

Background

- Understanding the local and regional epidemiology of *Candida* infections is important for planning empiric treatment regimens and guiding clinical practice.
- This is a systematic review and meta-analysis of candida infection rates in adults in Africa and Middle East (AFME).

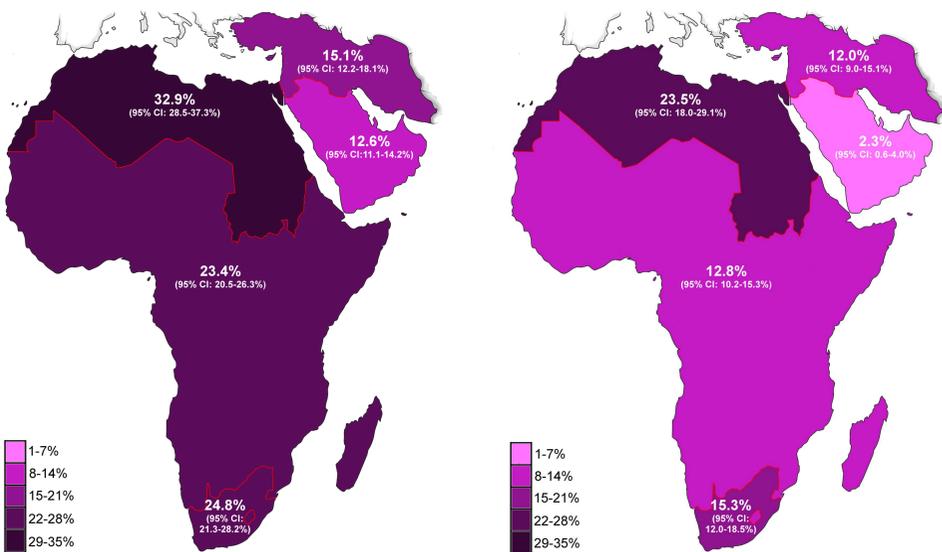
Methods

- PubMed and MedlinePlus were searched using pre-specified keywords for studies reporting candida infection rates in adults in AFME. Case reports, reviews, editorials and study protocols were excluded. Data were extracted and stratified by infection site and HIV status.
- Prevalence rates were calculated using weighted averages of patients with candida infection to all patients included. If numbers of patients are not reported, the rates of clinical samples from which candida species were isolated to total number of samples tested was used.
- Data were analyzed using Microsoft Excel and SAS 9.3 (SAS Institute, Cary, USA).

Results

- A total of 1,276 studies were identified, of which 263 (n = 217,778 patients/samples) met the inclusion criteria.
- The overall prevalence of candida infection was 18.83% (0.95 CI 16.31-21.34%). The prevalence of superficial candida infections (19.68%; 0.95 CI 16.72-22.64%) was significantly higher than invasive infections (12.42%; 0.95 CI 9.51-15.32%), (P = 0.016).
- Moreover, the prevalence of candida infections was significantly higher in HIV-infected (30.63%; 0.95 CI 26.68-34.59%) than in HIV-negative patients (15.07%; 0.95 CI 11.72-18.43%), (P < 0.001).
- Within AFME, the prevalence of candida infections was highest in north African countries (31.22%; 0.95 CI 26.62-35.83%) and lowest in the Arabian Peninsula (11.78%; 0.95 CI 10.06-13.51%), (P < 0.001), figure 1, 2, 3 and 4.

Figure 1 and Figure 2: Superficial and invasive *Candida spp.* infection rates in Africa and Middle East by region. Prevalence range is set the same in the both figures i.e. 1%-35%. In closer look, the colors are one or two shades lighter in invasive infections compared to corresponding superficial. This means that invasive infection rates are about 10% lower than superficial ones.



- C. albicans* (55.18%) was the commonest species causing invasive candida infections, followed by *C. parapsilosis* (17.40%), *C. tropicalis* (14.63%), *C. glabrata* (12.44%), *C. dubliniensis* (6.64%), *C. guilliermondii* (6.52%) and *C. krusei* (4.62%).
- However, superficial candida infections were predominated by *C. albicans* (76.92%), followed by *C. parapsilosis* (28.83%), *C. glabrata* (11.27%) and *C. tropicalis* (9.00%).
- Proportion of *Candida albicans* among all *Candida spp.* varied between invasive vs. superficial and among different regions in Africa and Middle East, figure 5, 6.
- Over the years in which the studies were reported, the prevalence of candida infection remained stable (r = 0.01, P = 0.8), but the proportion of infections caused by *C. albicans* decreased significantly (r = -0.24, P = 0.002).
- Overall attributable mortality was 29.01% (range 12.26 – 78.57%).

Conclusions

- The prevalence of superficial and invasive candida infections is relatively high in AFME region with decreasing proportion of *C. albicans* with more recent year of study.
- These data have direct clinical management implications for the region.

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Figure 3 and Figure 4: Superficial and invasive *Candida spp.* infection rates in Africa and Middle East by country. Superficial candida rates ranged from 0% to 85% while invasive rates ranged from 0% to 33%. Therefore two sets of color shades are used. While data for superficial infection were from about 2/3 of countries in AFME, for invasive infection less data were reported.

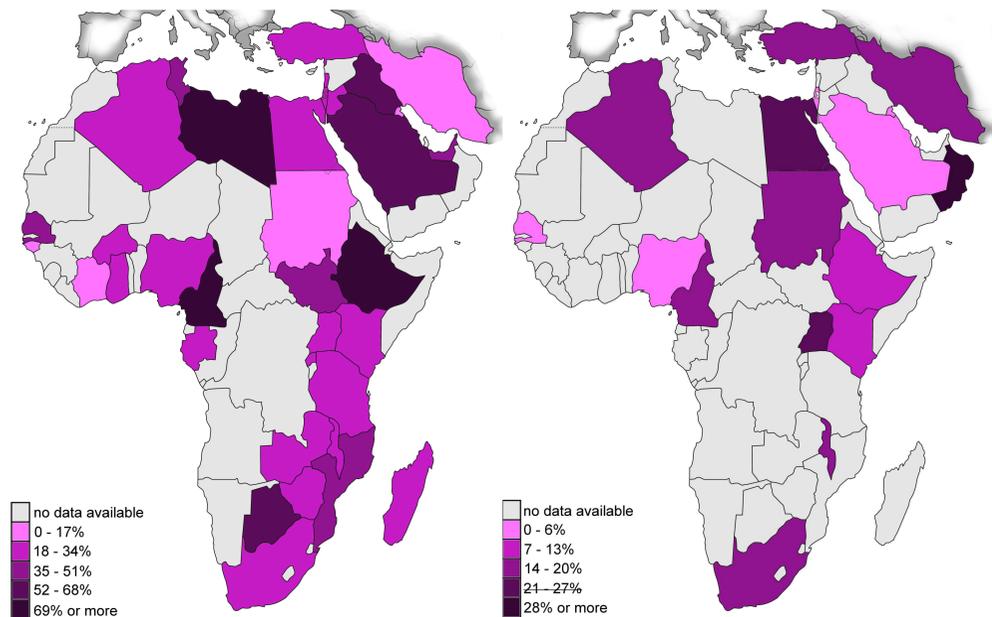


Figure 5: *Candida albicans* as proportion of all *Candida spp.* among invasive and superficial infections and among HIV negative and HIV positive patients in Africa and Middle East. *Candida albicans* is more common among patients with superficial infection or among HIV positive. While the difference is highly significant between superficial vs. invasive infection (p<0.001), it is not significant between HIV positive vs. HIV negative subgroups (overall p=0.1596, superficial vs. HIV infection p=0.013, invasive vs. HIV infection p=0.518).

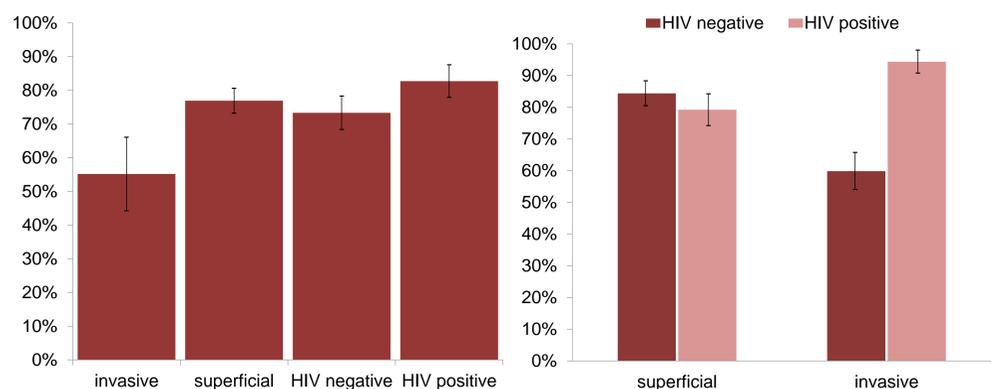
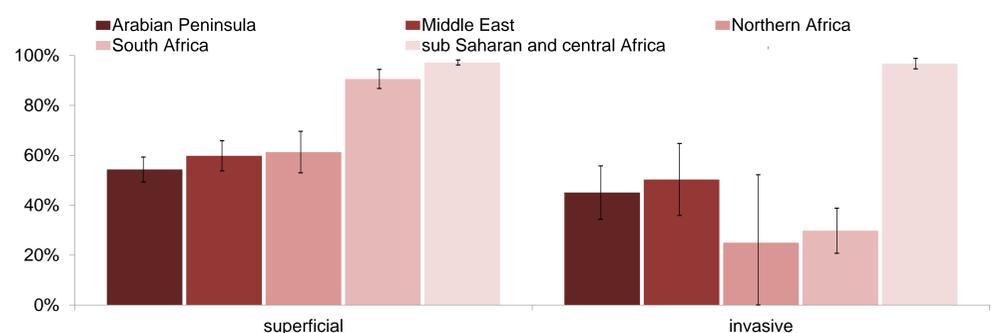


Figure 6: *Candida albicans* as proportion of all *Candida spp.* among different regions in Africa and Middle East. The percentage of *Candida albicans* among all *Candida species* was highest in the sub Saharan and central African regions and lowest in the Middle East and Arabian Peninsula (overall p<0.001, superficial infection vs. region p<0.001, invasive infection vs. region p<0.001).



- Prevalence of *C. albicans* superficial infections was highest in Sub Saharan and central Africa (22.74%), followed by the South African region (22.44%), Northern Africa (20.16%), Middle East (9.06%), and lowest was in Arabian Peninsula (6.85%).
- Prevalence of *non-albicans Candida spp.* superficial infections was highest in Northern Africa (12.75%), followed by Middle East (6.09%), Arabian Peninsula (5.76%), South Africa region (2.33%) and lowest was in Sub Saharan and central Africa (0.66%).
- Prevalence of *C. albicans* invasive infections was highest in Sub Saharan and central Africa (12.34%), followed by Middle East (6.05%), Northern Africa (5.88%), South Africa region (4.56%) and lowest was in Arabian Peninsula (1.03%).
- Prevalence of *non-albicans Candida spp.* invasive infections was highest in Northern Africa (17.64%), followed by South Africa region (10.73%), Middle East (5.98%), Arabian Peninsula (1.25%) and lowest was in Sub Saharan and central Africa (0.42%).