

Occurrences by Region and Age Groups and Antifungal Susceptibility Profiles of Opportunistic Filamentous Fungal Pathogens Collected in 8 Years of Global Surveillance

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Introduction

- Mould invasive infections have high mortality rates and due to the limited data available regarding isolates causing these infections, there is a reliance in surveillance and epidemiological data to understand the impact of infections caused by filamentous fungi.
- The knowledge of the geographic and age group variations in the organisms causing mould invasive infections is important to guide individual patient treatment, define treatment guidelines, and improve early recognition and timely initiation of appropriate antifungal treatment.
- We evaluated the occurrence of mould isolates causing invasive infections by region and age in 8 years of global surveillance and reported on the activity of systemic agents tested against the main mould species/groups.

Materials and Methods

- A total of 2,376 mould isolates were collected from invasive sources in 61 hospitals during 2017–2024.
- Only 1 isolate per patient episode was included.
- All isolates were identified by MALDI-TOF MS and/or ITS and β -tubulin sequencing.
- Isolates were tested by CLSI reference broth microdilution method following the M38 guidelines to determine minimum inhibitory concentration (MIC) or minimum effective concentration (MEC) values.

Results

- Of the 2,376 invasive mould isolates collected from 2017 to 2024, 44.8% were collected in Europe, 33.0% in North America and 20.5% in Asia-Pacific.
 - Few isolates (1.8%) were collected in Latin America, limiting the analysis for this region.
- Aspergillus fumigatus* was the most common species observed among the isolates in all three continents (Figure 1).
- Aspergillus* section Nigri, *A. section Flavi*, *Mucorales* and *Fusarium* spp. were the most common moulds after *A. fumigatus* regardless of the geographic region (Figure 1).
- These species were also the most common among children (<18 year; n=157 overall), adults (18–64 years; n=1039) and older adults (>65 years; n=933; Figure 2).
 - Patient age was not available for 18 isolates that were not included in this analysis.
- The rates of non-fumigatus *Aspergillus* spp. were higher in Asia-Pacific (35.6%) and Latin America (38.1%) when compared to Europe and North America (26–27%; Figure 3).
- Non-fumigatus *Aspergillus* spp. were more common in adults (28.9%) and older adults (30.1%) when compared to children (18.5%).
- The activity of systemic antifungals against main mould species/groups is listed in Table 1.
- Mould-active triazoles exhibited good activity against most of the *Aspergillus* spp., but poor activity against *Fusarium* species and *Lomentospora prolificans*.
- Voriconazole and the echinocandins had limited activity against the *Mucorales*.

Conclusions

- A. fumigatus*, *A. section Nigri* and *A. section Flavi*, *Mucorales* and *Fusarium* spp. were the most common moulds regardless of geographic region or patient age group.
- Despite the prevalence of common species, some differences in geographic regions and age groups were noted for non-fumigatus *Aspergillus* spp.
- The variations in the susceptibility profiles among mould species highlight the importance of continuous surveillance and availability of susceptibility data of filamentous fungi causing invasive infections that help guide treatment decisions.

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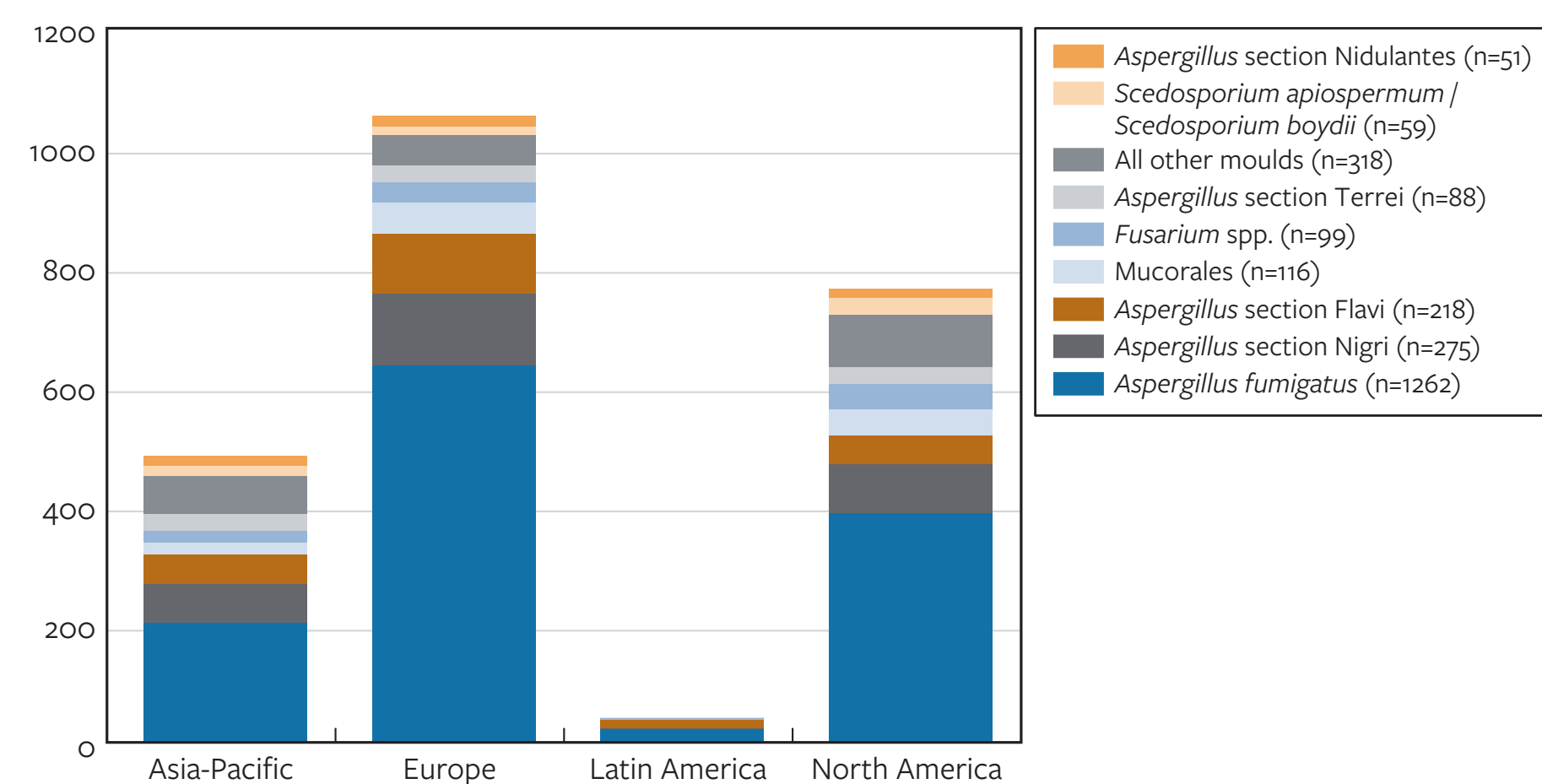
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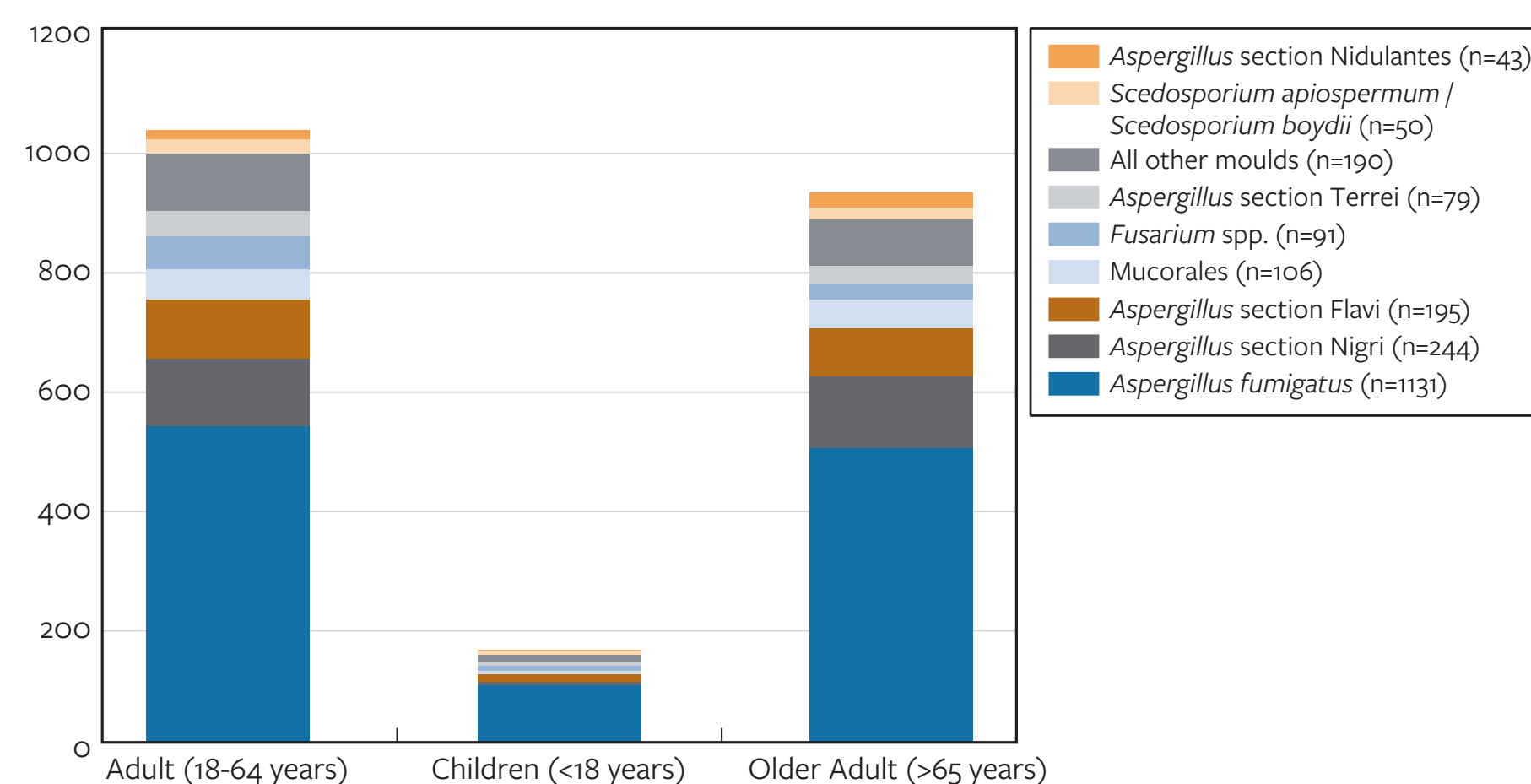
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Figure 1. Distribution of the main mould species by continent



All other moulds include: *Alternaria alternata* (2), *Aspergillus caelatus* (1), *A. fumisynnematus* (1), *A. hirsutisukae* (1), *A. lentulus* (8), *A. melleus* (1), *A. ochraceus* species complex (1), *A. sclerotiorum* (4), *A. sydowii* (4), *A. thermomutatus* (2), *A. udagawae* (2), *A. ustus* (5), *A. ustus* species complex (10), *A. versicolor* (8), *Aureobasidium pullulans* (1), *Exophiala attenuata* (2), *E. dermatitidis* (13), *Lomentospora prolificans* (24), *Medicopsis romeroi* (2), *Microascus cirrosus* (2), *Monascus ruber* (1), *Paecilomyces variotii* (12), *Penicillium chrysogenum* (2), *P. citrinum* (3), *P. georgiense* (1), *Phaeoacremonium parasiticum* (1), *Pleurostomophora richardsiae* (1), *Pseudophthomyces sacchari* (1), *Purpureocillium lilacinum* (19), *Rasamsonia argillacea* (6), *R. argillacea* species complex (5), *Sarocladium kilense* (1), *Scedosporium aurantiacum* (13), *S. dehoogii* (3), *Scopulariopsis brevicaulis* (2), *S. brevicaulis* / *Scopulariopsis brumptii* (3), *Trichoderma longibrachiatum* (1), unsp. *Aspergillus* (4), unsp. *Bipolaris* (1), unsp. *Chaetomium* (1), unsp. *Coprinellus* (2), unsp. *Curvularia* (11), unsp. *Exophiala* (1), unsp. *Paecilomyces* (8), unsp. *Penicillium* (1), unsp. *Phaeoacremonium* (1), unsp. *Phialemoniopsis* (1), unsp. *Sarocladium* (1), unsp. *Scedosporium* (1), unsp. *Scopulariopsis* (3), unsp. *Trichoderma* (1), and *Verruconis gallopava* (2).

Figure 2. Distribution of the main mould species by age group



Patient age was not available for 18 isolates. *All other moulds* include: *Alternaria alternata* (2), *Aspergillus caelatus* (1), *A. hirsutisukae* (1), *A. lentulus* (8), *A. melleus* (1), *A. ochraceus* species complex (1), *A. sclerotiorum* (4), *A. sydowii* (3), *A. thermomutatus* (2), *A. udagawae* (2), *A. ustus* (5), *A. ustus* species complex (9), *A. versicolor* (8), *Aureobasidium pullulans* (1), *Exophiala attenuata* (2), *E. dermatitidis* (13), *Lomentospora prolificans* (22), *Medicopsis romeroi* (1), *Microascus cirrosus* (2), *Monascus ruber* (1), *Paecilomyces variotii* (12), *Penicillium chrysogenum* (2), *P. citrinum* (3), *P. georgiense* (1), *Pleurostomophora richardsiae* (1), *Purpureocillium lilacinum* (18), *Rasamsonia argillacea* (6), *R. argillacea* species complex (5), *Sarocladium kilense* (1), *Scedosporium aurantiacum* (13), *S. dehoogii* (3), *Scopulariopsis brevicaulis* (1), *S. brevicaulis* / *Scopulariopsis brumptii* (3), *Trichoderma longibrachiatum* (1), unsp. *Aspergillus* (4), unsp. *Bipolaris* (1), unsp. *Chaetomium* (1), unsp. *Coprinellus* (2), unsp. *Curvularia* (8), unsp. *Exophiala* (1), unsp. *Paecilomyces* (7), unsp. *Penicillium* (1), unsp. *Phialemoniopsis* (1), unsp. *Sarocladium* (1), unsp. *Scedosporium* (1), unsp. *Scopulariopsis* (1), unsp. *Trichoderma* (1), and *Verruconis gallopava* (2).

Figure 3. Distribution of non-fumigatus *Aspergillus* spp. among regions and age groups

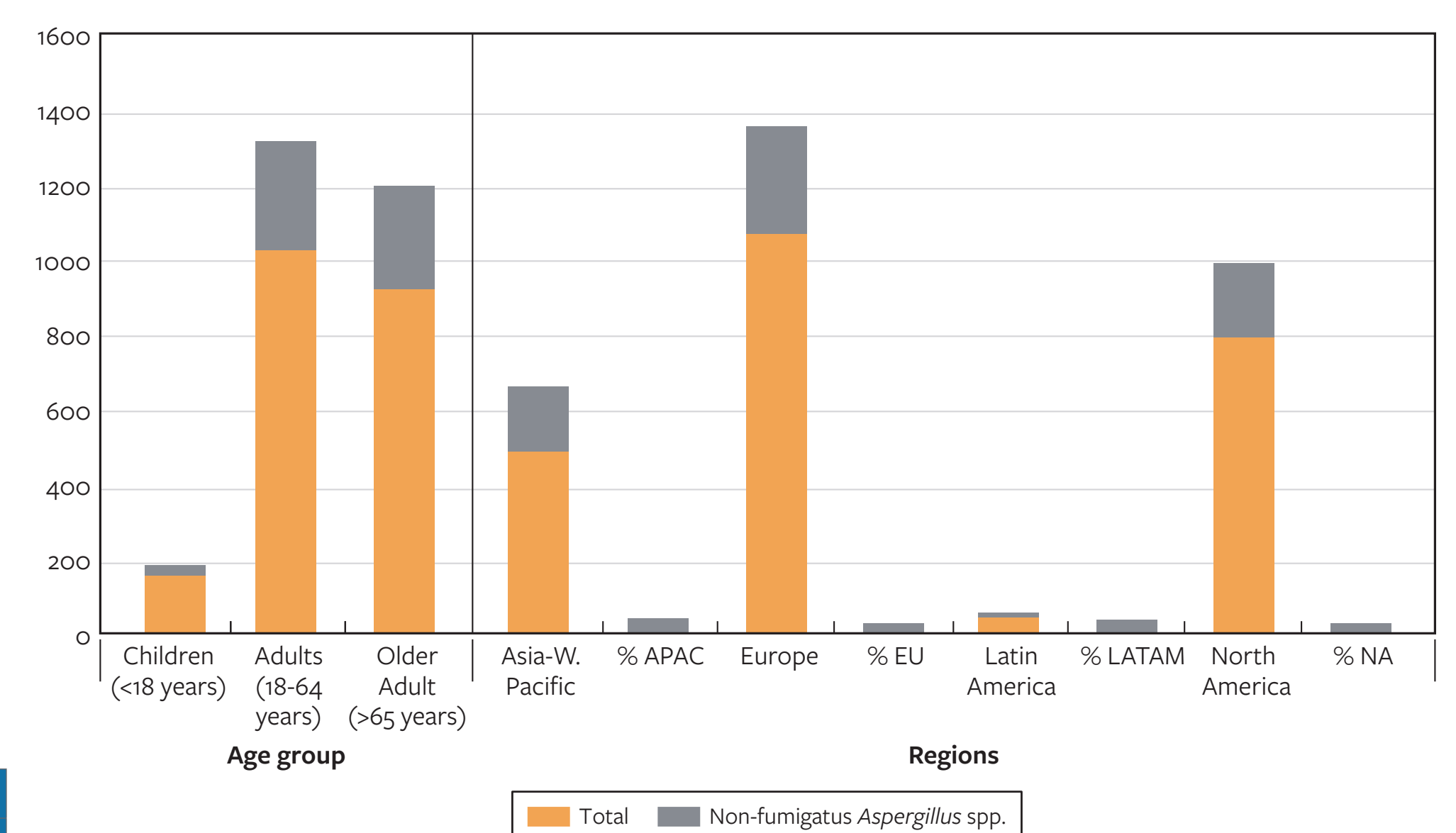


Table 1. Activity of systemic antifungal agents against main species/groups of filamentous fungi

Organism (no. tested)	MIC _{50/90} for azoles and amphotericin B and MEC _{50/90} for echinocandins (mg/L)				Isavuconazole	Voriconazole	Itraconazole	Posaconazole	Anidulafungin	Caspofungin	Amphotericin B
	Isavuconazole	Voriconazole	Itraconazole	Posaconazole							
<i>Aspergillus fumigatus</i> (n=1262)	0.5/1	0.5/0.5	1/1	0.25/0.5	0.015/0.03	0.03/0.06	1/2				
<i>Aspergillus</i> section Flavi (n=218)	0.5/1	0.5/1	0.5/1	0.25/0.5	0.008/0.015	0.015/0.03	2/2				
<i>Aspergillus</i> section Nigri (n=275)	2/4	1/2	2/8	0.5/1	0.004/0.015	0.015/0.03	0.5/1				
<i>Aspergillus</i> section Terrei (n=88)	0.5/0.5	0.25/0.5	0.5/0.5	0.25/0.25	0.015/0.03	0.015/0.06	2/4				
<i>Aspergillus</i> section Nidulantes (n=51)	0.12/0.25	0.12/0.25	0.5/1	0.25/0.5	0.015/0.03	0.03/2	2/2				
<i>Aspergillus</i> section Usti (n=15)	2/8	4/8	8/8	>8/8	0.03/0.12	0.5/2	1/2				
Other <i>Aspergillus</i> spp. (n=37) ^a	2/2	1/4	1/4	0.5/1	0.03/0.06	0.03/0.06	2/2				
<i>Mucorales</i> (n=116)	>8/8	>8/8	>8/8	0.5/8	>4/4	>4/4	0.5/1				
<i>Fusarium</i> spp. (n=99)	>8/8	>8/8	>8/8	>8/8	>4/4	>4/4	2/2				
<i>Scedosporium apiospermum/boydii</i> (n=59)	8/8	1/2	>8/8	2/8	2/4	1/4	4/4				
<i>Lomentospora prolificans</i> (n=24)	>8/8	>8/8	>8/8	>8/8	4/4	>4/4	>4/4				
<i>Purpureocillium lilacinum</i> (n=19)	0.5/1	0.25/0.5	>8/8	0.5/1	0.12/0.5	0.06/1	>4/4				
<i>Exophiala dermatitidis</i> (n=13)	0.5/1	0.25/0.25	0.5/0.5	0.25/0.25	>4/8	4/8	0.5/1				
<i>Scedosporium aurantiacum</i> (n=13)	8/8	0.5/1	>8/8	>8/8	>4/4	>4/4	>4/4				
<i>Paecilomyces variotii</i> (n=12)	8/8	4/8	0.25/0.5	0.25/0.5	0.008/0.008	0.5/1	0.12/0.5				
<i>Rasamsonia argillacea</i> species complex (n=11)	>8/8	>8/8	2/8	2/8	0.008/0.015	0.015/0.015	1/2				
Other Moulds (n=64) ^b	1/8	1/8	0.5/8	0.25/8	0.25/4	0.12/4	0.5/4				

^a Other *Aspergillus* spp. include: *Aspergillus caelatus* (1), *A. fumisynnematus* (1), *A. hirsutisukae* (1), *A. lentulus* (8), *A. melleus* (1), *A. ochraceus* species complex (1), *A. sclerotiorum* (4), *A. sydowii* (4), *A. thermomutatus* (2), *A. udagawae* (2), *A. versicolor* (8), and unsp. *Aspergillus* (4).

^b Other moulds include: *Alternaria alternata* (2), *Aureobasidium pullulans* (1), *Exophiala attenuata* (2), *Medicopsis romeroi* (2), *Microascus cirrosus* (2), *Monascus ruber* (1), *Penicillium chrysogenum* (2), *P. citrinum* (3), *P. georgiense* (1), *Phaeoacremonium parasiticum* (1), *Pleurostomophora richardsiae* (1), *Pseudophthomyces sacchari* (1), *Sarocladium kilense* (1), *Scedosporium dehoogii* (3), *Scopulariopsis brevicaulis* (2), *S. brevicaulis* / *Scopulariopsis brumptii* (3), *Trichoderma longibrachiatum* (1), unsp. *Bipolaris* (1), unsp. *Chaetomium* (1), unsp. *Coprinellus* (2), unsp. *Curvularia* (11), unsp. *Exophiala* (1), unsp. *Paecilomyces* (8), unsp. *Penicillium* (1), unsp. *Phaeoacremonium* (1), unsp. *Phialemoniopsis* (1), unsp. *Sarocladium* (1), unsp. *Scedosporium* (1), unsp. *Scopulariopsis* (3), unsp. *Trichoderma* (1), and *Verruconis gallopava* (2).

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