

# Burden of Serious Fungal Infections in Australia

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## Abstract

**Background:** We estimated the burden of serious fungal infections in Australia, population 23.5 million due to their consequences on human health.

**Methods:** Data on invasive candidiasis (IC), cryptococcosis, invasive aspergillosis (IA), other mold and fungal infections were analyzed. Population data were largely from the 2013 Australian Bureau of Statistics. On occasion, we used fungal infections in specific populations to estimate incidence. HIV, stem cell transplantation (SCT) and leukemia cases were from registries and critical care bed data from hospitals.

**Results:** Estimated numbers/rates of selected infections are in the Table (updated since abstract submission). In the 2000s, overall candidemia incidence was relatively low and was 4.4/10<sup>5</sup> person in neonates; ICU acquisition occurred in 1.43% patients present for ≥72h. Annual incidence of cryptococcosis was highest in Aborigines; 31% cases occur in immunocompetent hosts. *C. gattii* infection incidence is highest in the north. Proven/probable IA in SCT patients and AML/myelodysplasia is estimated at 15.2 (6 centers). Center rates of invasive mycoses in ALL were 14-32%. Rate of non-*Aspergillus* mold mycoses was 1.3/106/y (mucormycosis, 44%; 0.6/10<sup>6</sup>, 21 cases). *Scedosporium* and melanized fungi cause 30% and 15% cases, respectively. Estimated asthma prevalence in adults are 5-8%; assuming 2.5% asthmatics have ABPA, 57,500 ABPA patients are likely and 75,944 with SAFS. 559,136 Australia women get recurrent vaginal thrush.

**Conclusion:** From local data and literature estimates of infection prevalence, 1000 people in Australia/y develop candidemia, cryptococcosis, IA and non-*Aspergillus* infections. There is a high burden of vaginal candidiasis, ABPA and SFAS. Uncertainty surrounds estimates but for candidemia and *C. gattii* (recent surveys). There is urgency to validate/modify these.

## INTRODUCTION

The burden of serious fungal infections in Australia is uncertain. Invasive fungal disease (IFD) may be increasing in frequency due to improved diagnostics in medical mycology leading to better recognition, and increase in "at risk" patients with conditions and medical treatments leading to immunosuppression. Understanding of the burden of IFD in Australia is limited as there is no formal systematic or mandatory surveillance programme specific to fungal infections, although active surveillance networks have existed for candidemias (recent surveys) and cryptococcosis (recent surveys, voluntary laboratory reporting). In addition, debilitating skin, mucosal chronic and allergic fungal diseases, amenable to antifungal therapy have come to greater prominence.

Given the high morbidity of these entities affecting diverse patient populations, here, we have attempted to quantify the national burden of a number of serious fungal infections

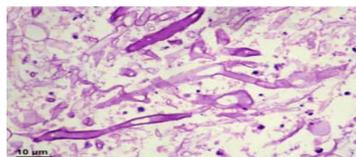


Fig.1 Broad irregular hyphae of *Rhizopus* spp.

## METHODS

We estimated the annual incidence of the following IFDs: Candidemia including that in neonates, cryptococcosis including *Cryptococcus gattii* infection, invasive aspergillosis (IA), and non-*Aspergillus* mold infections (Fig. 1). In addition, we have estimated the prevalence of allergic bronchopulmonary aspergillosis (ABPA) and severe asthma with fungal sensitisation (SAFS) and recurrent vaginal thrush. Information on population-based incidence, prevalence or total burden of these conditions in Australia is very limited. Where such data were available, we included it in the study (population data were from the 2013 Australian Bureau of Statistics).

Where the information was not available we used a pragmatic approach for the fungal condition:

1. We considered which populations were most at risk of the condition
2. We sought published or local estimates for incidence or prevalence measures for the condition in these specific risk populations eg. stem cell transplantation (SCT) or asthma patients
3. Critical care bed data were obtained from hospitals

## RESULTS

Table 1 shows the estimated numbers/rates of selected fungal infections.

In the 2000s, the following burden estimates were calculated:

**Candidemia** incidence was relatively low – 440 cases/yr with an incidence of 1.87/10<sup>6</sup> population but was significantly higher at 4.4/10<sup>5</sup> in neonates (Fig. 2). ICU acquired candidemia occurred in 1.43% patients present in the unit for 72 hours or more.

**With respect to cryptococcosis**, approximately 88 cases occur per year (Fig. 3) with 13 (14.8%) due to *C. gattii*. Annual incidence of cryptococcosis is highest in Aborigines (19.8/10<sup>6</sup> persons) and 31% of cases occur in immunocompetent hosts. *C. gattii* infection incidence is highest in northern Australia (Fig. 4).

**Invasive non-*Aspergillus* mold infections:** for proven/probable infections, 27 cases/yr of which 44% are due to mucormycetes (21 cases; 0.6/10<sup>6</sup> persons/y). *Scedosporium* and melanized fungi cause 30% and 15% cases, respectively.

**ABPA cases in asthma** were estimated to occur in 57,500 persons/yr in those with respiratory disease and **SAFS** in 75,944 individuals.

**IFD including IA** (based on 2012 data), **560 cases/yr** occurred at rates of 3-28.5% of individuals with hematological malignancies and/or SCT, and were highest in ALL (28.5%) and SCT (25%).

## RESULTS

**Table 1. Estimated numbers or rates of selected fungal infections: Australia.**

The Australian population at the end of 2013 was about 23,574,576 with 18.2% under the age of 15 years, and 14.4% over 65 years.

Infection	No. infections/yr (respiratory)	No. infections/yr (cancer/transplant)	Total burden/yr	Rate/10 <sup>5</sup> /yr
Candidemia	NA	130	440	1.87
Recurrent vaginal candidiasis (4x/y +)	-	-	559,136	6212
ABPA	57,500	-	57,500	245
SAFS	75,944	-	75,944	323
Non- <i>Aspergillus</i> mold infections	8	11	27	0.13
Cryptococcosis	NA	44	88	6.4
<i>Cryptococcus gattii</i> infection	8	9	13	0.62
IA and other IFD	-	560	560	3-29%

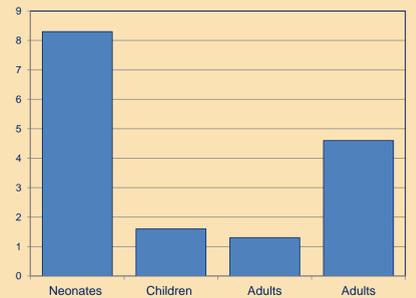
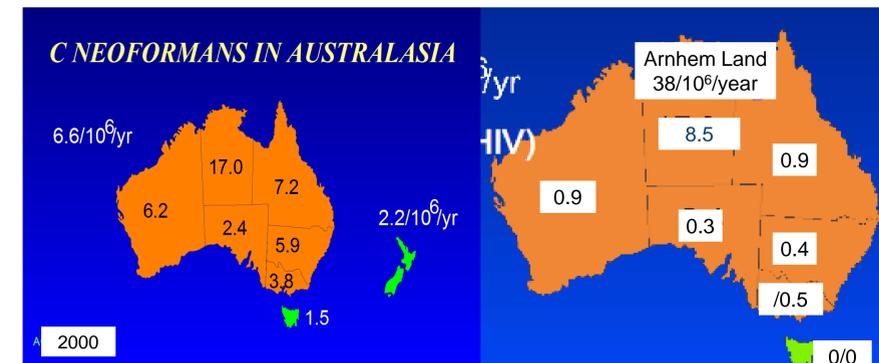


Fig. 2 Incidence candidemia cases per 100,000 population per annum

Figure 3 (Left). Incidence per 10<sup>6</sup> persons of cryptococcosis (all cases)

Figure 4 (Right). Population incidence *C. gattii* 2000-2007



**Cryptococcosis:: Overall incidence 6.6 per 10<sup>6</sup> population**

***C. gattii*: Overall incidence 0.6 per 10<sup>6</sup> population**

## Conclusions

- Estimating the burden fungal infections is challenging due to the lack of a dedicated mandatory systematic surveillance system and by limited sensitivity of traditional diagnostic tests.
- From local data and literature estimates, about 1560 people per year develop candidemia, cryptococcosis, IA and non-*Aspergillus* mold infections
- The burden of IFD is significant in vulnerable populations and cryptococcosis is especially prevalent in Aborigines.
- There is a high burden of vaginal candidiasis, ABPA and SAFS
- There is a need to validate and/or modify these estimates and institution of systematic surveillance is essential to improve outcomes.

## Acknowledgements