

## Phylogenomics of malaria and other apicomplexan parasites

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Apicomplexa are obligate intracellular parasites, many of which are responsible for diseases in human and other animals including malaria. They have small genomes, and have lost some distinct pathways which may contribute to pathogenicity and drug resistance. A comparative and phylogenomic analysis of 43 apicomplexa was conducted in the context of cellular, molecular, metabolic and evolutionary processes. Phylogenomic alignment was constructed by concatenating 522 genes from the core genome. We found significantly distinct relationships among hierarchical clusters of distance of phylogenomic, pairwise shared genes and pathways and only plasmodiums were found congruent among all the clusters. The number of some pathways varies substantially in different species, but some pathways remain almost same, with 41 pathways found in all species examined. Amino acid frequency in the whole genome is found highly variable compared to core genome and significantly correlated with GC (guanine-cytosine) content. Most of the malaria specific genes were found to be invasive. We have found significant correlations between proteome size and pathways in these organisms for metabolic pathways and informational genes. This data is consistent with the idea that information content of a genome exerts a selective pressure on genes necessary for genetic fidelity.

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## Management of MERS CoV cluster in A hospital, Eastern Province, KSA

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**Background:** In August 2014, there was a report on striking rise in positive cases of MERS-CoV in A Hospital in Saudi Arabia (SA) after unprotected exposure to MERS-CoV patient. This report describes the outbreak investigation, finding and response.

**Methods:** Rapid response team was activated and mobilized to the medical institute. Epidemic investigation was conducted. Epidemiological data regarding patients and health care workers in relation to unprotected exposure was collected. Based on risk stratification, expanded surveillance among health care workers including housekeepers and maintenance was conducted. In addition, information about environmental and infection control measures implementation were collected. Gaps were identified, a plan to close gaps was initiated and implemented by rapid response team in collaboration with hospital' stakeholders and designated staff. The plan consist of many aspects including infection prevention and control education, infection control measures auditing, case finding and management. This was continued and audited for 14 days after last reported laboratory confirmed results.

**Results:** During surveillance period, 8 cases of HCWs (2 physicians, 6 nurses), and two patients in addition to the index case were positive to MERS CoV. One physician, and 2 patients had no direct contact with the index case. No additional cases were identified after implementation of infection prevention and control measures in the hospital.

**Conclusions:** The outbreak of MERS-CoV was contained after implementing infection prevention and control measures. Early



case identification and risk stratification might played a major role in containing the cluster.

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## A place for ceragenin and LL-37 peptide in treatment of urinary tract infections

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**Background and purpose:** Urinary tract infections (UTIs) are one of the most common causes of medical intervention. High recurrence rates and increasing antibiotic resistance among uropathogens constitute a large social and economic problem. The most common agent of UTIs is Gram-negative uropathogenic *Escherichia coli* (UPEC). We used a set of experiments to investigate whether combination of ceragenins (CSAs) with LL-37, a peptide that is naturally expressed in the urinary tract, can be an effective treatment against extra- and intracellular pathogens associated with UTIs.

**Methodology:** Extracellular activity of tested agents both alone and in combinations was evaluated using a killing assay. We also assessed the effects of LL-37 peptide and ceragenin CSA-131 against intracellular *E. coli*, a clinical isolate obtained from patients diagnosed with reoccurring UTIs. The CFU (CFU/ml) of the intracellular *E. coli* was determined from the dilution factor and was used to calculate the percentage of bacterial outgrowth.

**Results:** Our results indicate that the CSA-131 activity can be enhancing by presence of endogenous LL-37 peptide. Such a combination was found to be more effective in eliminating extra- and intracellular *E. coli*. The combination of CSA-131 with LL-37 killed approximately 65% and 79% of the intracellular *E. coli* at 5 μM and 10 μM concentrations, respectively. Moreover, 10 μM of CSA-131 with LL-37 completely eliminated the intracellular *E. coli*.

**Conclusions:** We suggest that combinations of natural LL-37 peptide with ceragenins, such as CSA-131, possess the potential to treat urinary tract infections caused by drug-resistant bacteria. Moreover, intracellular activity of these combinations appears to be well suited for treatment of recurrent UTIs.

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## Reporting 4 *Candida auris* in National Guard Hospital, Riyadh/ Saudi Arabia

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**Introduction:** *Candida auris* was described initially in 2009 as a new species of the genus *Candida* in Japan, since then it has been reported to cause healthcare-associated infections, and hospital outbreaks from many countries in different continents. In 2016, the Center for Disease Control (CDC) and Public Health England have



issued a warning about the emergence of *Candida auris*; which is mostly multi drug resistant and has been associated with severe infections, and hospital outbreaks.

We present 4 cases associated with the isolation of *C.auris*, in National Guard Health Affairs (NGHA), Riyadh, KSA.

#### Cases:

- A 68 year old male was admitted to NGHA as a case of sub-acute massive stroke with respiratory failure, his respiratory and urine cultures grew pure *Candida auris*.
- A 54 Y/O male who was transferred to our institute from another hospital with deep intracerebral hemorrhage, whose urine cultures grew *C.auris*.
- A 61 Y/O male admitted to NGHA with lung carcinoma; *C.auris* was isolated from urine cultures.
- A 78 Y/O male, transferred to NGHA as a case of pulmonary and spinal TB; *C.auris* was picked up from a surveillance culture, which was implemented by IP&C at NGHA after the isolation of *C.auris* from other patients.

**Method:** All isolates that are germ tube negative, growing at 37degree on SDA, negative for pseudohyphae on Corn Meal Agar, were identified as *Candida auris* using VITEK® 2 system (bioMérieux, France), version 8.01, following the CLSI guidelines.

MALDI-TOF, version 3.0 failed to identify.

**Conclusion:** *C.auris* is becoming of clinical significance in hospitals, given concerns to its resistance, transmission and misidentification, infection control precautions should be applied to patients colonized or infected with *Candida auris*.

*C.auris* remains an unnoticed pathogen in routine microbiology laboratories, as 90% of the isolates characterized by commercial identification systems are misidentified as *C. haemulonii*.

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### Two-Tiered Approach to Control Multidrug Resistant Organisms Infections Using Centers of Disease Control (CDC) Based Care Bundles in King Abdulaziz Hospital, Jeddah



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**Background:** Multidrug-resistant organisms (MDROs) are a global threat that has severe impact on morbidity and mortality. Successful prevention requires administrative leadership and human resource commitment. This gave rise to the two-tiered approach for MDROs control. In the first tier are the baseline measures that define the problem. For uncontrolled problems, additional actions are selected from the second tier interventions. Purpose: To control MDROs incidence through implementation of a CDC based two-tiered MDROs control and antimicrobial stewardship programs.

**Methods:** The project was planned through PDCA four phases approach starting November 2017–February 2018 (figure1). MDROs incidence was calculated according to CDC MDRO & Clostridium difficile Infection Module, January 2017 as: number of hospital acquired infections (HAIs) by MDROs per thousand patient days. Phase1: Root Cause Analysis and surveillance was performed to identify the problem (figure2). Antimicrobial resistance was determined using Phoenix and MicroScan WalkAway systems. The methicillin-resistant *Staphylococcus aureus* DNA was detected by

automated BDMax instrument using BDMax MRSA XKit (Quebec, Canada). Phase2: Baseline measures such as on-job training regarding CDC based ventilator, central line, urinary catheter, surgical site and MDROs care bundles (figure3). Monitoring of hand hygiene compliance, surface disinfection, contact isolation precautions, HAI surveillance and antibiotic use. Phase3: Intensified measures were started in ICU as close auditing for link nurses participation in care bundles implementation and active surveillance. Phase4: Follow up measures and strict implementation of care bundles. Control measures were extended till December 2018.

**Results:** Overall MDROs incidence was reduced from 11.9 to 6.4/1000 pt days. ICU MDROs incidence was reduced from 64.4 to 12.9/1000 pt days (figures4&5). Follow up monitoring showed overall and ICU MDROs incidence of 6.8 and 10.8 per 1000 pt days respectively.

**Conclusions:** Intensified measures in ICU revealed marked reduction of MDROs incidence compared to baseline measures implemented in all departments.

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### Knowledge, attitude and practice towards droplet and airborne isolation precautions among pre-clinical medical students



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**Background:** Airborne transmission refers to infectious agents that are spread via inhalation droplet nuclei (residue from evaporated droplets) containing infective microorganisms that remains suspended in the air for long periods of time. They infect others via the upper and lower respiratory tracts.

**Objectives:** To obtain information about the knowledge, attitude and practices in regard to airborne infection related precautions among the undergraduate students.

**Method:** A cross sectional study conducted at OMC Sohar. Students in preclinical years asked to participate by simple random sampling. Data was collected by a self-filled questionnaire. Data analyzed in SPSS for frequencies and percentage.

**Result and Discussion:** 73 students participated in the study, 97% were female. 4th Year (Mean rank–49.07) and 5th Year (Mean rank– 29.05) student's responses differ significantly ( $p < 0.001$ ) in their responses about statements regarding knowledge about airborne germs and infections. 4th Year (Mean rank - 45.34) and 5th Year (Mean rank – 31.5) student's responses differ significantly ( $p = 0.005$ ) in their responses about statements regarding diseases those spread through inhalation of contaminated air. 4th Year (Mean rank–46.36) and 5th Year (Mean rank– 30.83) student's responses differ significantly ( $p = 0.002$ ) in their responses about statements regarding safety measures and airborne germs transmission prevention. 4th Year (Mean rank – 43.81) and 5th Year (Mean rank–32.51) student's responses differ significantly ( $p = 0.024$ ) in their responses about statements regarding knowledge about personal protective equipment's.

**Conclusion:** Students in pre-clinical years has insufficient knowledge regarding droplet and airborne infection and isolation precautions, however the responses are significantly differ in 4th and 5th year medical students.

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