Report:

Deaths involving *Clostridium difficile*: England and Wales, 2008

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Key findings

- The number of death certificates in England and Wales mentioning *Clostridium difficile* (*C. difficile*) infection fell by 29 per cent between 2007 and 2008 to 5,931, after increasing every year since records began in 1999
- Age-standardised death rates for deaths involving *C. difficile* decreased by 27 and 30 per cent for males and females respectively between 2007 and 2008, after more than tripling between 2004 and 2007
- Death rates involving *C. difficile* were highest in older age groups. In the 85 and over group, there were 2,331 and 2,303 deaths per million population for males and females respectively. This compares with figures for the under 45 age group of 1 death per million population for both males and females
- Between 2004 and 2008, *C. difficile* was involved in 1 per 1,000 deaths in England and Wales

This report presents the latest figures from the Office for National Statistics (ONS) database of deaths where *Clostridium difficile* (*C. difficile*) was mentioned as a contributory factor. It includes provisional figures for 2008 (based on provisional deaths registrations for 2008) and updated rates for 2007 (based on mid-year population estimates for 2007). Figures for 2004 to 2007 are provided for comparison purposes. Provisional mortality rates for 2008 have been calculated using the population projections for 2008,¹ as population estimates are not yet available. Final figures and rates will be provided in the next annual report.

Changes in this report

Reports on deaths involving *C. difficile* which were published in 2008 included breakdowns by individual communal establishment.^{2,3} Following feedback from users of the statistics, and comparison with other sources of data, it became apparent that the quality of the available data on place of death is not sufficient for figures at this detailed level to be routinely published as National Statistics (Background note 6). Consequently, alternative methods for the production of local-level figures on deaths involving *C. difficile* are being investigated, and comparable figures for 2004–08 are not included in this report.

Results

Number of deaths where *Clostridium difficile* contributed to the death or was the underlying cause of death

The number of death certificates mentioning *C. difficile* increased each year in England and Wales between 2004 and 2007 from 2,238 to 8,324 (Table 1 and Figure 1). However, in 2008 mentions of *C. difficile* on death certificates fell by 29 per cent, to 5,931. Among deaths with a mention of *C. difficile*, the percentage for which it was the underlying cause was similar (around 55 per cent) in each year until 2007, when it decreased to 49 per cent. This percentage decreased further in 2008 to 42 per cent.

Mortality rates for all deaths mentioning *Clostridium difficile*

Sex

Age-standardised rates for deaths involving *C. difficile* increased by 2.6 times among males, and by 2.4 times among females between 2004 and 2008. Rates increased from 24 to 62 per million population among males, and from 23 to 56 per million population among females (Table 2). However, in the latter part of this period, between 2007 and 2008, rates decreased for the first time, by 27 and 30 per cent respectively for males and females.

Table 1

Number of death certificates with *Clostridium difficile* mentioned and as the underlying cause, 2004–08¹

	2004	2005	2006	2007	2008
England and Wales²					
Certificates mentioning <i>C. difficile</i>	2,238	3,757	6,480	8,324	5,931
Certificates where <i>C. difficile</i> was the underlying cause of death	1,229	2,063	3,490	4,056	2,502
Percentage of mentions selected as underlying cause	55	55	54	49	42
England					
Certificates mentioning <i>C. difficile</i>	2,146	3,648	6,301	7,916	5,465
Certificates where <i>C. difficile</i> was the underlying cause of death	1,172	1,998	3,393	3,875	2,298
Percentage of mentions selected as underlying cause	55	55	54	49	42
Wales					
Certificates mentioning <i>C. difficile</i>	88	104	170	399	461
Certificates where <i>C. difficile</i> was the underlying cause of death	54	61	93	177	203
Percentage of mentions selected as underlying cause	61	59	55	44	44

1 Figures for deaths registered in 2008 are provisional.

2 England and Wales data include non-residents who died in England and Wales. Data for England and Wales separately exclude deaths of non-residents.

Table 2

Age-standardised mortality rates for *Clostridium difficile* by sex, 2004–08¹

	Rate per million population				
	2004	2005	2006	2007	2008 ¹
England and Wales²					
Males	23.7	37.0	65.5	84.7	61.9
Females	23.1	38.6	64.2	80.4	56.1
England					
Males	24.1	38.3	68.0	86.0	60.5
Females	23.5	39.8	66.2	81.0	54.8
Wales					
Males	16.2	16.2	23.3	63.2	80.8
Females	15.7	19.8	31.7	68.8	75.1

1 Mortality rates for 2008 have been calculated using provisional death registrations figures for 2008 and population projections for 2008 as estimates are not yet available. These rates are therefore provisional.

2 England and Wales data include non-residents who died in England and Wales. Data for England and Wales separately exclude deaths of non-residents.

Overall, mortality rates for deaths involving *C. difficile*, for males and females, were very similar in each year, with the biggest difference in rates being in 2008 (Figure 2).

Figure 2

Age-standardised mortality rates for *Clostridium difficile* by sex, 2004–08¹

1 Mortality rates for 2008 have been calculated using provisional death registrations figures for 2008 and population projections for 2008 as estimates are not yet available. These rates are therefore provisional.

Table 3

Age-specific mortality rates for *Clostridium difficile* by sex, 2004–08¹

Age group	Rates per million population					
	England and Wales ²		England		Wales	
	Males	Females	Males	Females	Males	Females
Under 45	0.5	0.7	0.5	0.7	0.2	0.7
45–54	6.5	6.5	6.4	6.3	6.3	8.1
55–64	27.9	24.0	27.9	23.8	24.4	27.8
65–74	132.4	121.8	134.9	122.8	91.5	100.3
75–84	660.3	642.4	671.5	650.7	479.5	504.0
85 and over	2,331.4	2,302.6	2,365.6	2,340.7	1,746.7	1,676.4

1 Mortality rates for 2008 have been calculated using provisional death registrations figures for 2008 and population projections for 2008 as estimates are not yet available. These rates are therefore provisional.

2 England and Wales data include non-residents who died in England and Wales. Data for England and Wales separately exclude deaths of non-residents.

Age

Most of the deaths involving *C. difficile* occur among older people. Mortality rates in specific age groups for England and Wales are shown in Table 3. In the 85 and over age group, there were 2,331 and 2,303 deaths per million population, for males and females respectively, in the period 2004 to 2008. This compares with 1 death per million population, for both males and females in the under 45 age group.

Place of death

Death certificates rarely specify the place where an infection was acquired. However, the place of death is recorded. Between 2004 and 2008, deaths involving *C. difficile* accounted for 1 per cent of all deaths in England and Wales (Table 4). Among deaths that occurred in NHS hospitals and NHS nursing homes, deaths involving *C. difficile* accounted for under 2 per cent of all deaths.

The majority of deaths occur in hospital (56 per cent of all deaths between 2004 and 2008 occurred in NHS hospitals). We would therefore expect the majority of *C. difficile* deaths to also occur in hospital. Many of these deaths in hospital will have been to patients who were admitted because they were already seriously ill with another condition. In England and Wales over the period 2004–08, 91 per cent of deaths that mentioned *C. difficile* occurred in NHS hospitals.

Table 4

Number of deaths mentioning *Clostridium difficile* by place of death, compared to all causes of death, 2004–08¹

	All cause number of deaths	Number of <i>C. difficile</i> deaths	Percentage of all <i>C. difficile</i> deaths	<i>C. difficile</i> as a percentage of all deaths in the establishment
England and Wales²				
Own home	483,226	273	1.0	0.06
NHS hospital	1,423,228	24,420	91.4	1.72
Non-NHS hospital	11,099	34	0.1	0.31
Hospice	121,799	146	0.5	0.12
NHS nursing home	11,950	188	0.7	1.57
Non-NHS nursing home	226,462	700	2.6	0.31
Private residential home	136,882	348	1.3	0.25
Local Authority residential home	32,901	81	0.3	0.25
Other places	95,437	540	2.0	0.57
Total	2,542,984	26,730	100.0	1.05
England				
Own home	451,697	259	1.0	0.06
NHS hospital	1,323,584	23,257	91.3	1.76
Non-NHS hospital	10,337	32	0.1	0.31
Hospice	117,398	145	0.6	0.12
NHS nursing home	11,843	187	0.7	1.58
Non-NHS nursing home	213,990	683	2.7	0.32
Private residential home	130,966	339	1.3	0.26
Local Authority residential home	31,221	80	0.3	0.26
Other places	86,168	494	1.9	0.57
Total	2,377,204	25,476	100.0	1.07
Wales				
Own home	31,438	14	1.1	0.04
NHS hospital	95,960	1,135	92.9	1.18
Non-NHS hospital	261	–	–	–
Hospice	4,249	1	0.1	0.02
NHS nursing home	103	1	0.1	0.97
Non-NHS nursing home	12,274	17	1.4	0.14
Private residential home	5,870	9	0.7	0.15
Local Authority residential home	1,677	1	0.1	0.06
Other places	7,944	44	3.6	0.55
Total	159,776	1,222	100.0	0.76

1 Figures for deaths registered in 2008 are provisional.

2 England and Wales data include non-residents who died in England and Wales. Data for England and Wales separately exclude deaths of non-residents.

Methods

Identification of deaths involving *Clostridium difficile*

All deaths are coded by the Office for National Statistics (ONS) according to the International Classification of Diseases (ICD) supplied by the World Health Organisation. In the Tenth Revision (ICD–10), used by ONS from 2001 onwards, 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. Since 1993 ONS has stored the text of death certificates on a database, in addition to all the ICD codes relating to causes identified on the death certificate. This means that it is possible to identify records where *C. difficile* is mentioned, but is not coded under the specific ICD–10 code.

In addition to extracting all deaths related to the specific A04.7 ICD–10 code, deaths mentioning a number of other ICD categories to which

diseases including *C. difficile* could be coded were also extracted. The text of these death certificates was then searched manually for mentions of *Clostridium difficile*, *C. difficile* or pseudomembranous colitis. The ICD–10 codes used to select deaths from 2001 onwards in order to search manually are shown in Box One.

Box one

Specific and non-specific ICD–10 codes related to *Clostridium difficile*

Specific codes ¹	Non-specific codes ¹
A04.7 (Enterocolitis due to <i>Clostridium difficile</i>)	A05.8 (Other specified bacterial food borne intoxications)
	A41.4 (Septicaemia due to anaerobes, excludes gas gangrene)
	A48.0 (Gas gangrene: Clostridial; cellulites, myonecrosis)
	A49.8 (Other bacterial infections of unspecified site)
	P36.5 (Sepsis of newborn due to anaerobes)

1 Codes used to identify deaths where *C. difficile* was the underlying cause of death (on deaths where *C. difficile* was mentioned): A04.7, A41.4, and A49.8.

Background notes

1. Since 1986 ONS has used the internationally recommended death certificate for neonatal deaths. This means that these deaths cannot be assigned an underlying cause of death.⁶ However, as the data for this report were based on all mentions of *C. difficile* or pseudomembranous colitis, neonates have been included. Neonatal deaths were extracted in the same way as described above for postneonatal deaths.
2. *C. difficile* was first described in the 1930s,⁷ but it was not identified as the cause of pseudomembranous colitis following antibiotic therapy until the late 1970s.^{8,9,10,11} Patients who have been treated with broad spectrum antibiotics (those affecting a wide range of bacteria, including intestinal bacteria) are at the greatest risk of *C. difficile* associated disease. In addition to antibiotic exposure, the risk of contracting *C. difficile* is also higher for elderly patients, those who have recently had gastrointestinal surgery, those who have a long length of stay in healthcare settings, and those who have a serious underlying illness or a condition that compromises their immune system.^{12,13} Patients are also at risk of developing *C. difficile* disease when there are outbreaks in hospitals. Poor infection control is also an important risk factor.
3. A 2003 Department of Health report addressed actions that should be taken to reduce levels of healthcare associated infections.¹⁴ A report on *C. difficile* and actions to reduce the chances of outbreaks was released by the Health Protection Agency (HPA) in February 2003.¹⁵ In January 2004, the HPA began to carry out a mandatory reporting scheme for all cases of *C. difficile* in people aged 65 years and over. In April 2007, the scheme was expanded to all patients aged two years and over.¹⁶ Results from the surveillance scheme are published annually, on the HPA website.¹⁷ Updated guidance on death certification, with specific reference to healthcare associated infections, was issued to doctors in May 2005.¹⁸ 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.¹⁹

4. The number of deaths due to *C. difficile* is difficult to estimate. Trends in mortality are normally monitored using the underlying cause of death (the disease which initiated the train of events leading directly to death). *C. difficile* and other infections that are often hospital-acquired, such as MRSA, are often not the underlying cause of death. Those who die with *C. difficile* are usually patients who were already very ill and it may be their existing illness, rather than *C. difficile*, which is designated as the underlying cause of death. There is therefore an interest in the number of deaths where *C. difficile* contributed to the death – only conditions which contribute directly to the death should be recorded on the medical certificate of cause of death (death certificate). Results presented in this report identify deaths where the underlying cause was *C. difficile* and those where it was mentioned on the death certificate as a contributory factor.
5. Provisional figures for 2008 death registrations were published on 21 May 2009. Deaths involving *C. difficile* for 2008 have therefore been marked as provisional to allow further quality assurance before the release of final figures in the next annual report. The quality of the provisional figures is comparable with final death registration figures released in previous years.
6. Investigation into relevant data quality issues has revealed that the quality of the available data on place of death is not sufficient for figures, at this detailed level to be routinely published as National Statistics. The place where a death occurred is recorded in death registration and cannot always be reliably translated into a specific, known healthcare organisation or site. The registrar of births and deaths is required by law to record the name and address of the place where the death occurred, and this information is provided by a qualified informant (usually a relative of the deceased). If a death is referred to the coroner and an inquest takes place, the place of death comes directly from the coroner via 'Form 99'. In practice, the information provided by informants is of variable quality. There is no way for the registrar to know, and nowhere in the current registration system for registrars to record, the NHS or other organisation that was responsible for the patient's care. For example, different parts of one hospital site may report to different NHS Trusts. There is also no direct relationship between the textual information recorded by the registrar and any recognised list or classification of healthcare units and sites, such as the NHS Organisation Codes.

Glossary

- a. ***Clostridium difficile* (*C. difficile*):** is a spore forming bacterium which is present as one of the 'normal' bacteria in the gut of up to 3 per cent⁴ of healthy adults. It is much more common in babies – up to two thirds of infants may have *C. difficile* in the gut, where it rarely causes problems. *C. difficile* can cause diarrhoea, ranging from a mild disturbance to very severe illness with ulceration and bleeding from the colon (colitis), and perforation of the intestine leading to peritonitis, which can be fatal.⁵ *C. difficile* disease occurs when normal, healthy intestinal bacteria are subdued by the use of antibiotics. This allows *C. difficile* to flourish in the gut and produce a toxin that causes diarrhoea. People over the age of 65 years are more susceptible to contracting infection.
- b. **Diarrhoea:** this occurs when the lining of the small or large intestine is irritated. *C. difficile* toxins are a major cause of antibiotic-associated diarrhoea. This leads to increased water being passed in the stools. Acute diarrhoea is usually caused by a viral infection or a bacterial infection and affects almost everyone from time to time. It usually clears up in a couple of days and is not serious. However, it can be serious in babies and the frail and elderly, because of the risk of dehydration.

- c. **Pseudomembranous colitis (PMC):** is a complication of antibiotic therapy often caused by *C. difficile* infection. PMC causes severe inflammation in areas of the colon (large intestine). Almost any antibiotic can cause PMC by upsetting the balance of the bacteria in the gut and intestines.
- d. **Age-standardised rate:** directly age-standardised rates make allowances for differences in the age structure of the population, over time and between sexes. 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 report we have used the European standard population. 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 males and females.

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