

Increased Hospitalizations Involving Fungal Infections during COVID-19 Pandemic, United States, January 2020–December 2021

Appendix

Appendix Table 1. International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) discharge diagnosis codes used to identify hospitalizations for fungal infections and COVID-19

Disease	Code, description
Invasive candidiasis	B37.5, candidal meningitis B37.6, candidal endocarditis B37.7, candidal sepsis
Coccidioidomycosis	B38.0, acute pulmonary coccidioidomycosis B38.1, chronic pulmonary coccidioidomycosis B38.2, pulmonary coccidioidomycosis, unspecified B38.3, cutaneous coccidioidomycosis B38.4, coccidioidomycosis meningitis B38.7, disseminated coccidioidomycosis B38.8, other forms of coccidioidomycosis B38.81, prostatic coccidioidomycosis B38.89, other forms of coccidioidomycosis B38.9, coccidioidomycosis, unspecified
Histoplasmosis	B39.0, acute pulmonary histoplasmosis capsulati B39.1, chronic pulmonary histoplasmosis capsulati B39.2, pulmonary histoplasmosis capsulati, unspecified B39.3, disseminated histoplasmosis capsulati B39.4, histoplasmosis capsulati, unspecified B39.5, histoplasmosis duboisii B39.9, histoplasmosis, unspecified
Blastomycosis	B40.0, acute pulmonary blastomycosis B40.1, chronic pulmonary blastomycosis B40.2, pulmonary blastomycosis, unspecified B40.3, cutaneous blastomycosis B40.7, disseminated blastomycosis B40.8, other forms of blastomycosis B40.81, blastomycotic meningoencephalitis B40.89, other forms of blastomycosis B40.9, blastomycosis, unspecified
Aspergillosis	B44.0, invasive pulmonary aspergillosis B44.1, other pulmonary aspergillosis B44.2, tonsillar aspergillosis B44.7, disseminated aspergillosis B44.8, other forms of aspergillosis B44.81, allergic bronchopulmonary aspergillosis B44.89, other forms of aspergillosis B44.9, aspergillosis, unspecified
Cryptococcosis	B45.0, pulmonary cryptococcosis B45.1, cerebral cryptococcosis B45.2, cutaneous cryptococcosis B45.3, osseous cryptococcosis B45.7, disseminated cryptococcosis B45.8, other forms of cryptococcosis

Disease	Code, description
Mucormycosis	B45.9, cryptococcosis, unspecified
	B46.0, pulmonary mucormycosis
	B46.1, rhinocerebral mucormycosis
	B46.2, gastrointestinal mucormycosis
	B46.3, cutaneous mucormycosis
	B46.4, disseminated mucormycosis
	B46.5, mucormycosis, unspecified
	B46.8, other zygomycoses
	B46.9, zygomycosis, unspecified
	Other specified mycoses
B41.7, disseminated paracoccidioidomycosis	
B41.8, other forms of paracoccidioidomycosis	
B41.9, paracoccidioidomycosis, unspecified	
B42.0, pulmonary sporotrichosis	
B42.1, lymphocutaneous sporotrichosis	
B42.7, disseminated sporotrichosis	
B42.8, other forms of sporotrichosis	
B42.81, cerebral sporotrichosis	
B42.82, sporotrichosis arthritis	
B42.89, other forms of sporotrichosis	
B42.9, sporotrichosis, unspecified	
B43.0, cutaneous chromomycosis	
B43.1, phaeomycotic brain abscess	
B43.2, subcutaneous phaeomycotic abscess and cyst	
B43.8, other forms of chromomycosis	
B43.9, chromomycosis, unspecified	
B48.0, lobomycosis	
B48.1, rhinosporidiosis	
B48.2, albuginosis	
B48.3, geotrichosis	
B48.4, penicilliosis	
B48.8, other specified mycoses	
Unspecified mycosis	B49, unspecified mycosis
<i>Pneumocystis pneumonia</i>	B59, pneumocystosis
COVID-19	U07.1, COVID-19, virus identified (April 2020–December 2021) B97.29*, other coronavirus as the cause of diseases classified elsewhere (February 2020–April 2020)

*This code for COVID-19 was recommended from March 1, 2020–April 30, 2020 (before the April 2020 release of U07.1) (<https://www.cdc.gov/nchs/data/icd/Announcement-New-ICD-code-for-coronavirus-3-18-2020.pdf>; <https://www.cdc.gov/nchs/data/icd/ICD-10-CM-Official-Coding-Guidance-Interim-Advice-coronavirus-feb-20-2020.pdf>).

Appendix Table 2. Demographic features, healthcare utilization, and outcomes for patients hospitalized with COVID-19–associated fungal infections, stratified by fungal pathogen, United States, 2020–2021*

Characteristic	Cause of infection									
	<i>Candida</i>	<i>Aspergillus</i>	<i>Coccidioides</i>	<i>Pneumocystis</i>	<i>Cryptococcus</i>	<i>Histoplasma</i>	Mucorales	<i>Blastomyces</i>	Other specified	Unspecified
Total no.	1,135	1,471	723	235	138	139	94	41	221	1,286
Male sex†	663 (58.4)	867 (58.9)	439 (60.7)	164 (69.8)	86 (62.3)	78 (56.1)	72 (76.6)	25 (61.0)	119 (53.8)	767 (59.6)
Median age	64 (54–73)	64 (55–72)	59 (45–71)	58 (47–67)	61 (52–69)	59 (50–70)	55 (44–67)	62 (45–73)	64 (52–74)	64 (54–73)
Age groups, y										
<1	NA	NA	0	0	0	0	0	0	0	0
1–4	NA	0	0	0	0	0	0	0	0	NA
5–14	NA	NA	0	0	0	0	0	0	NA	0
15–24	6 (0.5)	14 (1.0)	19 (2.6)	NA	5 (3.6)	NA	NA	0	NA	8 (0.6)
25–34	34 (3.0)	32 (2.2)	62 (8.6)	16 (6.8)	6 (4.3)	10 (7.2)	8 (8.5)	5 (12.2)	6 (2.7)	46 (3.6)
35–44	92 (8.1)	82 (5.6)	87 (12.0)	26 (11.1)	11 (8.0)	9 (6.5)	13 (13.8)	5 (12.2)	22 (10.0)	88 (6.8)
45–54	147 (13.0)	228 (15.5)	138 (19.1)	56 (23.8)	19 (13.8)	25 (18.0)	22 (23.4)	6 (14.6)	26 (11.8)	179 (13.9)
55–64	293 (25.8)	403 (27.4)	131 (18.1)	63 (26.8)	44 (31.9)	44 (31.7)	21 (22.3)	7 (17.1)	54 (24.4)	327 (25.4)
65–74	317 (27.9)	436 (29.6)	150 (20.7)	40 (17.0)	37 (26.8)	28 (20.1)	19 (20.2)	9 (22.0)	57 (25.8)	362 (28.1)
75–84	189 (16.7)	242 (16.5)	107 (14.8)	27 (11.5)	14 (10.1)	14 (10.1)	8 (8.5)	5 (12.2)	42 (19.0)	219 (17.0)
≥85	52 (4.6)	32 (2.2)	29 (4.0)	NA	NA	5 (3.6)	0	NA	10 (4.5)	55 (4.3)
Race/ethnicity										
White, NH	426 (37.5)	739 (50.2)	137 (18.9)	81 (34.5)	34 (24.6)	81 (58.3)	31 (33.0)	25 (61.0)	107 (48.4)	547 (42.5)
Black, NH	223 (19.6)	161 (10.9)	37 (5.1)	55 (23.4)	27 (19.6)	17 (12.2)	16 (17.0)	10 (24.4)	33 (14.9)	223 (17.3)
Hispanic or Latino	254 (22.4)	258 (17.5)	138 (19.1)	38 (16.2)	40 (29.0)	14 (10.1)	27 (28.7)	NA	40 (18.1)	230 (17.9)
Asian, NH	19 (1.7)	38 (2.6)	NA	NA	5 (3.6)	NA	NA	0	6 (2.7)	33 (2.6)
Other	42 (3.7)	57 (3.9)	14 (1.9)	10 (4.3)	8 (5.8)	14 (10.1)	NA	NA	9 (4.1)	57 (4.4)
Unknown	171 (15.1)	218 (14.8)	394 (54.5)	49 (20.9)	24 (17.4)	11 (7.9)	14 (14.9)	NA	26 (11.8)	196 (15.2)
US census region										
South	592 (52.2)	614 (41.7)	18 (2.5)	83 (35.3)	64 (46.4)	61 (43.9)	43 (45.7)	16 (39.0)	107 (48.4)	639 (49.7)
West	197 (17.4)	365 (24.8)	697 (96.4)	30 (12.8)	25 (18.1)	7 (5.0)	28 (29.8)	NA	42 (19.0)	190 (14.8)
Midwest	186 (16.4)	322 (21.9)	6 (0.8)	74 (31.5)	23 (16.7)	67 (48.2)	14 (14.9)	22 (53.7)	47 (21.3)	219 (17.0)
Northeast	160 (14.1)	170 (11.6)	NA	48 (20.4)	26 (18.8)	NA	9 (9.6)	NA	25 (11.3)	238 (18.5)
Urbanicity										
Urban	1,050 (92.5)	1,321 (89.8)	710 (98.2)	214 (91.1)	125 (90.6)	114 (82.0)	86 (91.5)	30 (73.2)	185 (83.7)	1,148 (89.3)
Rural	85 (7.5)	150 (10.2)	13 (1.8)	21 (8.9)	13 (9.4)	25 (18.0)	8 (8.5)	11 (26.8)	36 (16.3)	138 (10.7)
Healthcare utilization and outcomes										
Length of stay, d	29 (17, 45)	23 (14, 35)	8 (5, 15)	18 (9, 33)	19.5 (8, 31)	10 (4, 24)	18 (9, 30)	11 (5, 26)	21 (13, 33)	25 (15, 39)
ICU-level care	932 (82.1)	1,181 (80.3)	210 (29.0)	146 (62.1)	83 (60.1)	51 (36.7)	66 (70.2)	19 (46.3)	152 (68.8)	1,030 (80.1)
IMV receipt	884 (77.9)	1,115 (75.8)	159 (22.0)	115 (48.9)	71 (51.4)	37 (26.6)	54 (57.4)	17 (41.5)	131 (59.3)	977 (76.0)
In-hospital death	629 (55.4)	848 (57.6)	135 (18.7)	96 (40.9)	53 (38.4)	30 (21.6)	42 (44.7)	10 (24.4)	82 (37.1)	759 (59.0)

*Values are median (interquartile range) for continuous variables (median age) and number (%) for categorical variables. Cells containing <5 hospitalizations are not shown. ICU, intensive care unit; IMV, invasive mechanical ventilation; NA, not applicable; NH, not Hispanic or Latino.

†Sex was unknown for 1 hospitalized patient.

Appendix Table 3. Demographic features and outcomes for patients hospitalized with non-COVID-19-associated fungal infection during the COVID-19 pandemic, stratified by pathogen, United States, 2020–2021*

Characteristics	Cause of infection									
	<i>Candida</i>	<i>Aspergillus</i>	<i>Coccidioides</i>	<i>Pneumocystis</i>	<i>Histoplasma</i>	<i>Cryptococcus</i>	<i>Blastomyces</i>	Mucorales	Other specified	Unspecified
Total no.	7,154	5,777	5,555	3,483	2,247	1,884	502	475	2,079	6,313
Male sex†	3,702 (51.7)	3,288 (56.9)	3,355 (60.4)	1,184 (34.0)	1,328 (59.1)	1,310 (69.5)	347 (69.1)	298 (62.7)	1,091 (52.5)	3,377 (53.5)
Median age	64 (50–74)	64 (53–73)	57 (42–70)	52 (38–63)	58 (41–69)	55 (42–66)	60 (43–70)	55 (42–65)	63 (49–74)	63 (49–73)
Age group, y										
<1	34 (0.5)	14 (0.2)	NA	8 (0.2)	NA	0	0	NA	11 (0.5)	41 (0.6)
1–4	33 (0.5)	19 (0.3)	NA	10 (0.3)	16 (0.7)	NA	NA	NA	18 (0.9)	33 (0.5)
5–14	61 (0.9)	72 (1.2)	48 (0.9)	18 (0.5)	30 (1.3)	7 (0.4)	NA	6 (1.3)	37 (1.8)	59 (0.9)
15–24	133 (1.9)	186 (3.2)	298 (5.4)	71 (2.0)	91 (4.0)	54 (2.9)	22 (4.4)	29 (6.1)	80 (3.8)	131 (2.1)
25–34	469 (6.6)	248 (4.3)	565 (10.2)	579 (16.6)	224 (10.0)	199 (10.6)	46 (9.2)	32 (6.7)	105 (5.1)	419 (6.6)
35–44	622 (8.7)	386 (6.7)	696 (12.5)	573 (16.5)	283 (12.6)	290 (15.4)	63 (12.5)	73 (15.4)	146 (7.0)	576 (9.1)
45–54	880 (12.3)	625 (10.8)	923 (16.6)	675 (19.4)	325 (14.5)	359 (19.1)	72 (14.3)	92 (19.4)	256 (12.3)	829 (13.1)
55–64	1,511 (21.1)	1,416 (24.5)	1,075 (19.4)	751 (21.6)	476 (21.2)	448 (23.8)	111 (22.1)	116 (24.4)	455 (21.9)	1,341 (21.2)
65–74	1,761 (24.6)	1,610 (27.9)	1,035 (18.6)	476 (13.7)	479 (21.3)	347 (18.4)	97 (19.3)	84 (17.7)	496 (23.9)	1,474 (23.3)
75–84	1,191 (16.6)	990 (17.1)	700 (12.6)	258 (7.4)	267 (11.9)	152 (8.1)	65 (12.9)	32 (6.7)	319 (15.3)	1,016 (16.1)
≥85	459 (6.4)	211 (3.7)	212 (3.8)	64 (1.8)	55 (2.4)	27 (1.4)	22 (4.4)	8 (1.7)	156 (7.5)	394 (6.2)
Race/ethnicity										
White, NH	3,845 (53.7)	3,251 (56.3)	1,130 (20.3)	1,322 (38.0)	1,394 (62.0)	716 (38.0)	296 (59.0)	211 (44.4)	1,212 (58.3)	3,481 (55.1)
Black, NH	1,227 (17.2)	723 (12.5)	244 (4.4)	979 (28.1)	328 (14.6)	414 (22.0)	81 (16.1)	56 (11.8)	262 (12.6)	1,060 (16.8)
Hispanic or Latino	793 (11.1)	581 (10.1)	761 (13.7)	477 (13.7)	205 (9.1)	389 (20.6)	33 (6.6)	82 (17.3)	232 (11.2)	657 (10.4)
Asian, NH	108 (1.5)	225 (3.9)	102 (1.8)	99 (2.8)	41 (1.8)	70 (3.7)	23 (4.6)	8 (1.7)	27 (1.3)	95 (1.5)
Other	234 (3.3)	190 (3.3)	132 (2.4)	104 (3.0)	115 (5.1)	64 (3.4)	31 (6.2)	16 (3.4)	63 (3.0)	231 (3.7)
Unknown	947 (13.2)	807 (14.0)	3,186 (57.4)	502 (14.4)	164 (7.3)	231 (12.3)	38 (7.6)	102 (21.5)	283 (13.6)	789 (12.5)
US census region										
South	3,662 (51.2)	2,407 (41.7)	295 (5.3)	1,655 (47.5)	1,128 (50.2)	1,061 (56.3)	185 (36.9)	201 (42.3)	1,048 (50.4)	3,124 (49.5)
West	1,041 (14.6)	1,270 (22.0)	5,144 (92.6)	522 (15.0)	102 (4.5)	262 (13.9)	8 (1.6)	165 (34.7)	281 (13.5)	831 (13.2)
Midwest	1,432 (20.0)	1,266 (21.9)	91 (1.6)	690 (19.8)	915 (40.7)	281 (14.9)	283 (56.4)	72 (15.2)	454 (21.8)	1,224 (19.4)
Northeast	1,019 (14.2)	834 (14.4)	25 (0.5)	616 (17.7)	102 (4.5)	280 (14.9)	26 (5.2)	37 (7.8)	296 (14.2)	1,134 (18)
Urbanicity										
Urban	6,438 (90.0)	5,260 (91.1)	5,399 (97.2)	3,236 (92.9)	2,024 (90.1)	1,695 (90.0)	430 (85.7)	439 (92.4)	1,825 (87.8)	5,612 (88.9)
Rural	716 (10.0)	517 (8.9)	156 (2.8)	247 (7.1)	223 (9.9)	189 (10.0)	72 (14.3)	36 (7.6)	254 (12.2)	701 (11.1)
Healthcare utilization and outcomes										
Length of stay, d	13 (7, 24)	8 (4, 16)	5 (3, 10)	9 (5, 16)	6 (3, 12)	11 (5, 20)	6 (3, 13)	11 (4, 24)	7 (4, 15)	11 (6, 21)
ICU-level care	3,642 (50.9)	1,953 (33.8)	1,172 (21.1)	1,221 (35.1)	606 (27.0)	532 (28.2)	152 (30.3)	200 (42.1)	581 (27.9)	2,689 (42.6)
IMV receipt	2,429 (34.0)	1,318 (22.8)	526 (9.5)	805 (23.1)	326 (14.5)	315 (16.7)	84 (16.7)	114 (24.0)	342 (16.5)	1,839 (29.1)
In-hospital death	1,267 (17.7)	761 (13.2)	248 (4.5)	565 (16.2)	162 (7.2)	188 (10.0)	45 (9.0)	71 (14.9)	169 (8.1)	976 (15.5)

*Values are median (interquartile range) for continuous variables (median age) and number (%) for categorical variables. Cells containing <5 hospitalizations are not shown. ICU, intensive care unit; IMV, invasive mechanical ventilation; NA, not applicable; NH, not Hispanic or Latino.

†Sex was unknown for 9 hospitalized patients.