

Candidaemia and polymicrobial bacteraemias: England, Wales, and Northern Ireland, 2002

Key points:

- There were 1148 reports of *Candida* spp isolated from blood specimens in England, Wales, and Northern Ireland in 2002. These were reported to CDSC through the voluntary laboratory reporting system.
- *Candida albicans* was the most common species, accounting for more than 50% of all candidaemia reports.
- In 2002, 4365 patient episodes of laboratory diagnosed polymicrobial bacteraemias were reported to CDSC.
- Polymicrobial bacteraemias accounted for 12.6% of all bacteraemia episodes reported to CDSC in England, Wales, and Northern Ireland.

This article covers laboratory reports of *Candida* spp isolated from blood culture specimens, and polymicrobial bacteraemias (with or without cerebrospinal fluid). Rates were calculated using 2001 resident population denominators for England, Wales, and Northern Ireland. Regional analyses were made with reference to the English regional boundaries introduced in April 2002.

Candidaemia

There were 1148 reports of *Candida* spp isolated from blood specimens in England, Wales, and Northern Ireland in 2002 (table 1). The most commonly reported species was *Candida albicans* with 588 reports, comprising 51% of the total. This was followed by *C glabrata*, which accounted for 17% of reports, and *C parapsilosis*, with 11% of reports. Eleven per cent of isolates (131) were not identified further than the genus.

The greatest number of reports of candidaemia were received from London (173 reports, 15% of the total) followed by 147 reports from the South East (13% of the total, table 2). The least reports were received from Yorkshire and Humberside (69 reports) and the North East (68). The region-specific rates of candidaemia (figure 1) were highest in Northern Ireland at 4.50

reports per 100,000 population, followed by the North East at 2.70/100,000. Rates of candidaemia reports were lowest in the East Midlands (1.68/100,000) and Yorkshire and Humberside (1.39/100,000) regions.

Age-specific rates of candidaemia were highest in males aged under one year (10.90/100,000); followed by males aged over 75 years (9.72/100,000) and males aged between 65 and 74 years (7.27/100,000). Rates were higher in females than males in the 1 to 4, 10 to 14, and 15 to 44 age groups (figure 2).

Polymicrobial bacteraemia

Details of all bacteraemia and fungaemia reports from England, Wales, and Northern Ireland in 2002 (71,914 in total) were extracted from LabBase2. Multiple organism isolates from blood culture specimens are not linked on CoSurv/LabBase2, so polymicrobial bacteraemias (including bacteraemia/ candidaemia combinations) were established by identifying records that matched on specimen date, laboratory, date of birth, sex, and soundex*.

*A non-unique alphanumeric coding of the patients surname, which when combined with date of birth and sex allows duplicate reports of the same individual to be identified without the use of patient names.

Table 1 Laboratory reports of candidaemia, England, Wales, and Northern Ireland: 2002

	Number of reports	%
<i>Candida albicans</i>	588	51.2
<i>Candida famata</i>	5	0.4
<i>Candida glabrata</i>	199	17.3
<i>Candida guilliermondii</i>	13	1.13
<i>Candida kefyr</i>	4	0.4
<i>Candida krusei</i>	14	1.2
<i>Candida lusitanae</i>	16	1.4
<i>Candida parapsilosis</i>	130	11.3
<i>Candida tropicalis</i>	37	3.2
<i>Candida</i> spp (not further identified)	131	11.4
<i>Candida</i> spp (other named)	11	1.0
Total	1148	100

Table 2 Laboratory reports of candidaemia by region, England, Wales, and Northern Ireland: 2002

	Number of reports	%
North East	68	5.9
Yorkshire & Humberside	69	6.0
East Midlands	70	6.2
Eastern	108	9.4
London	173	15.1
South East	147	12.8
South West	111	9.7
West Midlands	121	10.5
North West	135	11.8
England	1002	87.3
Wales	70	6.1
Northern Ireland	76	6.6
England, Wales, and Northern Ireland	1148	100

Figure 1 Region-specific rates* of candidaemia with 95% confidence intervals, England, Wales, and Northern Ireland: 2002

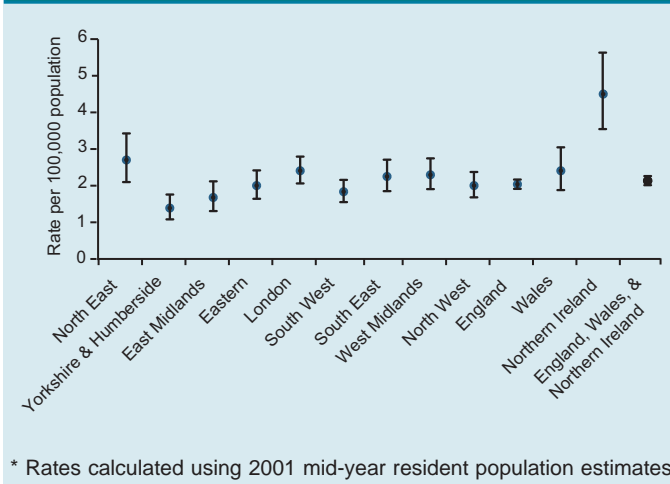
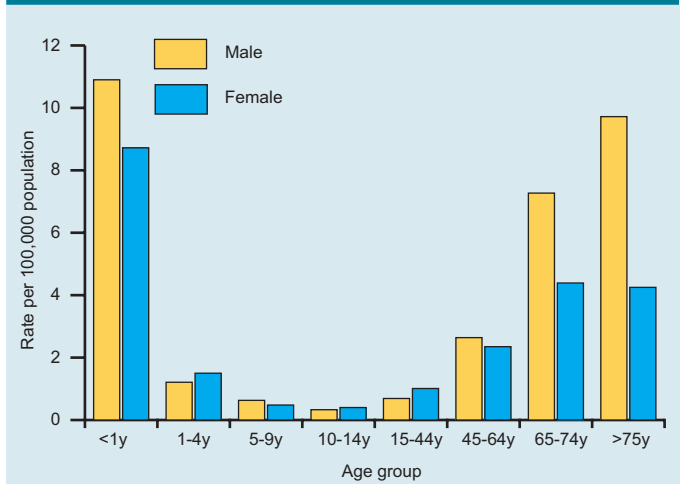


Figure 2 Age-specific rates of candidaemia per 100,000 population, England, Wales, and Northern Ireland: 2002



Out of 71,914 records, 9038 were identified as matching at least one other report on all these identifiers. These were analysed further to identify the number of patient episodes of polymicrobial bacteraemias. A total of 4365 patient episodes were identified. The other 62,876 reports were assumed to be monomicrobial bacteraemias.

For England, Wales, and Northern Ireland, 12.6% of bacteraemia episodes were polymicrobial (table 3). There was considerable variation in the rates of polymicrobial bacteraemias reported. The North East region had the highest polymicrobial bacteraemia rate by regional population at 13.43 per 100,000 population (figure 3), while the lowest rate was found in the South East, at 5.35/100,000. The overall rate for England, Wales, and Northern Ireland was 8.17/100,000.

The maximum number of organisms resulting in polymicrobial bacteraemia or fungaemias reported was five. This, however, accounted for less than one per cent (5 reports) of such episodes (figure 4). Four organisms were involved in 1.2% (53 reports) of

polymicrobial patient episodes, and three organisms (440 reports) were involved in 10.1% of episodes. Eighty-nine per cent of polymicrobial bacteraemia or fungaemia episodes (3867 reports) involved only two microorganisms.

One hundred and four different genera were named in bacteraemia/fungaemia reports (table 3) and consequently, many organism combinations were identified in polymicrobial infections. Rather than attempting to describe all these combinations, table 3 enables comparison of all genera across both presumptive monomicrobial and polymicrobial bacteraemias. *Staphylococcus* spp were the most common genera in both monomicrobial and polymicrobial reports. Although *S. aureus* was less prevalent among the polymicrobial bacteraemias (accounting for 11.3% of polymicrobial reports, compared to 20.6% of monomicrobial reports), coagulase-negative staphylococci were more common in polymicrobial reports (8.3%) than monomicrobial reports (8.1%).

Figure 3 Polymicrobial bacteraemia rates* per 100,000 population (95% confidence intervals), England, Wales, and Northern Ireland: 2002

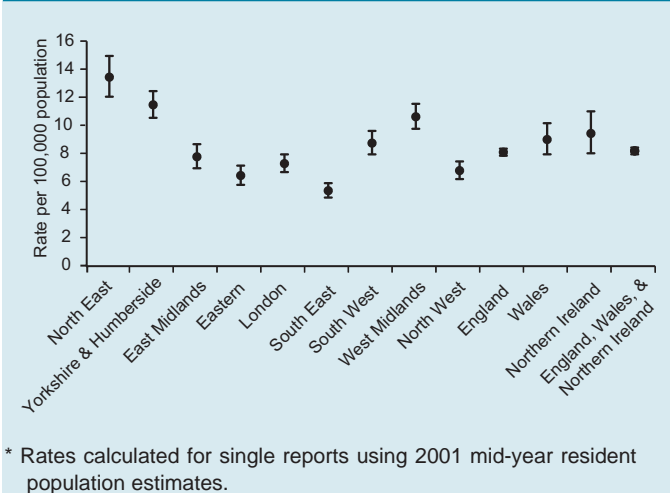


Figure 4 Number of organisms involved in polymicrobial bacteraemia episodes. England, Wales, and Northern Ireland: 2002

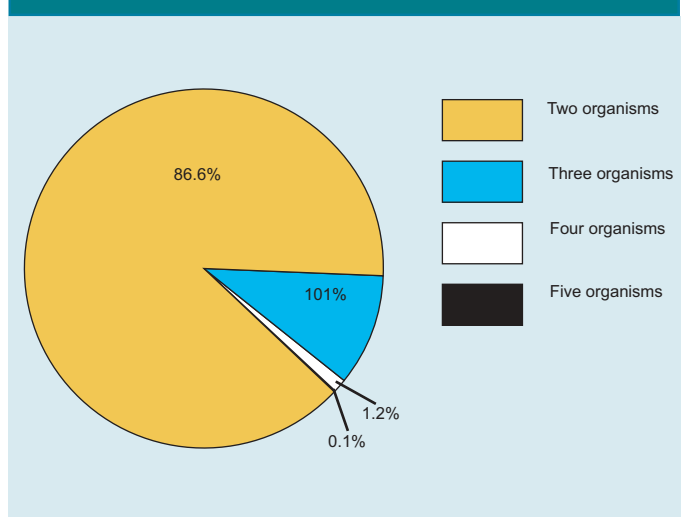


Table 3 Organisms reported in mono and polymicrobial bacteraemia and fungaemia reports, England, Wales, and Northern Ireland: 2002

Genus	Monomicrobial bacteraemias			Polymicrobial bacteraemias			Genus	Monomicrobial bacteraemias			Polymicrobial bacteraemias		
	Number of reports	(%)	Rank	Number of reports	(%)	Rank		Number of reports	(%)	Rank	Number of reports	(%)	Rank
<i>Abiotrophia</i>	10	0.02	64	1	0.01	59	<i>Kluyvera</i>	14	0.02	58	8	0.09	38
<i>Achromobacter</i>	4	0.01	78	1	0.01	59	<i>Lactobacillus</i>	16	0.03	56	14	0.15	29
<i>Acinetobacter</i>	828	1.32	12	193	2.14	11	<i>Lactococcus</i>	21	0.03	50	6	0.07	45
<i>Actinobacillus</i>	5	0.01	74	–	–	–	<i>Leclercia</i>	1	–	96	–	–	–
<i>Actinomyces</i>	5	0.01	74	1	0.01	59	<i>Legionella</i>	3	–	82	–	–	–
<i>Acremonium</i>	3	0.00	82	–	–	–	<i>Leptospira</i>	13	0.02	60	–	–	–
<i>Aerococcus</i>	56	0.09	34	19	0.21	24	<i>Leptotrichia</i>	3	–	82	–	–	–
<i>Aeromonas</i>	58	0.09	33	18	0.20	27	<i>Leuconostoc</i>	10	0.02	64	5	0.06	47
<i>Agrobacterium</i>	56	0.09	34	10	0.11	34	<i>Listeria</i>	89	0.14	28	7	0.08	41
<i>Alcaligenes</i>	72	0.11	31	17	0.19	28	<i>Malassezi</i>	3	–	82	–	–	–
<i>Arcanobacterium</i>	3	–	82	2	0.02	54	<i>Micrococcus</i>	106	0.17	25	11	0.12	31
<i>Aspergillus</i>	17	0.03	54	–	–	–	<i>Moraxella</i>	97	0.15	27	12	0.13	30
<i>Bacillus</i>	128	0.20	24	24	0.27	22	<i>Morganella</i>	258	0.41	21	104	1.15	18
<i>Bacteroides</i>	806	1.28	13	139	1.54	13	<i>Mycobacterium</i>	56	0.09	34	3	0.03	50
<i>Bartonella</i>	30	0.05	46	–	–	–	<i>Neisseria</i>	41	0.07	40	10	0.11	34
<i>Bifidobacterium</i>	2	–	90	–	–	–	<i>Nocardia</i>	1	0.00	96	1	0.01	59
<i>Bordetella</i>	15	0.02	57	1	0.01	59	<i>Ochrobactrum</i>	44	0.07	39	8	0.09	38
<i>Borrelia</i>	39	0.06	41	–	–	73	<i>Oligella</i>	2	–	90	–	–	–
<i>Branhamella</i>	1	–	96	1	0.01	59	<i>Pantoea</i>	75	0.12	30	19	0.21	24
<i>Brevibacterium</i>	7	0.01	68	3	0.03	50	<i>Pasteurella</i>	52	0.08	38	4	0.04	48
<i>Brevundimonas</i>	18	0.03	53	–	–	–	<i>Pediococcus</i>	2	–	90	–	–	–
<i>Brucella</i>	26	0.04	48	–	–	–	<i>Peptococcus</i>	12	0.02	63	2	0.02	54
<i>Burkholderia</i>	38	0.06	43	6	0.07	45	<i>Peptostreptococcus</i>	101	0.16	26	19	0.21	24
<i>Campylobacter</i>	89	0.14	28	7	0.08	41	<i>Porphyromonas</i>	1	–	96	–	–	–
<i>Candida</i>	1030	1.64	11	143	1.58	12	<i>Prevotella</i>	39	0.06	41	8	0.09	38
<i>Capnocytophaga</i>	5	0.01	74	–	–	–	<i>Propionibacterium</i>	140	0.22	23	23	0.25	23
<i>Cardiobacterium</i>	2	–	90	–	–	–	<i>Proteus</i>	1475	2.35	10	333	3.68	10
<i>Chromobacterium</i>	6	0.01	69	–	–	–	<i>Providencia</i>	56	0.09	34	25	0.28	21
<i>Chryseobacterium</i>	19	0.03	52	9	0.10	36	<i>Pseudomonas</i>	2177	3.46	8	409	4.53	8
<i>Citrobacter</i>	408	0.65	17	105	1.16	17	<i>Rahnella</i>	6	0.01	69	1	0.01	59
<i>Clostridium</i>	393	0.63	19	125	1.38	14	<i>Ralstonia</i>	9	0.01	67	–	–	–
<i>Comamonas</i>	60	0.10	32	9	0.10	36	<i>Rhodococcus</i>	6	0.01	69	2	0.02	54
<i>Corynebacterium</i>	347	0.55	20	88	0.97	19	<i>Rhodotorula</i>	6	0.01	69	–	–	–
<i>Cryptococcus</i>	26	0.04	48	–	–	–	<i>Saccharomyces</i>	6	0.01	69	2	0.02	54
<i>Dermabacter</i>	1	–	96	1	0.01	59	<i>Salmonella</i>	397	0.63	18	3	0.03	50
<i>Edwardsiella</i>	1	–	96	–	–	–	<i>Serratia</i>	689	1.10	14	120	1.33	15
<i>Eikenella</i>	5	0.01	74	–	–	–	<i>Shewanella</i>	2	–	90	1	0.01	59
<i>Empedobacter</i>	–	–	–	–	0.01	59	<i>Shigella</i>	1	–	96	–	–	–
<i>Enterobacter</i>	1647	2.62	9	391	4.33	9	<i>Sphingobacterium</i>	4	0.01	78	–	–	–
<i>Enterococcus</i>	3439	5.47	6	1325	14.66	2	<i>Sphingomonas</i>	21	0.03	50	3	0.03	50
<i>Erwinia</i>	1	–	96	–	–	–	<i>Staphylococcus</i>	19,278	30.66	1	2023	22.38	1
<i>Erysipelothrix</i>	1	–	96	–	–	–	<i>Staphylococcus aureus</i>	12,926	20.56	–	1025	11.34	–
<i>Escherichia</i>	12,838	20.42	3	1124	12.44	3	Coagulase-negative staphylococci	5087	8.09	5	753	8.33	–
<i>Eubacterium</i>	10	0.02	64	2	0.02	54	<i>Stenotrophomonas</i>	493	0.78	16	115	1.27	16
<i>Flavimonas</i>	27	0.04	47	7	0.08	41	<i>Stomatococcus</i>	3	–	–	–	–	–
<i>Flavobacterium</i>	13	0.02	60	4	0.04	48	<i>Streptobacillus</i>	–	–	–	1	0.01	59
<i>Fusobacterium</i>	31	0.05	45	11	0.12	31	<i>Streptococcus</i>	9589	15.25	4	1123	12.43	4
<i>Gardnerella</i>	2	–	90	–	–	–	<i>Trichosporon</i>	4	0.01	78	–	–	73
<i>Gemella</i>	38	0.06	43	11	0.12	31	<i>Veillonella</i>	13	0.02	60	1	0.01	59
<i>Haemophilus</i>	528	0.84	15	40	0.44	20	<i>Vibrio</i>	4	0.01	78	–	–	–
<i>Hafnia</i>	14	0.02	58	7	0.08	41	<i>Weeksella</i>	3	–	–	–	–	–
<i>Helicobacter</i>	176	0.28	22	–	–	–	<i>Yersinia</i>	17	0.03	54	1	0.01	59
<i>Kingella</i>	3	–	82	1	0.01	59							
<i>Klebsiella</i>	3079	4.90	7	714	7.90	7							
Other:	949	1.51		50	0.55								
Total number of reports	62,876	100		9038	100								

* Does not correspond to patient episodes, as each organism isolation constitutes a separate report.

Some genera (eg, *Acinetobacter* spp, *Bacteroides* spp, *Citrobacter* spp, *Clostridium* spp, *Corynebacterium* spp, *Enterobacter* spp, *Enterococcus* spp, *Klebsiella* spp, *Morganella* spp, *Proteus* spp, *Pseudomonas* spp, *Serratia* spp, and *Stenotrophomonas* spp) featured more commonly in polymicrobial than monomicrobial bacteraemias. Many genera were reported as being associated with monomicrobial bacteraemias and fungaemias, and a number of the more commonly reported genera were reported more often in monomicrobial rather than polymicrobial bacteraemias. These included *Candida* spp, *Escherichia* spp, *Haemophilus* spp, *Micrococcus* spp, *Salmonella* spp, and *Streptococcus* spp.

The age-specific rates of monomicrobial and polymicrobial bacteraemia episodes were considerably higher in adults aged over 75 years compared to all other age groups, followed by children aged under 1 year (figure 5). The age distribution of polymicrobial bacteraemias and fungaemias mirrored that of the monomicrobial bacteraemias.

Discussion

Of the 1148 reports of *Candida* spp isolated from blood culture specimens in England, Wales, and Northern Ireland in 2002, the majority concerned *C. albicans*. Other common *Candida* spp included *C. glabrata*, and *C. parapsilosis*. This mirrors the data published for the routine candidaemia report in the *CDR Weekly*, Volume 12 number 42 (1).

The proportions of the major *Candida* spp between 1990 and 1999 were given as 60% *C. albicans*, 11% *C. parapsilosis*, and 9% *C. glabrata* (2). In 2002, we reported a slightly lower proportion of *C. albicans* (57%) and a higher proportion of *C. glabrata* (15%) candidaemia reports in 2001, (1) and similarly the data reported here demonstrates a reduction in the proportion of candidaemias due to *C. albicans*, while the proportion of *C. glabrata* has increased. Others have also noted a significant increase in the incidence of *C. glabrata* bloodstream infection and concomitant decrease in the

incidence of *C. albicans* over the same time period (3). Only two per cent of candidaemias due to *C. glabrata* reported were in children aged under 14 years compared to 10% of *C. albicans* reports and 31% of *C. parapsilosis* reports. These results appear to show a similar distribution to those reported from a multi-centre observational study of candidaemias in adults and children at tertiary care centres in the United States (4). The majority of childhood *C. parapsilosis* reports were in children aged under 1 year, which may reflect the incidence of this species in neonatal intensive care units [personal communication, E Johnson, Mycology Reference Laboratory, Bristol, 15 October 2003].

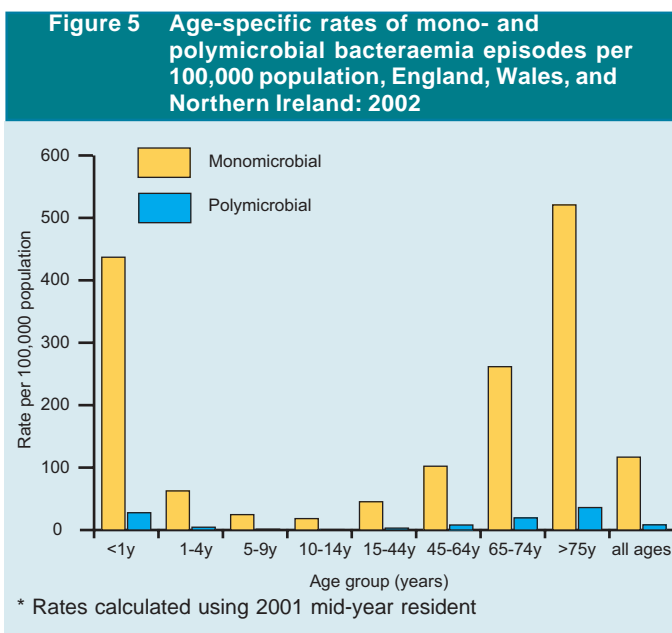
Eleven per cent of candidaemia reports did not identify the organism to the species level. This is a slight improvement on the 2001 data, but is still a high proportion of the total reports. As with most bacteraemia reports, rates of candidaemia were highest in the youngest and oldest age groups.

There were several uncommon *Candida* species that together comprised just 1% of the total number of reports. In addition, 47 reports (4%) of candidaemias were due to the less common species *C. guilliermondii*, *C. kefyr*, *C. krusei*, *C. lusitanae*, and *C. famata*.

As noted in the last *CDR Weekly* routine report on candidaemias (Volume 12 number 42) (1), the rates of invasive candidosis, the majority of which are candidaemias, have increased between the years 1990 and 1999 (2). The rate of candidaemia reports has increased from 1.94/100,000 in 2001 to 2.31/100,000 in 2002, which represents a continuation of the trend of an increasing number of reports of severe *Candida* spp infection. This may be due to an increase in reporting, or due to an increase in the incidence of candidaemias.

Polymicrobial bacteraemias have been associated with a poorer prognosis than monomicrobial bacteraemias, (5, 6) and it has been suggested that the frequency of these infections has increased in recent years (7). Four thousand three hundred and sixty-five patient episodes of polymicrobial bacteraemia due to over 100 genera were identified in England, Wales and Northern Ireland in 2002. This represents 12.6% of all reported bacteraemia episodes. This is a similar proportion of bacteraemias to other previous reports (5,6). The compilation of these data, however, relies on matching patient identifiers, and incomplete or incorrect data may lead to underestimation of the burden of polymicrobial bacteraemias.

The number of polymicrobial bacteraemia reports has increased in 2002 compared to 2001 and 2000 data. For example, 2730 episodes of polymicrobial bacteraemia were identified in 2000 (8) compared to 4212 in 2001 and 4365 in 2002. This increase cannot be explained by the inclusion of data from Northern Ireland. Polymicrobial episodes accounted for 5.2% of all bacteraemias reported to CDSC in 2000, which increased to 7.2% in 2001 and 12.6% in 2002. This may be due to an increase in reporting or may indicate an increase in the incidence of bacteraemias.



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