

*Communication*

# **Diagnosis of Breakthrough Fungal Infections in the Clinical Mycology Laboratory: An ECMM Consensus Statement**

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### **3. Consensus Recommendations**

#### *3.1. Diagnosis of Breakthrough Infections Caused by Yeasts*





*tropicalis* *Cryptococcus neoformans/gattii* *C. albicans*, *C. auris* *C. glabrata* *C. krusei* *C. parapsilosis* *C.*

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*Microascus*

*Scopulariopsis* *Rasamsonia*

*Aspergillus*

*n*

*Aspergillus*

*Aspergillus*

*Aspergillus*

*A. fumigatus*



3.3. Diagnosis of Breakthrough Infections due to Endemic Mycoses

*Paracoccidioides Sporothrix*                      *Blastomyces*   *Coccidioides*   *Emergomyces*   *Histoplasma*  
*Talaromyces marneffeii*                      *Penicillium marneffeii*

*Histoplasma*

*Coccidioides*   *Histoplasma*

*Blastomyces*

*Coccidioides*

*Histoplasma*

*Blastomyces*  
*Paracoccidioides*

*Coccidioides*  
*Sporothrix*

*Histoplasma*  
*Talaromyces*



*Aspergillus*

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**References**

*Mycoses* **2020** *63*

*J. Microbiol. Immunol. Infect.* **2015** *48*

*Mycoses* **2019** *62*

*J. Fungi* **2020** 6

*Curr. Fungal Infect. Rep.* **2019** 13

*Curr. Opin. Infect. Dis.* **2017** 30

*Mycoses* **2017** 61

*Int. J. Antimicrob. Agents* **2015** 46

*Med. Mycol.* **2017** 55

*Mycoses* **2013** 56

*Mycoses* **2017** 60

*Mycoses* **2018** 61

*J. Clin. Microbiol.* **2020** 58

*Clin. Microbiol. Rev.* **2020** 33

*Clin. Microbiol. Infect.* **2012** 18

*J. Clin. Microbiol.* **2016** 54

*Med. Mycol.* **2019** 57

*Curr. Opin. Infect. Dis.* **2019** 32

*Crit. Care* **2010** 14

*Clin. Infect. Dis.* **2005** 41

*Bone Marrow Transplant.* **2011** 47

*J. Clin. Microbiol.*

**2018** 56

*J. Fungi* **2020** 6

*J. Clin. Microbiol.* **2011** 50

52

*Clin. Infect. Dis.* **2011**

*Mycoses* **2015** 59

*Dis.* **2019** 70

*Clin. Infect.*

127

*J. Clin. Investig.* **2017**

*J. Clin. Microbiol.* **2012** 51

*Clin. Infect. Dis.* **2012** 54

*Medicina Tropical de São Paulo* **2015** 57  
*First WHO Model List of Essential in Vitro Diagnostics*

*Revista do Instituto de*

**2020** 6

*J. Fungi*

*J. Fungi* **2018** 4

*Futur. Microbiol.* **2019** 14

*J. Clin. Microbiol.* **2010** 49

*Mycol.* **2019** 58

*Med.*

66

*Clin. Infect. Dis.* **2018**

*Open Forum Infect. Dis.* **2020** 7



*J. Fungi* **2020** *6*

**2016**

*Infect.* **2018** *77*

*J Clin Microbiol.*

*J.*

*J. Infect.* **2019** *78*

*Med.* **1999** *78*

*Expert Rev. Mol. Diagn.* **201.7(i)4.8(nf.2018.10.)TJ**

**5**

*J. Clin. Microbiol.* **2014** *52*

*Expert Rev. Anti-infective Ther.* **2018** *17*

*Mycoses* **2019** *62*

*Med. Mycol.* **2019** *58*

*Clin. Infect. Dis.* **2020**

*Expert*

*Rev. Mol. Diagn.* **2020** *2020*

*Med. Mycol.* **2019** *58*

*PLoS ONE* **2014**

*Clin. Infect. Dis.*

*J. Crit. Care* **2018** *47*

*Front. Immunol.*

**2019** *10*

*J. Fungi* **2019** *5*

*Mycoses* **2017** *60*

*J.*

*Infect.* **2019** *78*

*J. Infect.* **2017** *75*

*Nat. Prod. Rep.* **2014** *31*

*Clin. Infect. Dis.* **2014** *59*

*Front. Microbiol.*

**2018** *9*

*J. Clin. Microbiol.*

**2017** *55*

*Antimicrob. Agents*

*Chemother.* **2017** *61*

*Int. J. Antimicrob. Agents* **2018** *52*

*BMC Infect. Dis.* **2014** *14*

*Med. Mycol.* **2014** *53*

*J. Clin. Microbiol.* **2018**

*J. Fungi* **2020** 6

*J. Clin. Microbiol.* **1986** 23

*Am. Rev. Respir. Dis.* **1986** 133

*J.*

*Infect. Dis.* **1987** 155

*Revista Iberoamericana de Micología* 22

*Braz. J. Infect. Dis.* **2017** 21

*PLoS ONE* **2018** 13

*J. Fungi* **2019** 5

*Mycopathologia* **2008** 165

*Clin. Vaccine Immunol.* **2012** 19

*PLoS Negl. Trop. Dis.* **2020** 14

*PLoS ONE* **2011** 6

*J. Clin. Microbiol.* **1998** 36

*Mycoses* **2020** 63

*J.*

*Travel Med.* **2011** 18

*J. Clin. Microbiol.* **2004** 42

*Diagn. Microbiol.*

*Infect. Dis.* **2011** 69

*Clin. Vaccine Immunol.*

**2011** 19

*J. Clin. Microbiol.* **2015** 53

*J. Fungi* **2020** 6

*Clin. Infect. Dis* **1997** 24

*Clin. Infect.*

*Dis.* **2008** 47

*Am. J. Clin. Pathol.* **2018** 149

*Am. J. Med.* 87

*Front. Microbiol.* **2020** 10

*Microbiol.* **2003** 41

*J. Clin.*

**2012** 50

*J. Clin. Microbiol.*

*J. Clin. Microbiol.* **2011** 49

*Mycopathol.* **2010** 170

*Chest* **2013** 143

*J. Fungi* **2019** 6

*J. Fungi* **2020** *6*

*J. Med. Microbiol.* **2007** *56*

*J. Clin. Microbiol.* **2012** *50*

