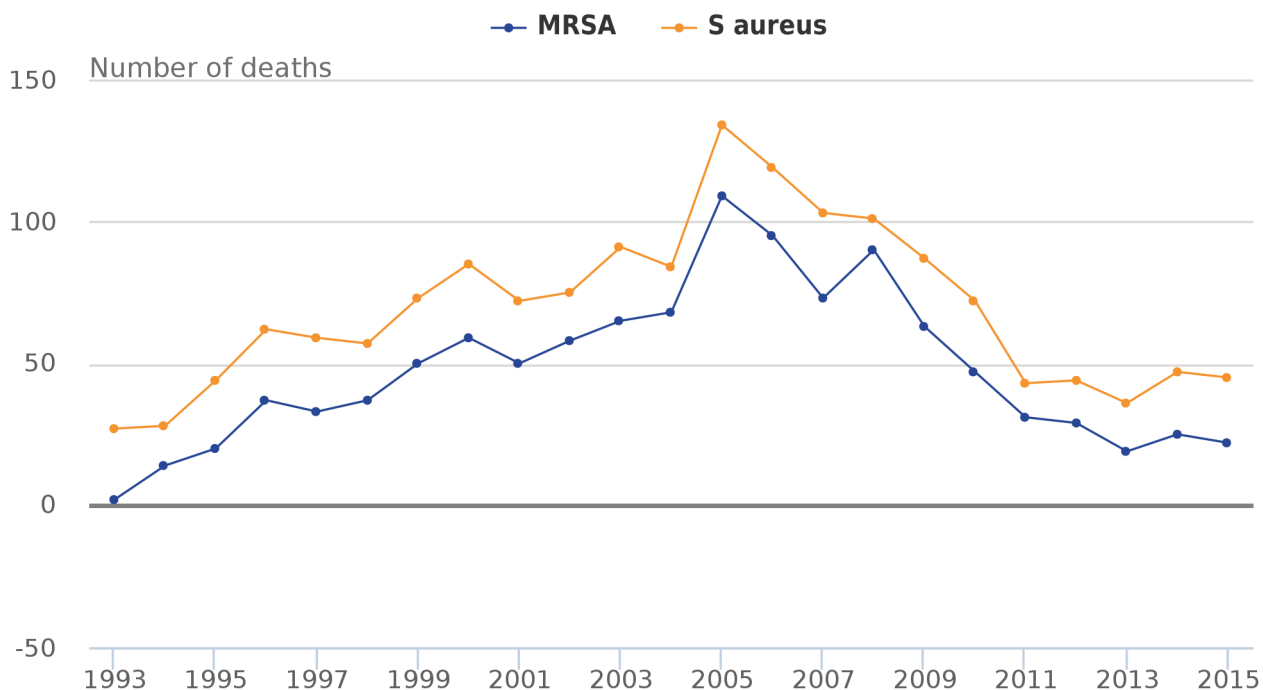
## 5. The proportion of meticillin resistant S. aureus infections drops below 50% for the first time in two decades

In 2015, there were 22 death certificates mentioning MRSA and 45 mentioning S. aureus (including those resistant to meticillin). A roughly equal proportion of deaths involving MRSA and S. aureus occurred in males and females.

The proportion of S. aureus deaths that are reported as meticillin-resistant tend to fluctuate annually. In 2015, approximately 49% of deaths involving S. aureus were identified as being resistant to meticillin. This is the first time the proportion of meticillin resistant S. aureus infections has been below 50% since 1995.

While MRSA and S. aureus infections may contribute to a death, sometimes they directly cause death. Approximately 27% (6 out of 22) of death certificates mentioning MRSA also recorded it as the underlying cause of death, while around 31% (14 out of 45) of those mentioning S. aureus recorded this as the underlying cause of death.

**Figure 2: Number of deaths involving S. aureus and MRSA, all persons, deaths registered in Wales between 1993 and 2015**



Source: Office for National Statistics

**Notes:**

1. Figures are based on postcode boundaries as of May 2016 and exclude deaths of non-residents.
2. Figures are for deaths registered in each calendar year.
3. In 2015 the average number of days between date of death and death registration was 4 days for C. difficile, MRSA and S. aureus.

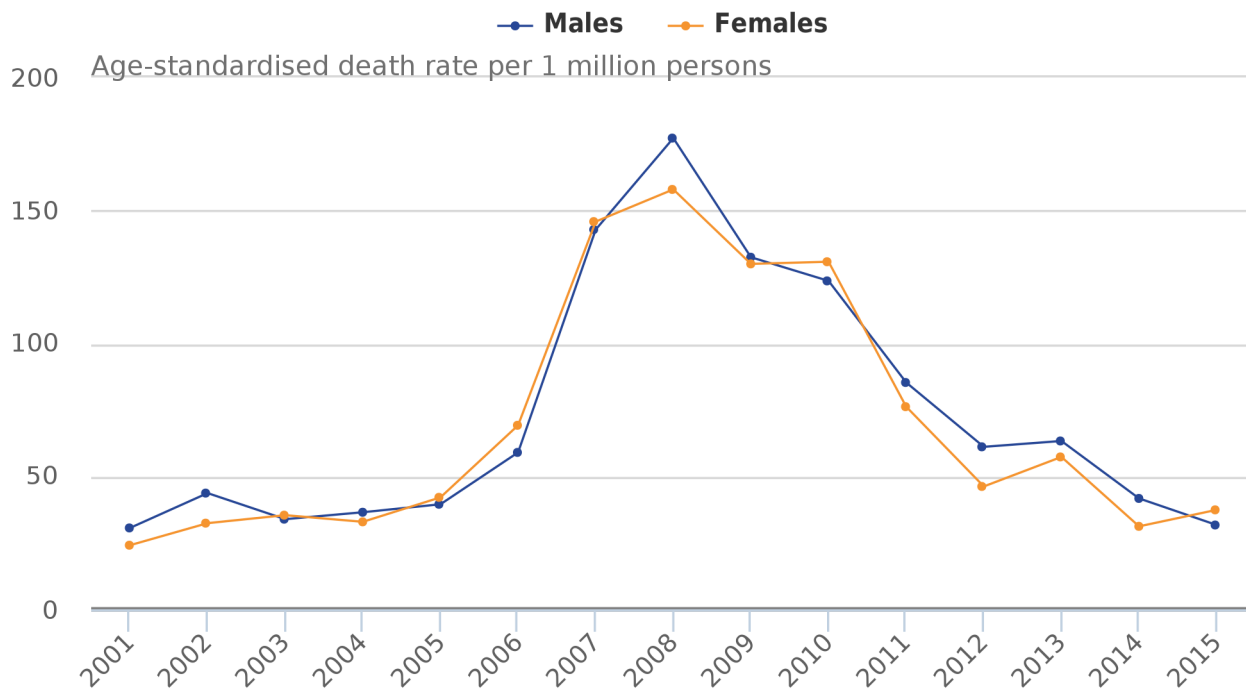
## 6. For two years in a row, the all person rate of death involving C. difficile is statistically similar to the lowest ever recorded rate

Age-standardised rates of deaths involving C. difficile rose sharply to their highest levels in the late-2000s. For all persons, the rate peaked in 2008 with 164.8 deaths per 1 million. Since this time, rates have progressively decreased to 34.3 deaths per 1 million in 2015. Since 2014, the all person rate of deaths involving C. difficile has not been significantly different to the lowest rate recorded in 1999.

For males, in 2015 the rate of death involving C. difficile was 31.7 deaths per 1 million. In recent years, the rate of death amongst males has improved, with the 2015 rate being significantly lower than that observed two years ago in 2013. In 2015, the rate of death involving C. difficile for males is the lowest observed since 2001.

For females, in 2015 the rate of death involving C. difficile was 37.4 deaths per 1 million. This rate is somewhat higher than that observed in 2014, where the rate was 31.2 deaths per 1 million. However, the difference between these two rates is not statistically significant.

**Figure 3: Age-standardised rates of death involving C. difficile, males and females, deaths registered in Wales between 2001 and 2015**



Source: Office for National Statistics

**Notes:**

1. Figures are based on postcode boundaries as of May 2016 and exclude deaths of non-residents.
2. Figures are for deaths registered in each calendar year.
3. Figures are for rates per million population, standardised to the 2013 European Standard Population.
4. Data are only available where cause of death has been coded using the Tenth Revision of the International Classification of Diseases. Deaths registered in 1999 were coded to both ICD-9 and ICD-10 as part of a special study to compare the two ICD revisions. The data for deaths registered in 1999 can be found in the respective data set which accompanies this release.
5. In 2015 the average number of days between date of death and death registration was 4 days for C. difficile, MRSA and S. aureus.
6. Please see the respective dataset for information on statistical significance and the overall reliability of the data reported here.

## 7. Rates of death involving MRSA and S. aureus have fallen since their peak in the mid-2000s

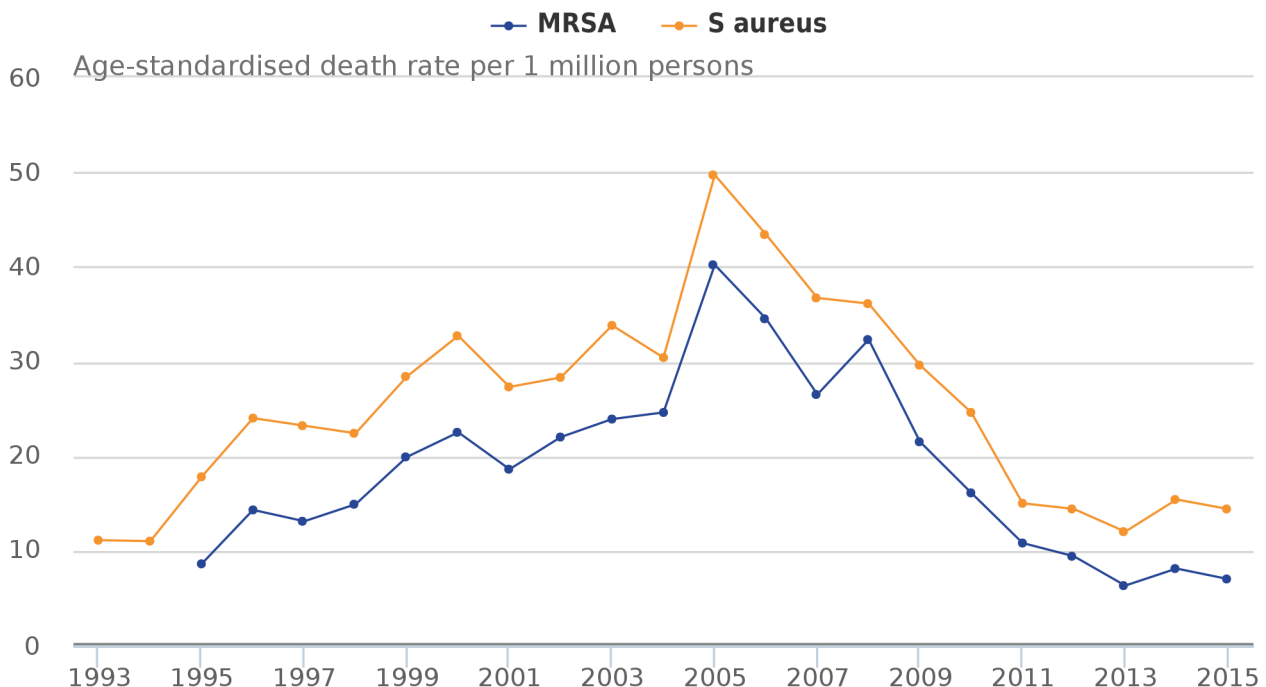
The age-standardised rates presented here are for all persons (males and females combined). This is because the number of deaths in each year since the 2005 peak has fallen to the extent that there are no longer sufficient deaths to calculate robust sex-specific age-standardised rates.

Since the early 1990s, age-standardised rates of deaths involving MRSA and S. aureus rose to their highest levels in the mid-2000s. Rates of death involving MRSA and S. aureus both peaked in 2005 with 40.2 and 49.7 deaths per 1 million persons, respectively.

Rates of death involving MRSA are generally on a downward trend. In 2015, with 7.0 deaths per 1 million persons, the rate of death involving MRSA is significantly lower than its 2005 peak.

Rates of death involving *S. aureus* have fallen significantly since the 2005 peak to 14.4 deaths per 1 million persons in 2015. Since 2011 there has been relatively little change in rates of death involving *S. aureus*.

**Figure 4: Age-standardised rates of death involving *S. aureus* and MRSA, all persons, deaths registered in Wales between 1993 and 2015**



Source: Office for National Statistics

Notes:

1. Figures are based on postcode boundaries as of May 2016 and exclude deaths of non-residents.
2. Figures are for deaths registered in each calendar year.
3. Figures are for rates per million population, standardised to the 2013 European Standard Population.
4. Age-standardised rates were not calculated where there were fewer than 10 deaths in a year due to low reliability. In such cases, the cell has been left blank.
5. In 2015 the average number of days between date of death and death registration was 4 days for *C. difficile*, MRSA and *S. aureus*.
6. Please see the respective dataset for information on statistical significance and the overall reliability of the data reported here.

## 8. Rates of death involving *C. difficile*, MRSA, and *S. aureus* are highest in the elderly

The majority of deaths involving *C. difficile*, MRSA, and *S. aureus* occur in those aged 85 years and over. This highlights the greater vulnerability of older people as they are likely to have relatively weaker immune systems compared with younger people.

## Deaths involving *C. difficile*

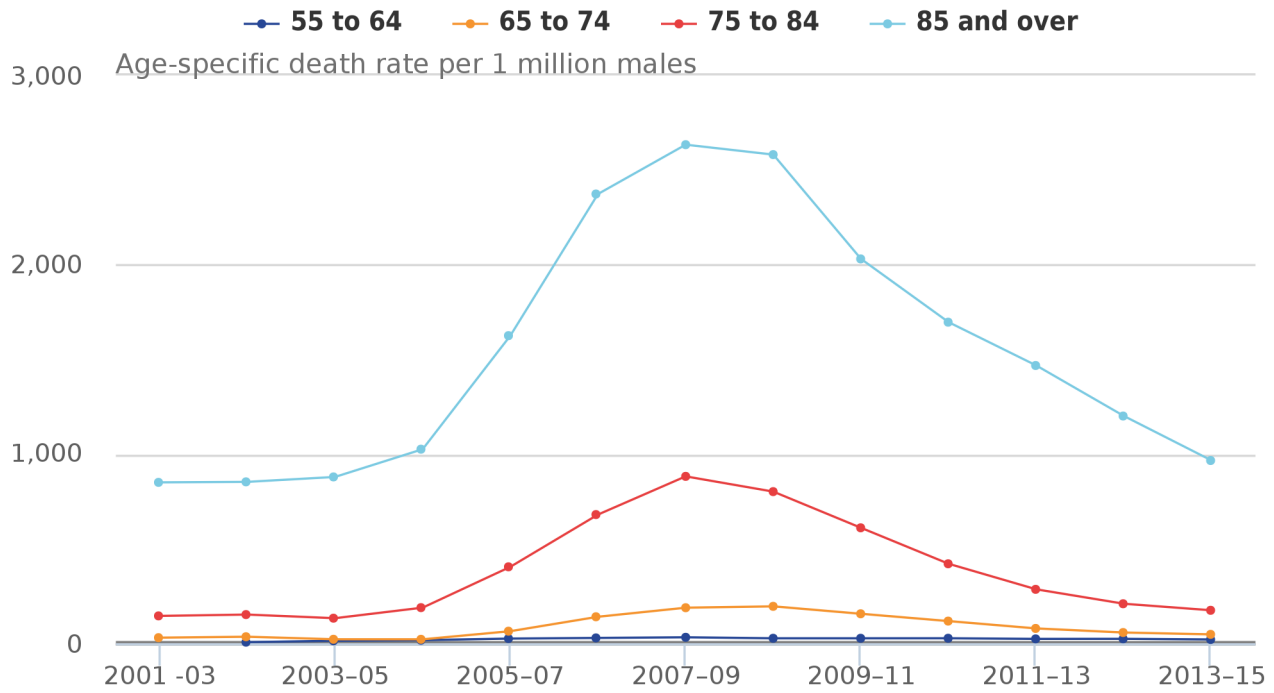
In each period from 2001 to 2003, the age-specific rate for deaths mentioning *C. difficile* increased with age. In the latest period, 2013 to 2015, the age-specific death rate for all persons aged 85 years and over was 845.1 deaths per 1 million. For those aged below 55 years, the rate was just 1.0 death per 1 million persons.

Since the early 2000s, there have not been statistically significant changes in rates for people in age groups below 65 years. For those in age groups 65 years and over, there were statistically significant changes, with rates initially increasing before peaking in the late 2000s and then decreasing. On the whole, this pattern is true for both males and females.

For males, the highest recorded rate was in the period 2007 to 2009 for those aged 85 years and over (2,634.3 per million males). Since this time, the rate in 2013 to 2015 (965.5 deaths per 1 million males aged 85 and over) has dropped to the lowest level observed since 2003 to 2005.



**Figure 5: Age-specific rates of death involving *C. difficile*, males, deaths registered in Wales between 2001 to 2003 and 2013 to 2015**



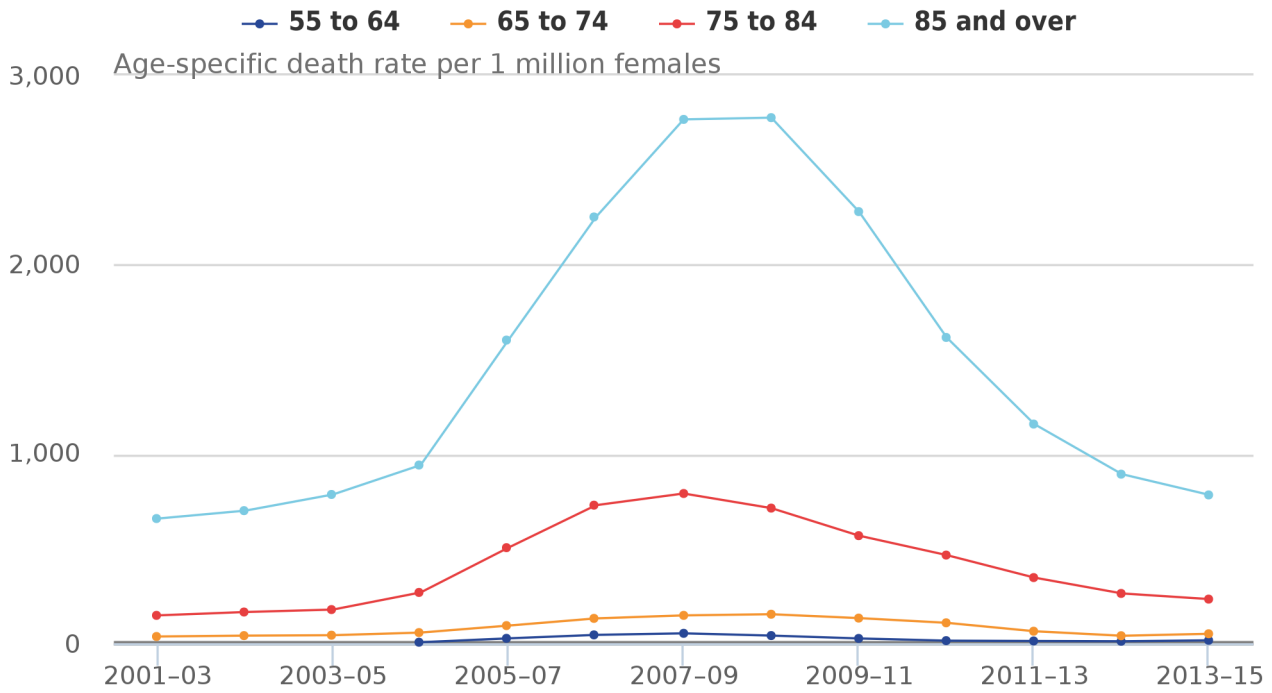
Source: Office for National Statistics

**Notes:**

1. Figures are based on postcode boundaries as of May 2016 and exclude deaths of non-residents.
2. Figures are for deaths registered in each calendar year.
3. Figures are for rates per million males.
4. Age-specific rates were not calculated where there were fewer than 3 deaths in an age group due to low reliability. In such cases, the cell has been left blank.
5. In 2015 the average number of days between date of death and death registration was 4 days for *C. difficile*, MRSA and *S. aureus*.
6. Please see the respective dataset for information on statistical significance and the overall reliability of the data reported here.

For females, the highest recorded rate was in the period 2008 to 2010 for those aged 85 years and over (2,777.1 per million females). Despite a small increase since the previous period, the rate in 2013 to 2015 (783.5 deaths per 1 million females aged 85 and over) is significantly lower than when it peaked.

**Figure 6: Age-specific rates of death involving *C. difficile*, females, deaths registered in Wales between 2001 to 2003 and 2013 to 2015**



Source: Office for National Statistics

**Notes:**

1. Figures are based on postcode boundaries as of May 2016 and exclude deaths of non-residents.
2. Figures are for deaths registered in each calendar year.
3. Figures are for rates per million females.
4. Age-specific rates were not calculated where there were fewer than 3 deaths in an age group due to low reliability. In such cases, the cell has been left blank.
5. In 2015 the average number of days between date of death and death registration was 4 days for *C. difficile*, MRSA and *S. aureus*.
6. Please see the respective dataset for information on statistical significance and the overall reliability of the data reported here.

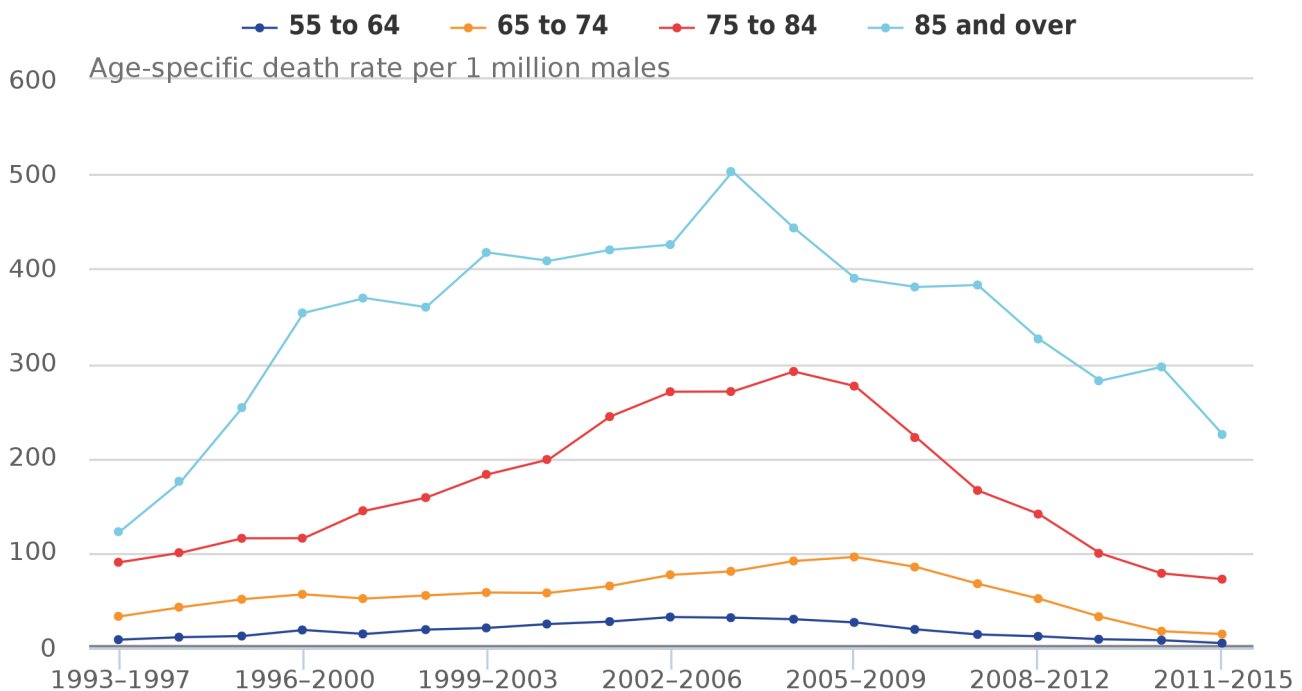
## Deaths involving MRSA and *S. aureus*

Due to the small number of death certificates mentioning MRSA and *S. aureus* in each year, we have pooled data from 5-year periods in order to observe differences between the sexes and age groups.

In each 5-year period from 1993 to 1997, the age-specific rate for deaths mentioning MRSA and *S. aureus* increased with age and tended to be higher for males than females. Across time, and for both sexes, rates were lowest among those under the age of 55 years and highest among those aged 85 years and over. There has been no significant change in the age-specific MRSA death rates for males and females under 55 years and females aged 55 to 64 years over time. In other age groups, rates initially increased before falling to levels similar to those observed in the period 1993 to 1997.

For males, the highest recorded rates were in the period 2003 to 2007 for those aged 85 years and over. In 2011 to 2015, in the same age group, rates for both MRSA and S. aureus have both fallen by more than 50%. Specifically, for deaths involving MRSA there were 224.8 deaths per 1 million males. For S. aureus, there were 317.8 deaths per 1 million males.

**Figure 7: Age-specific rates of death involving MRSA, males, deaths registered in Wales between 1993 to 1997 and 2011 to 2015**



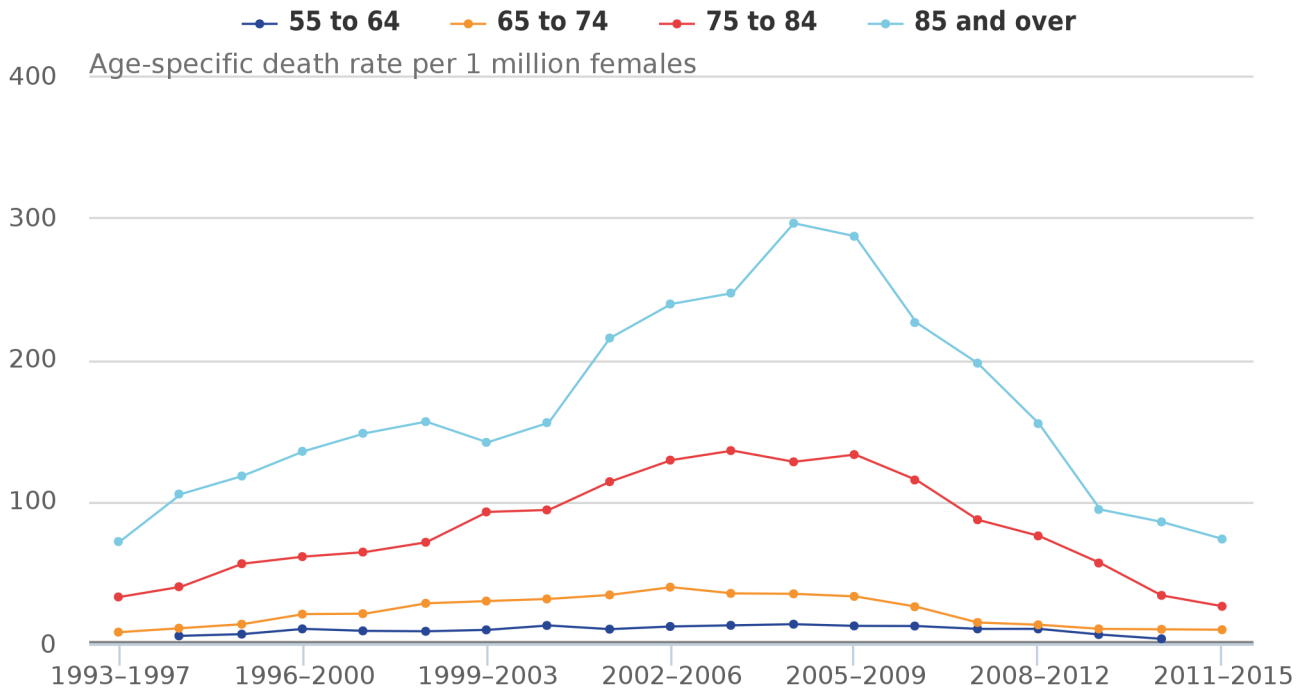
Source: Office for National Statistics

Notes:

1. Figures are based on postcode boundaries as of May 2016 and exclude deaths of non-residents.
2. Figures are for deaths registered in each calendar year.
3. Figures are for rates per million males.
4. In 2015 the average number of days between date of death and death registration was 4 days for C. difficile, MRSA and S. aureus.
5. Please see the respective dataset for information on statistical significance and the overall reliability of the data reported here.

For females, the highest recorded rates were in the period 2004 to 2008 for those aged 85 years and over. In 2011 to 2015, in the same age group, the rate for MRSA has fallen by 75%, whereas for deaths involving S. aureus the reduction is around 60%. Specifically, for deaths involving MRSA there were 73.4 deaths per 1 million females. For S. aureus, there were 139.1 deaths per 1 million females.

**Figure 8: Age-specific rates of death involving MRSA, females, deaths registered in Wales between 1993 to 1997 and 2011 to 2015**



Source: Office for National Statistics

**Notes:**

1. Figures are based on postcode boundaries as of May 2016 and exclude deaths of non-residents.
2. Figures are for deaths registered in each calendar year.
3. Figures are for rates per million females.
4. Age-specific rates were not calculated where there were fewer than 3 deaths in an age group due to low reliability. In such cases, the cell has been left blank.
5. In 2015 the average number of days between date of death and death registration was 4 days for *C. difficile*, MRSA and *S. aureus*.
6. Please see the respective dataset for information on statistical significance and the overall reliability of the data reported here.

## 9. The majority of deaths involving *C. difficile*, MRSA, and *S. aureus* take place in NHS hospitals

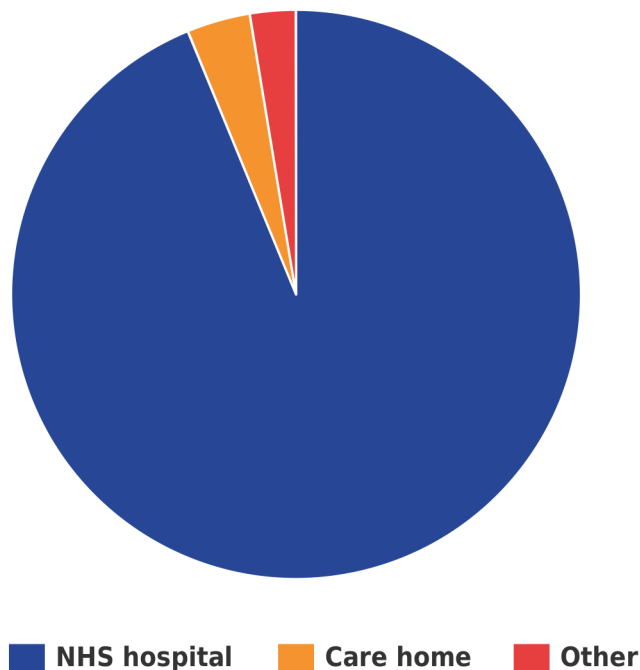
### Deaths involving *C. difficile*

Deaths involving *C. difficile* accounted for 0.4% of all deaths registered in Wales in the period 2013 to 2015.

A breakdown by place of death shows that around 94% of deaths involving *C. difficile* in Wales occurred in NHS hospitals. These deaths represent 0.7% of deaths in NHS hospitals over the period. A similar pattern has been observed in each 3-year period from 2001 to 2003.

Although relatively small in comparison with NHS hospitals, care homes consistently had the second highest proportion of deaths involving *C. difficile* over time.

**Figure 9: Percentage of deaths involving *C. difficile* by place of occurrence, all persons, deaths registered in Wales, 2013 to 2015**



**Notes:**

1. Based on the communal establishment boundaries as of May 2016.
2. Figures exclude deaths of non-residents.
3. Figures are for deaths registered in each calendar year.
4. Percentages rounded to the nearest 1 decimal place.
5. The category 'other' includes deaths occurring in places other than NHS hospitals and care homes.
6. In 2015 the average number of days between date of death and death registration was 4 days for *C. difficile*, MRSA and *S. aureus*.

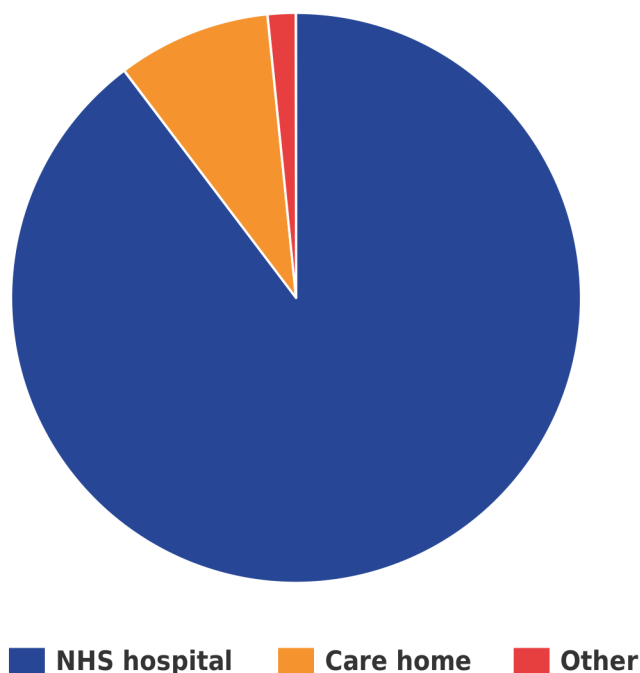
## Deaths involving MRSA and *S. aureus*

Deaths involving *S. aureus* (including MRSA) accounted for 0.2% of all deaths registered in Wales in the period 2011 to 2015.

A breakdown by place of death shows that 93% of deaths involving *S. aureus* and 90% of MRSA deaths in Wales occurred in NHS hospitals. These figures represent 0.2% and 0.1% of all deaths in NHS hospitals over the period. A similar pattern has been observed in each 4-year period from 1993 to 1997 onwards.

Care homes had the second highest number and percentage of all deaths involving *S. aureus* and MRSA.

**Figure 10: Percentage of deaths involving MRSA by place of occurrence, all persons, deaths registered in Wales, 2011 to 2015**



Source: Office for National Statistics

Notes:

1. Based on the communal establishment boundaries as of May 2016.
2. Figures exclude deaths of non-residents.
3. Figures are for deaths registered in each calendar year.
4. Percentages rounded to the nearest 1 decimal place.
5. The category 'other' includes deaths occurring in places other than NHS hospitals and care homes.
6. In 2015 the average number of days between date of death and death registration was 4 days for *C. difficile*, MRSA and *S. aureus*.

## 10. Use of these statistics

Incidence and mortality data for *C. difficile*, MRSA, and *S. aureus* infections in Wales are primarily used by Public Health Wales to highlight the burden of these infections and to monitor and evaluate intervention programs aimed at reducing this burden. These data are also used by local health boards and individual healthcare establishments.

In 2004, the Welsh government published its [strategy for reducing healthcare associated infections](#) in hospitals in Wales. In addition, the Welsh Healthcare Associated Infection Programme (WHAIP; Public Health Wales) conducts comprehensive surveillance of both [C. difficile](#) and [MRSA](#). These surveillance programmes provides Health Boards with information about rates of various infections in their institutions, highlighting potential areas for investigation and action.

## 11. Registration delays

The information used to produce mortality statistics is based on the details collected when deaths are certified and registered. In Wales, deaths should be registered within five days of the death occurring, but there are situations where this isn't possible. Deaths considered unexpected, accidental or suspicious will be referred to a coroner who may order a post-mortem or carry out a full inquest to ascertain the reasons for the death.

Statistics on deaths involving the infections described in this bulletin are presented based on the number of deaths registered in each calendar year, rather than the number of deaths that occurred. This method is used because there is a requirement for consistent and timely data, despite a potential limitation in data quality caused by registration delays.

In 2015, the average (median) number of days between date of death and death registration for deaths where any of the infections in this bulletin were mentioned on the death certificate or selected as the underlying cause was 4 days.

The majority of deaths mentioning *C. difficile* and those identifying it as the underlying cause were registered in 5 days (70% and 68% respectively) while 86% and 80% were registered within 30 days.

The majority of deaths mentioning MRSA and those identifying it as the underlying cause were registered in 5 days (73% and 66% respectively) while 86% and 100% were registered within 30 days.

The majority of deaths mentioning *S. aureus* and those identifying it as the underlying cause were registered in 5 days (80% and 79% respectively) while 89% and 93% were registered within 30 days.

For all of the infections described in this bulletin, practically all deaths which were registered in 2015 occurred during the same year. As such, registration delays are likely to have no impact on the trends reported in this bulletin.

## 12. References

BUPA (2014), [Clostridium difficile infection](#) [accessed 2 August 2016].

Herold B, Immergluck L, Maranan M, Lauderdale D, Gaskin R, Boyle-Vavra S, Leitch C, Daum R (1998) [Community-acquired Methicillin-Resistant Staphylococcus aureus in children with no identified predisposing risk](#). Journal of the American Medical Association, 279(8).pp 593-598.

National Health Service (2016). [Clostridium difficile](#) [accessed 2 August 2016].

Public Health Wales (2016) [Clostridium difficile and Staphylococcus aureus bacteraemia Surveillance Update](#) [accessed 2 August 2016].

Public Health Wales (2011) [Staphylococcus aureus \(MRSA\)](#) [accessed 2 August 2016].

Salmenlinna S, Lyytikäinen O, and Vuopio-Varkila J (2002) [Community-acquired Methicillin-Resistant Staphylococcus aureus, Finland](#). Emerging Infectious Disease Journal [e-journal], 8(6), June.

Welsh government (2004) [Healthcare Associated Infections – A Strategy for Hospitals in Wales](#). [accessed 2 August 2016].

World Health Organisation (1992) International Classification of Diseases and Health Related Problems. World Health Organisation, Geneva.

World Health Organisation (1975) Manual of the International Classification of diseases, injuries, and causes of death. World Health Organisation, Geneva.

## 13. Quality and methodology

Statistics on mortality are derived from the information provided when deaths are certified and registered. Information about the underlying mortality data, including details on how the data is collected and coded are available in the [mortality metadata](#). The [Mortality Statistics](#) and Deaths involving [Clostridium difficile](#) and [MRSA](#) in Wales Quality and Methodology Information documents contain important information on:

- the strengths and limitations of the data
- the quality of the output: including the accuracy of the data and how it compares with related data
- uses and users
- how the output was created

### Data source

The information used in this bulletin is based on the details collected when deaths are certified and registered. All deaths are coded by ONS according to the International Classification of Diseases (ICD) produced by the World Health Organisation (WHO).

Since 1993, ONS has stored the text of death certificates on a database, along with all the ICD coding related to causes identified on the death certificate. The Tenth Revision of ICD (ICD-10) has been used to code deaths in Wales since 2001.

Since 1986, ONS has used the internationally recommended death certificate for neonatal deaths (infants under 28 days old). This certificate was only designed to record all conditions found at death. This means that neonates cannot be assigned an underlying cause of death. However, as the data were based on deaths where *C. difficile*, MRSA, or *S. aureus* were mentioned on the death certificate, neonates have been included. Neonatal deaths were extracted in the same way as described for post-neonatal deaths (see below).

### Approach used in selecting deaths – *C.difficile*

The text on death certificates were used in combination with ICD-10 codes to identify those mentioning *C. difficile*.

In ICD-10 there is a specific code (A04.7) for 'Enterocolitis due to *Clostridium difficile*'. While this code identifies the vast majority of deaths involving *C. difficile*, a small number of *C. difficile*-related deaths are not captured by this code alone.

In addition to extracting all deaths related to the specific A04.7 ICD-10 code, deaths mentioning other codes to which diseases including *C. difficile* could be coded were also extracted. The text of these death certificates was searched manually for mentions of *Clostridium difficile*, *C. difficile* or pseudomembranous colitis. The ICD-10 codes used to select deaths in order to search manually are shown in Box 1 in the accompanying data set.



Deaths registered in 1999 were coded to both ICD-9 and ICD-10 as part of a special study to compare the two ICD revisions.

## Approach used in selecting deaths – MRSA and S. aureus

The text on death certificates were used in combination with ICD-10 codes to identify those mentioning MRSA and S. aureus in a two step process.

A number of infections are specifically related to S. aureus or other staphylococcal species. First, all deaths were extracted where any of these infections was mentioned on the death certificates. These deaths were extracted using the ICD-10 codes given in Box 1 in the accompanying data set. The text of these death certificates was then searched, both electronically and manually, to identify MRSA and S. aureus.

Conversely, some infections have different causative organisms and may be caused by Staphylococcus species or other pathogens. The second step therefore involves extracting all deaths which had these non-specific infections mentioned on the death certificate. The codes used to identify these infections are given in Box 2 in the accompanying data set. The text of these death certificates was then searched manually to identify MRSA and S. aureus.

Deaths with an underlying cause of S. aureus were identified by selecting those deaths with a mention of S. aureus that also had as the underlying cause one of the infections listed in Box 1 or Box 2. The same procedure was followed in order to identify deaths with MRSA as the underlying cause.

## 14. Background notes

1. Figures are for deaths registered in each calendar year while rates are based on mid-year population estimates as the denominator.
2. Statistics on mortality are derived from the information provided when deaths are certified and registered. Information about the underlying mortality data, including details on how the data is collected and coded are available in the [mortality metadata](#). Further information about the methods and quality of these statistics can be found in the Quality and Methodology Information reports for Mortality Statistics and Deaths involving [Clostridium difficile](#) and [MRSA](#) in Wales.
3. Numbers of deaths due to the healthcare associated infections described in this bulletin are difficult to estimate. Trends in mortality are usually monitored using the underlying cause of death (the disease which initiated the train of events leading directly to death). However, healthcare associated infections are often not the underlying cause of death. Those who die from healthcare associated infections are usually patients who were already very ill, and it is their existing illness which is often given as the underlying cause of death. There is interest in the number of deaths where healthcare associated infections contributed to the death – only conditions which contribute directly to the death should be recorded on the death certificate. Results presented in this bulletin identify deaths where the underlying cause was a healthcare associated infection and also where a healthcare associated infection was mentioned as the underlying cause or as a contributory factor in the death.
4. Although C. difficile and MRSA are commonly referred to as healthcare associated infections, it is not possible to state from the information on a death certificate where the infection was acquired, nor can assumptions be made about quality of care. People are often transferred between hospitals, care homes and other establishments, and may acquire infections in a different place from where they died.
5. Revised [guidance on death certification](#), with specific reference to healthcare associated infections, was issued to doctors in July 2010. This was followed by a message from the Chief Medical officer to all doctors reminding them of their responsibilities with respect to death certification and drawing their attention to the guidance ([DH, 2005](#)).
6. There are two types of rates reported in this bulletin; age-specific and age-standardised. Age-specific rates may be calculated for given age groups and are defined as the number of deaths in the age group per million (or thousand) population in the same age group. While these rates can be compared between

times, places, and sub-populations, the tables containing them are usually large and may be difficult to assimilate. In addition, where there are very few deaths these rates will be imprecise and may be difficult to interpret. Age-standardised rates make allowances for differences in the age structure of the population, over time and between sexes. The rates presented here have been age-standardised using the [direct method of standardisation](#). The age-standardised rate for a particular disease is that which would have occurred if the observed age-specific rates for the disease had applied in a given standard population. In this bulletin, the 2013 European Standard Population has been used. This is a hypothetical population standard, which is the same for both males and females, allowing standardised rates to be compared over time and between sexes.

7. Age-specific rates were not calculated where there were fewer than 3 deaths in an age group. Similarly, age-standardised rates were not calculated where there were fewer than 10 deaths in a given period, while those which were calculated from 10 to 19 deaths may have low reliability and are therefore marked by (u). Where a rate has not been calculated due to low counts as described, the cell has been left blank, and marked by (u) to show the rate was not calculated due to low reliability.
8. In this bulletin, a difference which is described as 'statistically significant' has been assessed using confidence intervals. Confidence intervals (CIs) are a measure of the statistical precision of an estimate and show the range of uncertainty around it. Calculations based on small numbers of events are often subject to random fluctuations. Significance is assigned on the basis of non-overlapping CIs. While more formalised and accurate methods of significance testing are available, the non-overlapping CI method is used because it is both simple to calculate and easily understood. As a general rule, if the confidence interval around an estimate overlaps with the interval around another, there is no significant difference between the two estimates.
9. Special extracts and tabulations of deaths involving *C. difficile* and MRSA in Wales are available to order for a charge (subject to legal frameworks, disclosure control, resources and agreement of costs, where appropriate). Such request or enquiries should be made to:  
  
Mortality Analysis Team, Health Analysis and Life Events Division Office for National Statistics Government Buildings Cardiff Road Newport Gwent NP10 8XG Tel: +44 (0)1633 456491 E-mail: [mortality@ons.gsi.gov.uk](mailto:mortality@ons.gsi.gov.uk)
10. The [ONS charging policy](#) is available on our website.
11. We would welcome feedback on the content, format and relevance of this release. Please send feedback to the postal or email address above.
12. Details of the [policy governing the release of new data](#) are available from the [UK Statistics Authority](#).
13. A list of the names of those given pre-publication access to the statistics and written commentary is available in the pre-release access list. The rules and principles which govern pre-release access are featured within the Pre-Release Access to Official Statistics Order 2008.
14. National Statistics are produced to high professional standards set out in the Code of Practice for Official Statistics. They undergo regular quality assurance reviews to ensure that they meet customer needs. They are produced free from any political interference.