

## A Brief Note on Invasive Fungal Disease

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### Description

Fungal diseases have emerged as important causes of morbidity and mortality worldwide. The rising incidence of fungal diseases is due to increases in the number of susceptible individuals including people living with human immunodeficiency virus HIV/AIDS, cancer patients, immunosuppressive therapy, organ transplant recipients and patients requiring critical care with prolonged hospitalization.

### Invasive Fungal Disease

More than 90% of fungal-related deaths result from species that belong to one of the four genera. The species of these fungal genera cause a spectrum of diseases which ranges from superficial conditions of the outer keratinised layer of the skin to Invasive Fungal Disease (IFD) of the bloodstream and/or deep seated organs such as the brain, heart, liver, lungs, spleen and the kidneys. Of particular concern is the high mortality rate associated with invasive fungal infections, which often exceeds 50% despite antifungal therapy.

Africa, although not unique in this context, is a favourable environment for fungal infections, given the high burden of risk factors. An online survey was developed asking about laboratory infrastructure and antifungal drug availability. We received 40 responses of 164 researchers contacted from 21 African countries. Only five institutions of 40 located potentially fulfilled the minimum laboratory requirements for European Confederation of Medical Mycology Excellence Centre blue status. Difficulties included low access to susceptibility testing for both yeasts and moulds (available in only 30% of institutions) and antigen detection (available in only 47.5% of institutions as an in-house or outsourced test), as well as access to mould-active antifungal drugs such as amphotericin B deoxycholate, itraconazole voriconazole and posaconazole (5-0%). United and targeted efforts are crucial to face the growing challenges in clinical mycology.

Approximately a fifth of the world's people live in Africa, a continent with a propitious environment for fungal infections. The continent is marked by social and health inequalities, with a national health insurance scheme absent in most countries. Additionally, a large proportion of its population lives in rural settings and are exposed to environmental factors that increase the risk for fungal diseases. Africa has the largest population

living with HIV, AIDS, and tuberculosis globally, which are major risk factors for fungal infections. Meanwhile, access to treatment for these three conditions is still low in many countries, and has become even worse with the COVID-19 pandemic. This problem is mainly attributed to poorly funded and overburdened health systems in many African countries; thus dealing with the probably high burden of fungal infections is a challenge.

### Fungal Infections

Despite the global importance of superficial and invasive mycoses, there is still little information regarding the epidemiology of fungal infections in some areas of the world, including in Africa. Medical mycology has made important advances, but non-specific signs and symptoms and the rapid progression of fungal disease in immunocompromised patients continue to present a challenge to clinicians and laboratories. Notable limitations include few resources and investments in clinical mycology and diagnostic resources, as well as difficulties in accessing antifungal therapy. A poor awareness of fungal diseases among health-care professionals and policy makers, as well as the unaffordability of, toxicity of, and little access to antifungal treatment options are some of the challenges facing the continent.

With few exceptions (such as testing for Cryptococci antigen), advances within the past 5 years in non-culture-based diagnostics have not reached most Low-Income and Middle-Income Countries (LMICs). Therefore, it is necessary to assess the present status of the diagnosis of fungal infections in these regions to guide health professionals, patients, and policy makers. Africa has not yet been comprehensively evaluated for its capability to diagnose and treat fungal diseases. These studies are important not only for epidemiological purposes, but also to guide the appropriate implementation of preventive, diagnostic, and therapeutic measures in medical mycology. Hence, under the umbrella of the European Confederation of Medical Mycology (ECMM) and the International Society for Human and Animal Mycology (ISHAM), we surveyed African institutions to obtain an overview of the current state of mycological laboratory capacities and availability of antifungal treatment in the field of invasive fungal diseases.

We designed a cross-sectional survey with 29 questions about the profile and size of institutions, antifungal drug availability, laboratory infrastructure, and methods used to identify

pathogens and antifungal susceptibility, as well as antigen detection and molecular tests. The institutions were classified according to whether the laboratories potentially met the ECMM criteria for blue, silver, gold, or diamond status, or did not meet the criteria. The minimal requirements for the blue status are the identification of relevant yeasts and moulds, susceptibility testing on yeasts and moulds according to standard procedures, and the performance of antigen ELISA for

antigen. The criteria used for the classification of mycology centres are not restricted to the laboratory, but also consider the clinical and epidemiological dimensions, involvement in clinical trials, and in part depend on the type of patients cared. This classification procedure was not an accreditation visit or round organized by the ECMM. Instead, we only checked the level at which centres were likely to be accredited if they had formally applied.