Table 1. Characteristics of Breakthrough IFI Among Hematologic Malignancy Patients Receiving ISA Prophylaxis

Age/ Gender	Disease	IFI site	Organism	Diagnostic Test	ANC Nadir	Neutropenia Duration (days)	Duration ISA (days)	Outcome (12 weeks)
32M	AML	Lung	*Aspergillus fumigatus*	BAL: fungal culture	<10	118	38	Death
65M	Aplastic anemia	Blood, lung	*Scedosporium apiospermum*	Blood culture	<100	14	13	Death
44F	ALL	Lung	*Aspergillus nigri*	Lung FNA: PCR, path	0	143	52	Partial response
63F	AML	Lung	Unknown*	Lung FNA negative	110	90	73	Partial response

*Probable IFI; other threecases were proven.

Conclusion. We demonstrate a 12% rate of breakthrough IFI among hematologic malignancy patients on ISA prophylaxis, similar to published rates (10–15%) on posaconazole prophylaxis. Further study is needed to characterize risk factors for and epidemiology of ISA breakthrough.

Disclosures. **S. B. Doernberg**, Genentech: Consultant, Consulting fee. Actelion: Consultant, Consulting fee.

416. Culture-Documented Invasive Mold Infections (cIMIs) at MD Anderson Cancer Center (MDACC) in Houston, Texas Pre- and Post-Hurricane Harvey

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Background. Hurricane Harvey caused record flooding in late August 2017. As flood damage causes mold overgrowth, excess rates of IMIs in immunocompromised cancer patients is of concern.

Methods. We compared the rates (patient-1,000 days) of cIMIs (EORTC/MSG criteria), in the period 7 months preceding and 7 months following hurricane Harvey, diagnosed in cancer patients at our institution. We focused on the four molds (*Aspergillus*, *Fusarium*, *Mucorales*, *Scedosporium*) that account for the vast majority of cIMIs in our patient population.

Results. No changes in cIMI rates (0.184 pre-Harvey vs. 0.171 post–Harvey, P = NS) and mold distribution as causes of cIMIs were seen (table). No increased cases of cIMIs were encountered amongst different services (table), including patients with lymphoma/multiple myeloma or solid tumors (40% pre-Harvey vs. 31% post-Harvey, P = NS).

Conclusion. Despite concerns for extensive environmental mold exposure after hurricane Harvey, we did not detect increased rates of cIMIs nor the emergence of unusual molds as causes of IMIs in high-risk cancer patients at MDACC, including in patients with solid tumors, where mold-active prophylaxis is not used. Whether excess IMI cases not fitting the traditional diagnostic criteria (e.g., biomarker-positive but culture-negative IMIs) or pneumonias not requiring hospitalization were seen, requires further study.

	Inpatient Hospital Infection Rates 7 Months Pre Harvey	Inpatient Hospital Infection Rates 7 Months Post Harvey
Aspergillus	0.1506	0.1621
Mucorales	0.0167	0.0000
Fusarium	0.0167	0.0085
Scedosporium	0.0000	0.0000
Total	0.1840	0.1706
	Inpatient Service Line Infection Rates 7 Months Pre Harvey	**Inpatient Service Line Infection Rates 7 Months Pre Harvey**
MM/Lymphoma	0.3185	0.2441
Solid Tumor	0.0588	0.0594
Leukemia	0.3655	0.5052
Stem Cell Transplant	0.1835	0.184

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417. Clinical Mycology in Latin America and the Caribbean: Diagnostic Capabilities and Antifungal Therapy

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Background. No data are available about diagnostic capabilities and practice in clinical mycology in Latin America and the Caribbean.

Methods. Here, we conducted an online survey aimed to assess availability, routine diagnostic procedures and access to therapy. Contacts were made through LIFE initiative (Leading International Fungal Education), SBI (Brazilian Society of Infectious Diseases), SBAC (Brazilian Society of Clinical Analysis), and SBM (Brazilian Society of Microbiology) during the first 2018 trimester.

Results. We got 128 responses, each one from a single healthcare institution. Countries included Brazil (96), Mexico (9), Colombia (5), Uruguay (3), Guatemala (3), Argentina (2), Chile (2), Paraguay (2), Venezuela (2), Barbados (1), Ecuador (1), Honduras (1), and Peru (1). Most frequent institution profiles were public (38%), private (14%), and university hospitals (22%). Number of hospital beds varied between 12–3,000 (median 200 beds). ICU beds ranged 3–500 (15 beds). Most institutions provided care for hematology (63%) and HIV (31%) patients. Yeast identification was performed by biochemical tests (76%), automated methods (65%), and MALDI-TOF (15%). Twelve percent of responders had access to DNA sequencing. Almost a half (39%) of institutions did not undertake antifungal susceptibility tests, 47% did it only for yeasts, 2% molds. Fifteen (12%) institutions performed antifungal susceptibility tests routinely for all fungal isolates. Automated methods were the most frequently used antifungal susceptibility methodology (38%). Eighty-two (64%) institutions had no access to therapeutic drug monitoring (TDM). Cryptococccal antigen testing was available for 75% of responders.

Conclusion. This survey was the largest and most updated snapshot of the clinical mycology scenario in Latin America and Caribbean. Efforts should be made to improve diagnostic capabilities and equalize regional disparities.

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418. Evaluation of β-D-Glucan (BG) and Galactomannan (GM) Detection Assays in the Diagnosis of Invasive Fungal Infections in High-Risk Pediatric Cancer Patients

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Background. Diagnosing IFD in pediatric patients is challenging: cultures are often negative and diagnostic efficacy of biomarkers such as β-D-glucan assay (BG) and galactomannan assay (GM) is unclear. The 2017 International Pediatric Fever and Neutropenia Guideline Panel recommended against the use of fungal biomarkers for the diagnosis of IFD in pediatric patients.

Methods. We conducted a retrospective chart review of pediatric oncology patients at UCM Comer Children's Hospitals between July 2009 to December 2016 to determine the utility of BG and GM for diagnosis of IFD. Inclusion criteria: neutropenic fever (FN), high risk for IFD (fever >5 days unresponsive to antibiotics or recurrent fever with persistent neutropenia), and ≥1 fungal biomarker sent. IFD was diagnosed using EORTC/MSG criteria with patients divided to two groups: "Proven or likely" and "less likely or unlikely." Data pertaining to possible causes of false-positive BG and GM was collected: presence of bacterial infection, receipt of immunoglobulin (IVIG), albumin or certain antibiotics (i.e., ampicillin/sulbactam or piperacillin/tazobactam)

Results. Of 667 FN episodes (FNEs), 116 FNEs in 74 patients were considered high-risk for IFD and had >1 biomarker sent. BG was sent on 76 FNEs and GM on 115 FNEs,. Underlying diagnoses included: Acute lymphoblastic leukemia (43 cases (37%)), acute myeloid leukemia (27 (24%)), lymphoma (12 (10%)), solid tumors (28 (24%)), others (6 (5%)). Overall, 59 (51%) cases underwent stem cell transplant. Of 15 deaths, five were related to fungal infection. Sensitivity, specificity, positive and negative predictive values for BG are 43%, 87%, 63% and 78%, respectively, and for GM 15%, 95%, 50% and 79%, respectively. False-positive BG was noted in six FNEs. False-positive GM was noted in four FNEs (2 with non-*Aspergillus* molds, and two patient had bacteremia.

Conclusion. Both BG and GM have low sensitivity and positive-predictive value supporting low utility in IFD diagnosis for pediatric patients. Our study shows a false-positive BG may be as high as 250 pg/mL in the absence of clinical and radiological symptoms suggesting IFD. High specificity of the GM may be of value in diagnosing invasive *Aspergillosis* (IA). Novel fungal biomarkers are needed for early IFD detection to improve outcomes.

Disclosures. **All authors:** No reported disclosures.

419. Diagnostic Performance of Immunohistochemistry Test to Differentiate Aspergillosis from Mucormycosis With Formalin-Fixed Tissue Specimens

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Background. Distinguishing aspergillosis from mucormycosis is clinically important as different antifungal agents are required. However, the sensitivity of fungal culture is suboptimal and histomorphologic diagnosis is not always accurate due to morphologic similarities. We investigated the diagnostic performance of immunohistochemistry (IHC) test for diagnosis of aspergillosis and mucormycosis.

Methods. Patients who met the criteria for mycologically proven aspergillosis or mucormycosis and in whom formalin-fixed, paraffin-embedded tissues were available were enrolled at a tertiary hospital from January 1992 to October 2017. Mycologically proven invasive fungal infections were defined as there were the histologic evidence of tissue invasion of hyphae and the recovery of *Aspergillus* species or agents of mucormycosis (*Rhizopus* spp., *Cunninghamella* spp., *Apophysomyces*spp., *Saksenaea* spp., *Absidia* spp., *Mucor* spp.) by culture from sterile specimens. Anti-*Aspergillus* mouse monoclonal antibody (1:50; clone WF-AF-1; LSBio, WA, USA) and anti-*Rhizopus arrhizus* mouse monoclonal antibody (1:100; clone WSSA-RA-1; LSBio, WA, USA) were used for IHC test, and we evaluated the diagnostic performance of IHC test using sensitivity and specificity.

Results. A total of 32 invasive fungal infection including 12 proven mucormycosis and 20 proven aspergillosis were analyzed. The fungal species from sterile sites and diagnostic performance of IHC test for these 30 patients were shown in Table 1.

Conclusion. The IHC test seems to be useful in compensating the limitations of histomorphologic diagnosis in distinguishing between aspergillosis and mucormycosis.

Keywords. Aspergillosis; Mucormycosis; Histomorphology; Immunohistochemistry

Table 1: Diagnostic Performance of Mucormycosis and Aspergillosis Immunohistochemistry Tests in Proven Mucormycosis and Proven *Aspergillosis*

IHC Test Result	Proven Mucormycosis, No. of Cases (n = 12)	Proven Aspergillosis, No. of Cases (n = 20)	Diagnostic Performance % (95% CI)
Mucormycosis			
Positive	12	0	Sensitivity: 100 (70–100)
Negative	0	0	Specificity: 100 (80–100)
Aspergillosis			
Positive	0	18	Sensitivity: 90 (67–98)
Negative	0	2	Specificity: 100 (70–100)

Abbreviations: CI, confidence interval; IHC, immunohistochemistry.

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420. A Rapid PCR Assay Detects Fungemia Due to Mixed *Candida* Species That Is Missed by the Clinical Microbiology Laboratory

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Background. As identified by blood cultures, ~4% of candidemia is caused by mixed *Candida* spp. Studies of PCR-based diagnostics, however, suggest that ≥ 2 spp. can be detected in 6%–36% of candidemia. Our objective was to use molecular methods to determine rates of mixed *Candida* spp. fungemia at our center.

Methods. We devised a rapid, PCR assay that identifies *Candida* spp. by amplifying *ACT1* and accounting for differences in intron sizes. We extracted total DNA from blood culture bottles from 15 patients, from which *Candida* had been recovered by the clinical microbiology laboratory.

Results. Using standard laboratory protocols and MALDI-TOF, candidemia was ascribed to a single *Candida* sp. in 14 patients. In one patient, *C. albicans* and *C. glabrata* co-infection was identified. Using our PCR marker, threepatients (15%) were found to have mixed spp. infections, including the patient known to have *C. albicans/C. glabrata* co-infection. In one patient diagnosed originally with *C. glabrata* fungemia, *C. albicans* was also identified. In one patient diagnosed with *C. parapsilosis* fungemia, *C. fabianii* was also identified. In the latter two cases, analysis of colonies recovered from subculturing of blood culture bottles subsequently confirmed the presence of both spp. Comparative phenotypic studies of *C. parapsilosis* and *C. fabianii* isolates from the co-infected patient revealed that colony morphologies were indistinguishable on solid agar at 48 hours. Thereafter, *C. parapsilosis* formed smaller wrinkled colonies, comprised of a mixture of elongated and round cell morphologies, whereas *C. fabianii* demonstrated round small cells, and formed smooth, big colonies. In addition, *C. parapsilosis* showed increased agar invasion and echinocandin resistance. *C. fabianii* had increased growth rate, biofilm formation and resistance to neutrophil killing.

Conclusion. Mixed *Candida* spp. may account for more cases of fungemia than currently recognized by clinical laboratories. In some cases, failure to detect mixed spp. infections can have important clinical implications, including failure to appreciate antifungal resistance. It is possible that complementary phenotypic or virulence characteristics between isolates of different spp. may potentiate pathogenesis. More efficient methods of screening for mixed *Candida* spp. infections are needed for clinical laboratories.

Disclosures. **All authors:** No reported disclosures.

421. Babesiosis: Retrospective Review of 38 Cases from Upper Midwest

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Background. Babesiosis is a tick-borne illness caused by protozoal infection of the genus *Babesia*. Clinical presentation varies widely from asymptomatic to rapidly fatal infection and diagnosis requires a high index of clinical suspicion. It is an emerging health risk and clinicians need to be aware of its different clinical manifestations.

Methods. We retrospectively collected and analyzed data from 38 patients with babesiosis from 1990 to 2015.

Results. Mean age of patients was 63 years. 68% of patients required hospitalization with 21% requiring intensive care unit (ICU) stay. Mean length of illness before diagnosis was 15.6 days and symptoms comprised of malaise (82%), subjective fever (71%), chills (55%), anorexia (29%), arthralgia (29%), and nausea (16%). Only 47% of the patients recalled tick bites. Mean hemoglobin in the outpatients was 12.4 g/dL compared with 9.8 g/dL in the hospitalized patients ($P < 0.01$). Among hospitalized patients, mean hemoglobin for ICU admissions was 7.5 g/dL vs. 10.9 g/dL ($P < 0.01$) for those without ICU stay. Mean parasitemia was 10.1% in those requiring ICU compared with 1.4% in those admitted to the medical floor ($P < 0.01$). 28.9% had Lyme disease, and 10.5% had anaplasma coinfection. Co-morbidities included diabetes mellitus (n = 3), asplenia (n = 5), and immunosuppression (n = 3). Diagnosis was made with PCR and peripheral smear in 50% of patient whereas 50% were diagnosed with PCR alone. In 27% of patients with positive PCR, peripheral smear was negative. All patients with asplenia required hospitalization with 3/5 requiring ICU with initial parasitemia ranging from 2.5 to 28% and duration of parasitemia ranging from 10 to 142 days. Initial treatment comprised of clindamycin plus quinine in 31% of patients whereas combination of atovaquone and azithromycin was used in 69% of patients. Median duration of treatment was 10 days. Overall three patients underwent exchange transfusion with parasitemias ranging from 12.3 to 28.5%. None of the patients died during hospitalization.

Conclusion. Less than half of the patients with babesiosis recall tick bites. There is usually a delay in diagnosis of up to 2 weeks due to nonspecific nature of symptoms. In more than one-fourth of patients with babesiosis peripheral smear may be falsely negative. Hemoglobin and percentage parasitemia seemed to correlate with severity of illness.

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422. Brucellosis Regimens Comparison in a Saudi Tertiary Academic Medical Center

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Background. Brucellosis is a zoonotic infectious disease caused by *Brucella* spp. that affects multiple body systems and may lead to several complications. Saudi Arabia is one of the countries where brucellosis is endemic. The purpose of this study was to describe the epidemiological characteristics of brucellosis as well as assessing outcomes of different antibiotic regimens.

Methods. A retrospective cohort study was conducted in a Saudi tertiary academic medical center. Eligible patients were adults with confirmed brucellosis (via culture, antibody test, or both) seen between January 2008 and March 2018 who received antibiotic therapy. Endpoints included clinical cure, all-cause mortality, and length of stay (LOS). Data were analyzed using ANOVA and chi-square. A P-value of < 0.05 was considered statistically significant.

Results. Out of 580 patients screened, 79 met the criteria and were included in the study. Based on the most common regimens prescribed, patients were divided into three groups, doxycycline–rifampin–aminoglycoside (DRA) with 39 patients, doxycycline–rifampin (DR) with 28 patients, and other regimens with 12 patients. All groups did not differ in their baseline characteristics except for the location (mostly outpatients or inpatients and very few in the intensive care unit), duration of therapy, and the presence of co-infection (most patients did not have co-infections). The most common risk factor was consumption of raw dairy products and most patients had