UK Health Security Agency

Laboratory surveillance of fungaemia due to yeasts in England: 2023

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Contents

Introduction

Several taxonomic revisions to species previously classified as *Candida* have been implemented in the period covered by this Health Protection Report (HPR) (1). The focus has therefore shifted from candidaemia in previous years to include bloodstream infections due to *Candida* and other yeast species (as listed in the data tables associated with this report) and will continue to evolve while the taxonomy of this group becomes more clearly defined.

The analyses in this report are based on data relating to diagnoses of bloodstream infections due to yeasts between 2014 and 2023 in England. Data for England were extracted from the UK Health Security Agency's Second Generation Surveillance System (SGSS), a voluntary surveillance database, on 04 June 2024. In England, laboratories are requested to submit data individually to SGSS, with reporting based on clinically relevant isolates.

It should be noted that the data presented here for earlier years may differ from that in previous candidaemia publications due to the inclusion of late reports. The COVID-19 pandemic affected the general case-mix of hospital patients during much of 2020; this has likely impacted any trends reported here.

The report includes analyses on the trends, age and sex distribution, geographical distribution and antifungal susceptibility of laboratory-reported cases of fungaemia due to yeast species. Rates of fungaemia were calculated using mid-year resident population estimates for the respective year and geography. Geographical analyses were based on cases in England being assigned to 1 of 9 regions formed from administrative local authority boundaries.

Main points

The main findings from this report are that:

- between 2019 and 2023 there was a 23% increase in the number of laboratory reports of fungaemia due to yeasts (from 1,714 to 2,112 reports) in England
- *C. albicans* was the most commonly reported cause of fungaemia in 2023, followed by *N. glabratus* and *C. parapsilosis* respectively
- reports of fungaemia due to *C. auris* in England remain low, though reports have increased following a decline during COVID-19 restrictions
- In 2023, the rate of bloodstream infections due to yeast across England had increased by 42% since 2014 and by 4% from 2022
- in contrast to many pathogens, the overall rate of bloodstream infections due to yeasts increased over the COVID-19 pandemic period (2020 to 2021)
- rates of bloodstream infections due to yeasts varied by region and by patient ethnicity
- rates of bloodstream infections due to yeasts are higher in more deprived populations of the country than the least deprived (4.8 and 3.0 per 100,000 population respectively)
- rates of fungaemia due to *C. albicans* and *N. glabratus* were highest in the eldest of the population, while rates due to *C. parapsilosis* were highest in the youngest of the population

Trends in England

Overall, there was a 23% increase in the number of laboratory reports of fungaemia due to yeasts between 2019 and 2023 (1,714 to 2,112 reports; Table 1). In 2023, 66% (1,385 out of 2,112) of yeast isolates from blood were *Candida*, of these 61% (848 out of 1,385) were *C. albicans*. The second most common genus of yeast isolated from blood was *Nakaseomyces* (27%; 573 out of 2,112 isolates), all were identified as *N. glabratus*. Ten other genera of yeast were reported to have caused bloodstream infections, however each had fewer than 50 (<2.4%) reports in 2023. In 2023, 96% (2,028 out of 2,112) of yeast isolates from blood were reported to species level, which is higher compared to 2022 (95%; Table 1). Not identifying yeast to species level could mean that there is insufficient evidence to accurately assign isolates to a specific genus (for example, *Candida*).

Figure 1 shows the rate per 100,000 population trends of total fungaemia due to yeasts and fungaemia due to *Candida* and *Nakaseomyces* genera between 2014 and 2023. In 2023, the rate of BSI due to yeast across England was 3.7 per 100,000 population, which represents an increase of 42% since 2014 and an increase of 4% from 2022 (Figure 1; a full list of documented species is included within the data tables). This is the highest rate observed in the last 10 years.

The observed increase in BSI due to yeast from 2014 to 2017 may be due to increased reporting following the launch of the Second Generation Surveillance System (SGSS), and associated training for local laboratories, in 2014, adoption of new laboratory testing methods such as MALDI-TOF which facilitate identification of fungal species, raised awareness following the publication of the British Society for Medical Mycology (BSMM) guidance in 2015 and the widely reported *Candida auris* outbreaks within hospitals in 2015 and 2016 (3).

In contrast to many pathogens, the rate of bloodstream infections due to yeasts increased over the COVID-19 pandemic period (2020 to 2021). The increase in incidence may be due to increased number of patients being admitted to intensive care units (ICUs) in 2020, as a result of the pandemic (4). Patients on ICUs are at higher risk for BSI due to yeast as the setting allows the opportunistic pathogen to become invasive, with many risk factors for fungaemia overlapping with characteristics of patients on ICUs (5).

Table 1. Reports of fungaemia by yeast species in England, 2019 to 2023

Species	2019: Number	2019: %	2020: Number	2020: %	2021: Number	2021: %	2022: Number	2022: %	2023: Number	2023: %
Candida	**1,079**	(100)	**1,238**	(100)	**1,349**	(100)	**1,311**	(100)	**1,385**	(100)
C. albicans	683	(63)	841	(68)	876	(65)	832	(63)	848	(62)
C. auris	5	(<1)	1	(<1)	4	(<1)	1	(<1)	5	(<1)
C. dubliniensis	40	(4)	37	(3)	50	(4)	58	(4)	52	(4)
C. haemulonis	7	(<1)	0	(0)	0	(0)	0	(0)	0	(0)
C. metapsilosis	1	(<1)	2	(<1)	4	(<1)	5	(<1)	3	(<1)
C. orthopsilosis	9	(<1)	1	(<1)	2	(<1)	3	(<1)	2	(<1)
C. parapsilosis	182	(17)	218	(18)	267	(20)	242	(18)	308	(22)
C. tropicalis	63	(6)	52	(4)	52	(4)	75	(6)	79	(6)
Candida spp., sp. not recorded	73	(7)	70	(6)	83	(6)	80	(6)	68	(5)
Candida spp., other named	16	(1)	16	(1)	11	(<1)	15	(1)	20	(1)
Clavispora	**29**	(100)	**29**	(100)	**41**	(100)	**31**	(100)	**29**	(100)
C. lusitaniae [note 1]	29	(100)	29	(100)	41	(100)	31	(100)	29	(100)
Cryptococcus	29	(100)	25	(100)	34	(100)	25	(100)	28	(100)
C. neoformans	24	(83)	17	(68)	19	(56)	20	(80)	18	(64)
Cryptococcus spp., sp. not recorded	5	(22)	8	(36)	15	(50)	5	(21)	10	(38)
Debaryomyces	3	(100)	0		0		0		0	
D. hansenii [note 1]	3	(100)	0		0		0		0	
Kluveromyces	6	(100)	5	(100)	10	(100)	10	(100)	9	(100)

Species	2019: Number	2019: %	2020: Number	2020: %	2021: Number	2021: %	2022: Number	2022: %	2023: Number	2023: %
K. lactis	0	(0)	1	(20)	0	(0)	0	(0)	0	(0)
K. marxianus [note 1]	6	(100)	4	(80)	10	(100)	10	(100)	9	(100)
Meyerozyma	13	(100)	16	(100)	12	(100)	22	(100)	19	(100)
M. caribbica	0	(0)	0	(0)	1	(8)	0	(0)	1	(5)
M. guilliermondii [note 1]	13	(100)	16	(100)	11	(92)	22	(100)	18	(95)
Nakaseomyces	506	(100)	472	(100)	464	(100)	570	(100)	573	(100)
N. glabratus [note 1]	505	(>99)	470	(>99)	463	(>99)	570	(100)	573	(100)
N. nivariensis [note 1]	1	(<1)	2	(<1)	1	(<1)	0	(0)	0	(0)
Nakazawaea	0		1	(100)	0		0		0	
N. peltate [note 1]	0		1	(100)	0		0		0	
Pichia	28	(100)	18	(100)	30	(100)	30	(100)	43	(100)
P. anomola	0	(0)	1	(6)	0	(0)	1	(3)	3	(7)
P. cactophila [note 1]	2	(7)	0	(0)	0	(0)	1	(3)	0	(0)
P. jadinii [note 1]	1	(4)	0	(0)	1	(3)	0	(0)	0	(0)
P. kudriavzevii [note 1]	25	(89)	17	(94)	27	(90)	27	(90)	38	(88)
P. norvegensis [note 1]	0	(0)	0	(0)	1	(3)	0	(0)	0	(0)
Pichia spp., sp. not recorded	0	(0)	0	(0)	1	(3)	1	(3)	2	(5)
Rhodotorula	14	(100)	23	(100)	13	(100)	22	(100)	16	(100)
R. dairenensis	1	(7)	0	(0)	0	(0)	1	(5)	1	(6)
R. glutinis	0	(0)	0	(0)	1	(8)	1	(5)	0	(0)

Species	2019: Number	2019: %	2020: Number	2020: %	2021: Number	2021: %	2022: Number	2022: %	2023: Number	2023: %
R. mucilaginosa	5	(36)	9	(39)	7	(54)	8	(36)	8	(50)
Rhodotorula spp., other named	3	(21)	7	(30)	2	(15)	5	(23)	3	(19)
Rhodotorula spp., sp. not recorded	5	(36)	7	(30)	3	(23)	7	(32)	4	(25)
Saccharomyces	6	(100)	4	(100)	5	(100)	11	(100)	9	(100)
S. cerevisiae	6	(100)	4	(100)	5	(100)	10	(91)	9	(100)
Saccharomyces spp., sp. not recorded	0	(0)	0	(0)	0	(0)	1	(9)	0	(0)
Starmerella	1	(100)	1	(100)	0		0		1	(100)
S. magnoliae [note 1]	0	(0)	1	(100)	0		0		1	(100)
S. sorbosivorans [note 1]	1	(100)	0	(0)	0		0		0	(0)

Note 1: previously categorised as *Candida* species.

Figure 1. Trends in fungaemia reports per 100,000 population in England, 2014 to 2023

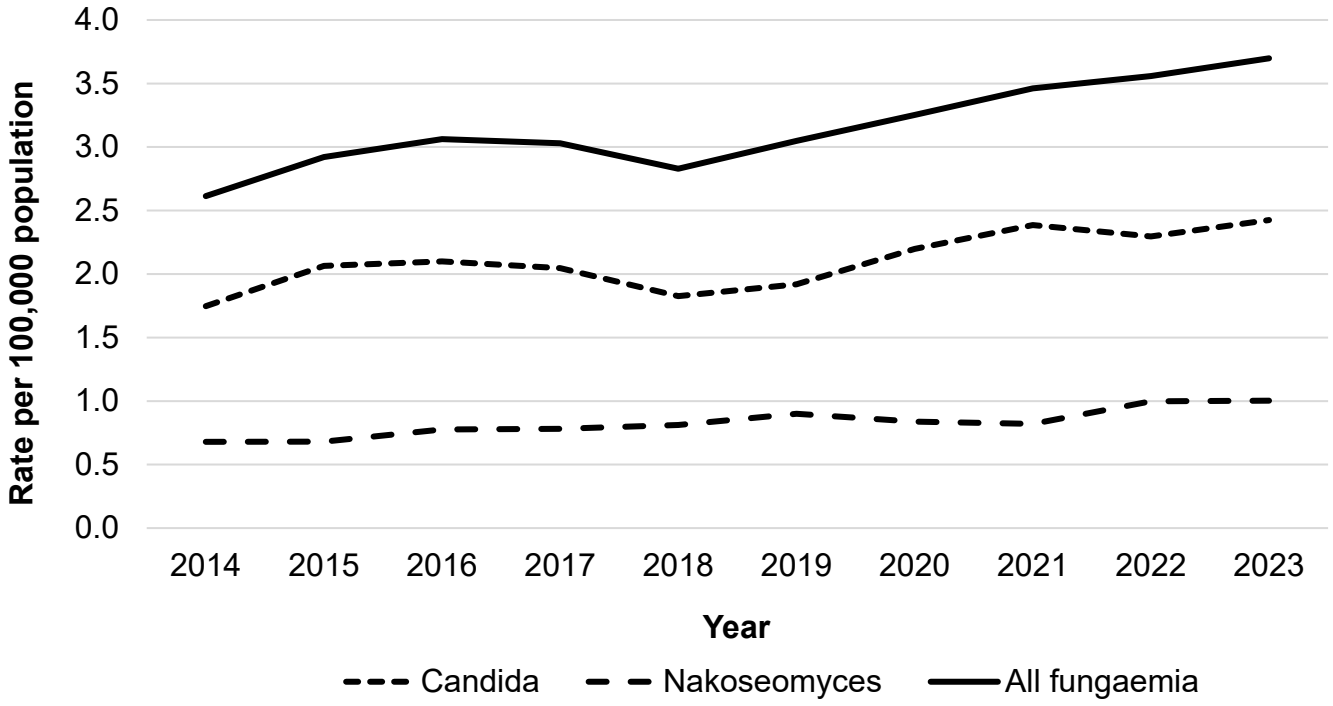


Table 2 shows the regional rates of fungaemia due to yeast by group in 2023.

Table 2. Rate per 100,000 population of fungaemia reports by region in England, 2023

Region	All fungaemia	*Candida*	*Nakaseomyces*
North East	4.1	2.9	0.9
North West	4.4	2.8	1.2
Yorkshire and Humber	2.8	2.0	0.6
East Midlands	4.0	2.5	1.2
East of England	3.6	2.5	0.9
West Midlands	3.5	2.4	0.9
London	4.1	2.5	1.2
South East	3.3	2.1	1.0
South West	3.6	2.4	0.9
England	**3.7**	**2.4**	**1.0**

The rate of fungaemia reports across England in 2023 ranged from 4.4 in the North West to 2.8 per 100,000 in Yorkshire and Humber (Table 2). Variation in fungaemia due to yeast in 2023 is reported by ethnic group (Table 3). The highest number and rate per 100,000 population of fungaemia was recorded in people in a white ethnic group. In 2023, the incidence of fungaemia decreased as deprivation decreased from 4.8 per 100,000 in the most deprived 20% to 3.0 per 100,000 in the least deprived 20% of the population in England (Table 4). Table 3 shows the number of reports and rates of fungaemia by ethnic group in 2023.

Table 3. Fungaemia reports by ethnic group in England in 2023, BSI per 100,000 ethnic population [note 2]

Ethnic group	All fungaemia: number	All fungaemia: rate	*Candida*: Number	*Candida*: Rate	*Nakaseomyces*: Number	*Nakaseomyces*: Rate
White	1,643	3.6	1,069	2.3	487	1.1
Asian or Asian British	119	2.2	82	1.5	28	0.5
Black, African, Caribbean or black British	81	3.4	53	2.2	11	0.5
Mixed or multiple ethnic groups	38	2.3	33	2.0	3	0.2
Any other ethnic group	8	0.7	4	0.3	3	0.2
Not known or Not stated	23		9		10	

Note 2: 200 (9.5%) BSI episodes could not be linked to ethnic group information.

Table 4 shows rates of fungaemia by Indices of Multiple Deprivation (IMD) quintile in 2023.

Table 4. Fungaemia rate per 100,000 population by IMD quintile, England, 2023

IMD Quintile	All fungaemia	*Candida*	*Nakaseomyces*
1 (most deprived)	4.8	3.2	1.2
2	4.5	2.9	1.3
3	3.2	2.2	0.8
4	3.5	2.3	1.0
5 (least deprived)	3.0	2.0	0.8

Note 3: Data for IMD is based on the patient residence information. Records are excluded when this information is not available. In 2023 the number of records excluded was 58 out of 2,112 (2.7%).

Candida

Candida are the most commonly reported cause of fungaemia in the period 2019 to 2023. Of the *Candida*-causing fungaemia in England in 2023, *C. albicans* accounted for 62% (848 out of 1,385) of reports (Table 1). In comparison with other causes of bloodstream infections, *C. albicans* was ranked 22nd among monomicrobial and 31st among polymicrobial bacteraemia in 2022 (6), down from 18th and up from 33rd respectively in 2021. The second most common *Candida* species isolated from blood was *C. parapsilosis* which accounted for 22% (308 out of 1,385) of reports (Table 1).

C. auris (recently re-classified as *Candidozyma auris*) is a fungal pathogen of clinical concern. Reports of fungaemia due to *C. auris* in England remain low, though reports have increased following a decline during COVID-19 restrictions (1 report in 2020 to 5 reports in 2023; Table 1).

The rate of candidaemia reports across England in 2023 ranged from 2.9 in the North East to 2.0 per 100,000 in Yorkshire and Humber (Table 2). There was variation in candidaemia by ethnic group in 2023, similar to that found overall for fungaemia (Table 3). The highest number of reports and rate per 100,000 population of fungaemia was recorded in people in a white ethnic group.

In 2023, the incidence of candidaemia decreased as deprivation decreased from 3.2 per 100,000 in the most deprived 20% to 2.0 per 100,000 in the least deprived 20% of the population in England (Table 4). With the exception of IMD quintile 4 which had a higher rate than IMD quintile 3, this trend mirrors that for all fungaemia. There was a 37.5% decrease in the rate of candidaemia between the highest and lowest deprived populations.
Figure 2 shows the highest rate of *C. albicans* candidaemia was for people aged 75 years and over at 5.8 per 100,000 (8.5 in males and 2.6 per 100,000 in females), followed by those aged 64 to 74 and less than one year at 3.7 per 100,000 and 3.0 per 100,000, respectively. Rates of *C. albicans* candidaemia were higher in males than females except in the 1 to 4 and 15 to 44 age groups.

Figure 3 shows the highest rate of *C. parapsilosis* candidaemia was in children aged less than one year at 1.3 per 100,000 (1.6 in males and 1.0 per 100,000 in females), followed by those aged 64 to 74 and aged 75 and over, both at 1.0 per 100,000 population. Rates of *C. parapsilosis* candidaemia were higher in males than females except in the 5 to 9 and 15 to 44 age groups.

Figure 2. *Candida albicans* candidaemia age and sex rates per 100,000 population in England, 2023

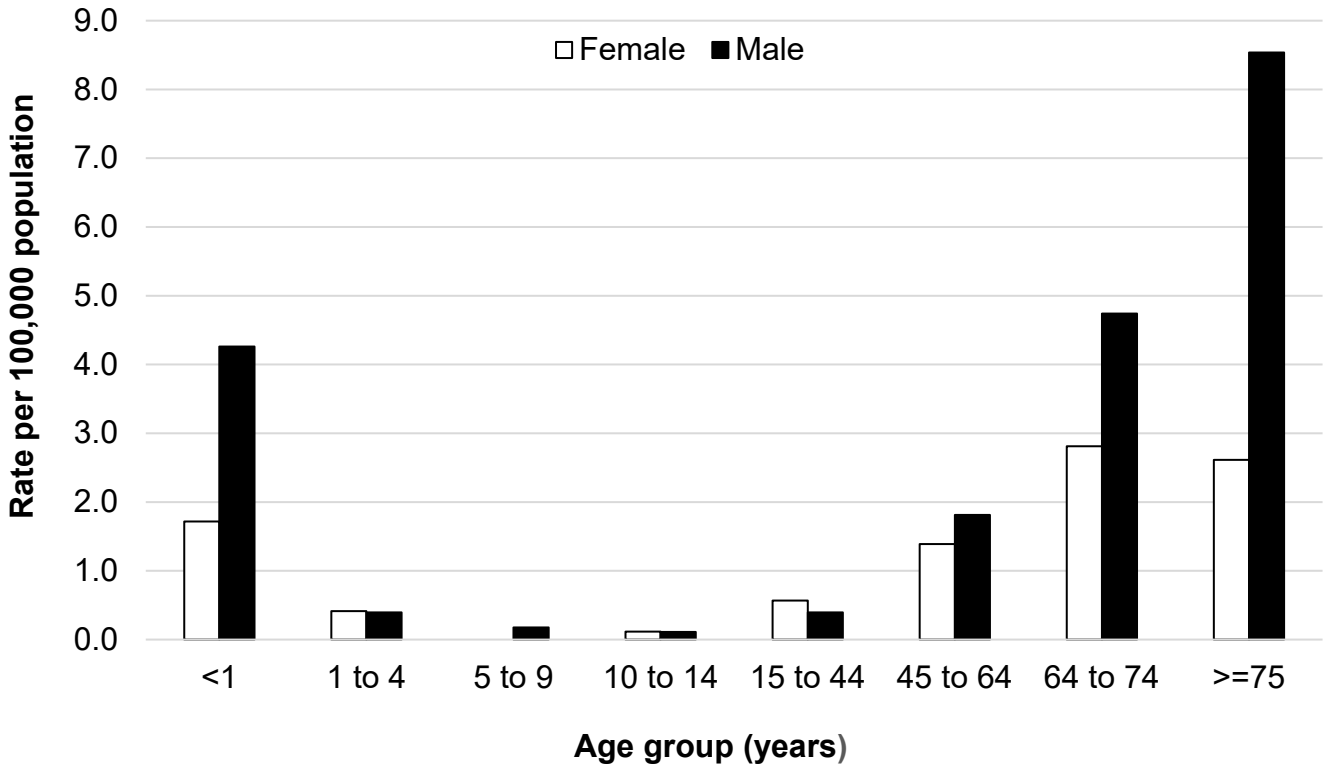
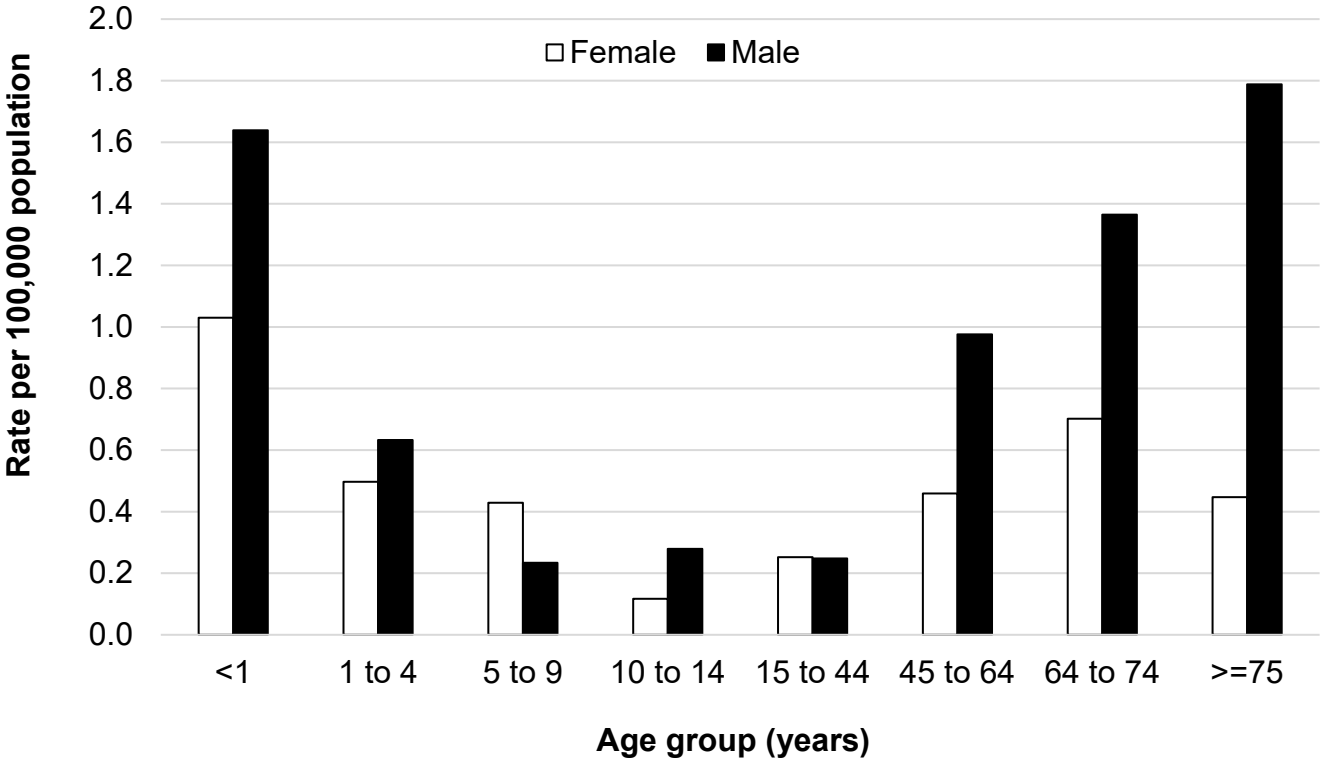


Figure 3. *Candida parapsilosis* candidaemia age and sex rates per 100,000 population in England, 2023



In England, the percentage of *C. albicans* candidaemia reports that were accompanied by antifungal susceptibility data in 2023 was 52% (57% in 2022), 44% (46%), 62% (63%), 17% (28%) and 50% (56%) for amphotericin B, caspofungin, fluconazole, flucytosine and voriconazole respectively. In 2023, resistance to each of the listed antifungals was 2% or less.

The percentage of *C. parapsilosis* candidaemia reports that were accompanied by antifungal susceptibility data in 2023 was 48% (66% in 2022), 37% (48%), 53% (69%), 19% (33%) and 52% (68%) for amphotericin B, caspofungin, fluconazole, flucytosine and voriconazole respectively. In 2023, resistance to each of the listed antifungals was 2% or less with the exception of fluconazole for which resistance was 5%. This should be monitored as there are increasing reports of fluconazole resistant *C. parapsilosis* from countries such as Spain, Italy, Turkey, South America and South Africa (7).

Resistance data displayed in this report is as provided by laboratories in England to SGSS, the methodology by which susceptibility testing was performed is not captured. European Committee on Antimicrobial Susceptibility Testing (EUCAST) and Clinical and Laboratory Standards Institute (CLSI) resistance breakpoints differ and the correct cut-off should be selected by laboaratories according to the susceptibility method used.

British and European guidelines on fungal diagnostics and management (8, 9) emphasise the role of rapid diagnosis and identification of clinically significant fungal isolates to species level, as well as the need for susceptibility testing. Further increases in the levels of antifungal susceptibility testing are needed to improve our understanding of resistance trends, inform antifungal stewardship activities and improve patient outcomes for yeast species bloodstream infections. However, increasing literature provides the usual antifungal susceptibility patterns for many species of *Candida* and allied genera that may help to inform therapeutic decisions (10).

Table 5 shows the number of reports for prevalent *Candida* species-causing candidaemia that were tested and the proportion that were resistant to key antifungals (amphotericin B, anidulafungin, caspofungin, fluconazole, flucytosine, voriconazole) in England between 2019 and 2023. In these tables R = resistant and NT stands for 'number tested'.

Table 5a. Antimicrobial susceptibility for *Candida*-causing *Candida albicans* in England, 2019 to 2023

Antimicrobial agent	2019: NT	2019: R (%)	2020: NT	2020: R (%)	2021: NT	2021: R (%)	2022: NT	2022: R (%)	2023: NT	2023: R (%)
amphotericin B	353	(<1)	454	(<1)	481	(<1)	471	(<1)	437	(<1)
anidulafungin	132	(5)	156	(8)	191	(3)	206	(1)	208	(<1)
caspofungin	282	(<1)	389	(2)	409	(<1)	386	(0)	375	(0)
fluconazole	418	(<1)	528	(<1)	526	(<1)	520	(1)	528	(1)
flucytosine	205	(<1)	281	(3)	271	(2)	236	(1)	141	(2)
voriconazole	358	(2)	465	(2)	490	(1)	464	(1)	425	(1)

Table 5a. Antimicrobial susceptibility for *Candida*-causing *Candida parapsilosis* in England, 2019 to 2023

Antimicrobial agent	2019: NT	2019: R (%)	2020: NT	2020: R (%)	2021: NT	2021: R (%)	2022: NT	2022: R (%)	2023: NT	2023: R (%)
amphotericin B	116	(0)	140	(1)	157	(0)	160	(<1)	148	(0)
anidulafungin	37	(5)	56	(0)	68	(0)	73	(1)	86	(2)
caspofungin	100	(1)	118	(0)	125	(0)	117	(<1)	115	(<1)
fluconazole	129	(2)	153	(<1)	176	(5)	167	(2)	164	(5)
flucytosine	84	(0)	83	(0)	90	(2)	79	(0)	60	(2)
voriconazole	110	(<1)	141	(0)	166	(2)	164	(<1)	159	(1)

Nakaseomyces

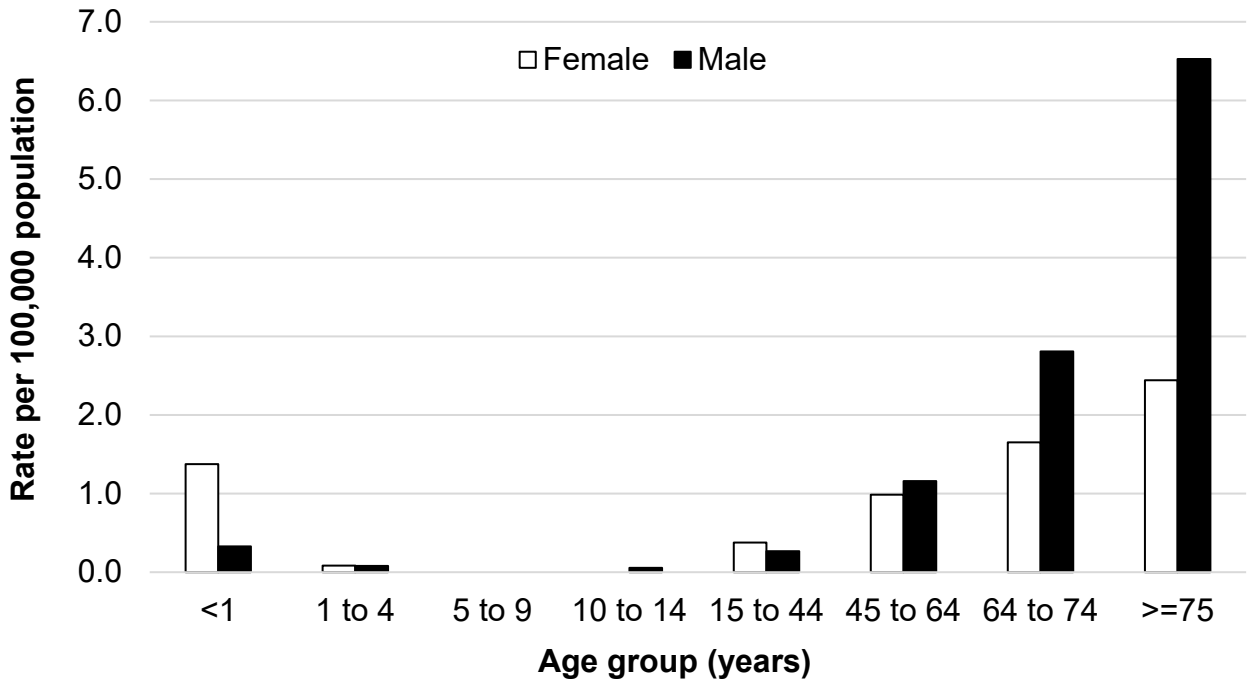
Nakaseomyces are the second most commonly reported cause of fungaemia in the period 2019 to 2023. Of the *Nakaseomyces spp.* causing fungaemia in England in 2023, *N. glabratus* accounted for all 573 reports (Table 1). In comparison with other causes of bloodstream infections, *N. glabratus* was ranked 31st among monomicrobial and 39th among polymicrobial bacteraemia in 2022 (6), up from 33rd and 43rd respectively in 2021.

The rate of *Nakaseomyces* reports across England in 2023 ranged from 1.2 in London, East Midlands and North West to 0.6 per 100,000 in Yorkshire and Humber (Table 2). Similarly to candidaemia, there was variation in fungaemia due to *Nakaseomyces spp*. by ethnic group in 2023 (Table 3). The highest number of reports and rate per 100,000 population of fungaemia due to *Nakaseomyces* was recorded in people in a white ethnic group.

In 2023, the incidence of fungaemia due to *Nakaseomyces* was highest in the most deprived 40% of the population (1.2 and 1.3 per 100,000 population in IMD quintiles 1 and 2 respectively; Table 4). The incidence decreased to 0.8 to 1.0 in the 60% least deprived of the population (IMD quintiles 3 to 5) There was a 33.3% decrease in the rate of fungaemia between the highest and lowest deprived populations.

Figure 4 shows the highest rate of *N. glabratus* fungaemia was in people aged 75 years and over at 4.2 per 100,000 (6.5 in males and 2.4 per 100,000 in females), followed by those aged 64 to 74 and 45 to 64 at 2.2 per 100,000 and 1.1 per 100,000, respectively.

Figure 4. *Nakaseomyces glabratus* fungaemia age and sex rates per 100,000 population in England, 2023



In England, the percentage of *N. glabratus* fungaemia reports that were accompanied by antifungal susceptibility data in 2023 was 55% (59% in 2022), 40% (41%), 46% (67%), 17% (29%) and 36% (43%) for amphotericin B, caspofungin, fluconazole, flucytosine and voriconazole respectively. In 2023, resistance to fluconazole and voriconazole was 17% and 21% respectively. Resistance to amphotericin B, caspofungin and flucytosine was 2%, 8% and 5% respectively.

Interpreting resistance trends in *N. glabratus* has been difficult due to differences in the standard breakpoints used by laboratories to define antifungal susceptibility. EUCAST and CLSI breakpoints for fluconazole previously differed in their interpretation. However, introduction of the EUCAST 'Susceptible Increased exposure' category now aligns more closely with the CLSI 'susceptible-dose-dependent' category (indicating that the isolate is susceptible with high doses of fluconazole) (11, 12). This could account for changes in the percentage of isolates being reported as resistant to fluconazole (Table 7). EUCAST methodology does not currently have a *N. glabratus* breakpoint for voriconazole, due to insufficient evidence that this antifungal should be used in the treatment of *N. glabratus* (13). Further, for caspofungin susceptibility testing, only the Etest method is reliable, which requires expertise to read; many laboratories are moving to anidulafungin as a sentinel echinocandin instead, as resistance mutations in some yeast isolates confer resistance to both drugs (14). In caspofungin susceptibility testing, only the Etest method is reliable, which requires expertise to read; many laboratories are moving to anidulafungin as a sentinel echinocandin instead, as resistance mutations in some yeast isolates confer resistance to both drugs (14).

Table 7 shows the number of *Nakaseomyces glabratus* causing fungaemia that were tested and the proportion that were resistant to key antifungals (amphotericin B, anidulafungin, caspofungin, fluconazole, flucytosine, voriconazole) in England between 2019 and 2023.

Table 6. Antimicrobial susceptibility for *Nakaseomyces*-causing fungaemia in England, 2019 to 2023
In this table, R = resistant and NT stands for 'number tested'.

Antimicrobial agent	2019: NT	2019: R (%)	2020: NT	2020: R (%)	2021: NT	2021: R (%)	2022: NT	2022: R (%)	2023: NT	2023: R (%)
amphotericin B	301	(<1)	280	(<1)	267	(0)	339	(2)	316	(2)
anidulafungin	126	(4)	121	(<1)	115	(<1)	176	(<1)	199	(4)
caspofungin	184	(6)	187	(7)	160	(10)	236	(5)	232	(8)
fluconazole	208	(15)	191	(8)	190	(9)	267	(14)	265	(17)
flucytosine	201	(<1)	171	(0)	156	(0)	164	(<1)	95	(5)
voriconazole	265	(13)	239	(10)	232	(12)	245	(14)	206	(21)

Reference microbiology service

In 2023, the percentage of reports of fungaemia due to yeast in which the organism was not fully identified was 4%. Precise species identification of isolates would improve the monitoring of trends in infections due to yeast genera. The UKHSA Mycology Reference Laboratory (MRL, Bristol) offers referred (charged for) taxonomic identification and susceptibility testing services for fungi from systemic and other significant infections (15).

Acknowledgements

These reports would not be possible without the weekly contributions from microbiology colleagues in laboratories across England, without whom there would be no surveillance data. The support from colleagues within the UKHSA Mycology Reference Laboratory (MRL, Bristol) is greatly valued in the preparation of the report. Feedback and specific queries about this report are welcome and can be sent to: hcai.amrdepartment@ukhsa.gov.uk

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