

1768th Conference

INFECTION CONTROL & MICROBIAL PATHOGENESIS 2018



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e-Poster Presentation

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Seroprevalence and hematological investigation of toxoplasmosis in female population of Lahore, Pakistan

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Toxoplasmosis is a wide spread zoonotic infection of warm blooded animals including humans all over the world. This infection caused by a Protozoon parasite *Toxoplasma gondii*. The parasite completes its life cycle in both humans and cats. It causes severe congenital abnormalities such as hydrocephalus and mental retardation in infants. Keeping in view the importance of this parasite, the present study was designed to study the seroprevalence of toxoplasmosis and to investigate the hematological changes in female population in Lahore. Fresh blood of females were used for analysis of hematological changes, while serum was analyzed to estimate the seroprevalence of toxoplasmosis by using ELISA technique and all the information was collected with the help of questionnaire and analyzed to find out the risk factors. Overall prevalence in female population in Lahore was found 27%. Among pregnant and non pregnant females prevalence rate was 31% and 24% respectively. Prevalence rate was higher in housewives as they are usually in direct contact with vegetables during food preparation *T. gondii* infection was found more in those who had contact with cats or any pet animal. Hematological parameters of samples were analyzed Hb and PCV level decreased and lymphocyte and neutrophil count was significantly increased in infected females. Health education and public awareness is needed to reduce the infection rate in local population of Lahore.

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Notes:

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The threat of zoonotic diseases and Ebola Virus Disease specifically

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Public health systems are not always prepared for outbreaks of infectious diseases. Although in the past several public health institutes, like the French 'Institut Pasteur' and the Dutch 'Tropeninstituut', were prominent surveyors of infectious diseases, the investments in worldwide public health have decreased. Now more attention is given to curative healthcare compared to preventive healthcare. The recent Ebola Virus Disease outbreak in West Africa initiated a new wave of interest to invest in Worldwide Public Health to prevent outbreaks of highly contagious diseases. Zoonotic diseases are threatening as the population does not have natural nor artificial (from vaccination) immune response to new diseases like in the Ebola Virus Disease outbreak in 2014. The new strain of the Ebola Virus in West Africa was slightly less lethal, compared to other Ebola Virus strains, but the threat of spreading was far bigger as it had a longer incubation time. Most public health systems are not trained well enough to mitigate highly infectious and deadly disease outbreaks. NGO's helping to fight the outbreak are often better trained in curative treatments and have less experience with biological (bioweapon) threats for which the military are trained for. The UNMEER mission was unique in this. It was a setting in which military and civilian actors cooperate in fighting a biological threat. Protection is essential for health workers. Smart systems have to be developed to prevent further spreading of the disease, but it is not only the biosafety, which has to be considered, but also the biosecurity, as misuse of extremely dangerous strains of microorganisms cannot be excluded. Several zoonotic infectious diseases, like anthrax, smallpox and haemorrhagic fevers are listed as potential bioweapons. Therefore both biosafety and biosecurity have to be implemented in all measures to fight outbreaks of highly infectious diseases.

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E-BABE- Use of nano-plates for detection of pathogenic bacteria in water tubes

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Nanotechnology is an emerging field that covers a wide range of disciplines, including the frontiers of chemistry, materials, medicine, electronics, optics, sensors, information storage, communication, energy conversion, environmental protection, aerospace and more. It focuses on the design, synthesis, characterization and application of materials and devices at the nanoscale. Nanomaterials are the foundation of nanotechnology and are anticipated to open new avenues to numerous emerging technological applications. Nanotechnology has grown very fast in the past two decades because of the availability of new approaches and tools for the synthesis, characterization, and manipulation of nanomaterials. The purification of drinking water is a primary environmental application of nanotechnology. Contamination and over freshwater resources. Seawater is becoming a recognized source for drinking water, as freshwater becomes significantly scarce. We use the iron oxide nanoplates carried with specific virus that detect the Pathogenic bacteria (E.COLI) in water tube as an indicator for the pathogenicity of the water tube and as a method for choosing the suitable way for water purification.

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Sexually transmitted infections: Knowledge, perceptions, and attitudes of youth in a mining community, a focus group discussion study of obuasi municipality of Ghana

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Sexually transmitted infections (STIs) remain a public health problem globally with youth disproportionately affected by the epidemic. Furthermore, high prevalence of STIs have been linked with mining communities in the literature. The combined effect of being young and resident in a mining community therefore increases the vulnerability of this population to STIs. It is against this background that the study seeks to ascertain the knowledge, attitudes, and perceptions of STIs among youth in the Obuasi mining community. Using a qualitative approach, five focus group discussions that recruited 52 participants aged 15-24 years were conducted. The main themes for the FGDs were knowledge, perceptions, and attitudes on STIs. Results from the study revealed that youth in the mining community had fair knowledge of STIs generally, however, this knowledge is limited and fraught with misconceptions such as, candidiasis is an example of STI, oral contraceptives can prevent STIs, and all STIs are viral infections. It was also found that condom use is a preferable STI prevention method for the youth, yet they do not have extensive knowledge about condom use. Moreover, stigma, shame and unavailability of testing and treatment centers at the community level are major barriers to youth sexual health improvement and STIs control generally. Since behavior change which is influenced by knowledge, attitudes and perceptions is vital to the fight against STIs among the youth, any future interventions for STIs should include or better still target increasing STI knowledge, and improving attitude of youth in mining communities.

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Host induced gene silencing for pest/pathogen control

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Commercial crops, such as corn, wheat, and soy are subject to damage from a variety of biotic and abiotic sources, leading to reduced yields and a loss of income. There are a variety of strategies available to mitigate damage from biotic sources, including breeding for improved resistance, the application of pesticides, and crop rotation. Genetic engineering methods offer additional methods. One such method, host induced gene silencing (HIGS) is an approach that shows promise for the control of a variety of problematic crop-damaging organisms, ranging from nematodes and insects, to fungi and parasitic plants. In general, HIGS utilizes RNA interference (RNAi) molecules produced by the plant, which then target key genes in pests/pathogens, ideally leading to improved resistance of the plant and a reduction in damage. This approach has been demonstrated to be effective in both laboratory and field settings, in a variety of host plants and targeting diverse pests/pathogens. Currently, no HIGS-protected crops are being used in a commercial setting. As this area of research is still very much in development, the possible off-target and non-target effects need to be assessed, as do the long-term stability and effectiveness. Practical implementation of HIGS to commercial crop production will rely on extensive field-testing, as well as regulatory and marketplace acceptance of new varieties.

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Vitamin D deficiency in hepatitis C virus infection: What's old? What's new?

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In the last few years, a growing body of clinical evidence has highlighted the risk of vitamin D deficiency in chronic hepatitis C patients and that vitamin D levels are associated with the course of hepatitis C virus infection, adverse effects and treatment response to peginterferon/ribavirin. Recently, studies have found that vitamin D status is related to drug resistance and increased risk of infection in patients with liver cirrhosis. Vitamin D-related gene polymorphisms have been found to explain the interactions between vitamin D deficiency and HCV infection, offering a new perspective to understand current problems such as the development of insulin resistance and racial differences in sustained virological response. Studies have been conducted to determine whether vitamin D supplementation as an adjuvant yields a better result compared to traditional HCV treatment. Here, we provide a brief review of the past and present knowledge of vitamin D in HCV infection.

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Bacterial dissemination and molecular surveillance in public hospital in South Africa

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In South Africa it is estimated that approximately 1 in 7 patients entering South African hospitals are at high risk of acquiring a hospital-acquired infection (HAI). Quantitative cross-sectional studies were performed in four public hospitals in the eThekweni district of KwaZulu-Natal province, South Africa from September to November, 2017. Focus was on three wards viz. intensive care unit, paediatric ward and general male ward. Within each ward 5 sites were swapped viz. drip stand, patient files, patient bed, sink and ward reception. DNA was extracted using PureLink Microbiome DNA purification kit followed by amplification of the V3-V4 region of the 16S amplicon. Resulting PCR product was sequenced on an Illumina® MiSeq platform. Metagenomic data analysis revealed distinct diversity in the microbial populations associated with various hospital sites investigated. Bacteria made up more than 85% of the DNA reads compared to viruses or unclassified kingdom levels. Proteobacteria followed by Bacteroidetes and Firmicutes are the top phylums. The class mostly presented is Gammaproteobacteria, Flavobacteria and Baccili. The highest frequency of bacteria originated from the order Pseudomonadales and Enterobacteriales. The common families found was Moraxellaceae and Enteriobacteriaceae. As expected, *Acinetobacter* was found at genus level, but the variety of species was a surprise. Contact with contaminated surfaces in the health care setting attributes to cross infection. Variations was found within sites, wards and between hospitals. The information can assist IPC officers to deal with the hospital “microbiota” and a guideline to ascertain any shifts or variation in bacteria composition.

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An advanced uracil DNA glycosylase-supplemented loop-mediated isothermal amplification (UDG-LAMP) technique used in the sensitive and specific detection of *Cryptosporidium* spp. in AIDS patients

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The rapid and accurate detection of *Cryptosporidium* spp. is critically important for the prevention and timely treatment of cryptosporidiosis in AIDS patients (APs). This study was conducted to examine a UDG-LAMP technique for the first time to diagnose cryptosporidiosis in APs. After collecting demographic and clinical data, three stool samples were collected from the participants (120 volunteering APs). The microscopic examination of stained smears using the acid-fast method and the UDG-LAMP assay were performed for each sample. 10% of APs were infected with *Cryptosporidium* spp. The number of detected cryptosporidiosis cases using the acid-fast staining and UDG-LAMP methods were significantly different ($P < 0.001$). Diarrhea and weight loss were found to be significantly associated with cryptosporidiosis in patients ($P < 0.05$). The pretreatment of LAMP reagents with UDG successfully eliminated the likelihood of product re-amplification remaining from previous reactions. The UDG-LAMP technique could detect cryptosporidiosis in APs with high sensitivity and rapidity without carryover contamination.

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Exploring the climatic and land use factors behind the 1999 Vancouver Island outbreak of *Cryptococcus gattii*

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Why do infectious diseases emerge where they do? Climatic and land use changes are considered the two major factors, with increasing debate around which factor is more important. In Canada, a fungus called *Cryptococcus gattii* emerged on Vancouver Island in 1999 for unknown reasons, capable of causing a potentially fatal respiratory and neurological disease upon inhalation of its spores. The research project proposed here aims to investigate the environmental factors behind the emergence of *C. gattii* on Vancouver Island using geographic information systems and remote sensing. Environmental data (e.g. seasonal temperature, precipitation, etc.) at 30-m resolution for Vancouver Island were collected from the ClimateBC program for 1984-2012. Annual land cover and forest harvest data, as well as elevation, were also used. Georeferenced *C. gattii* occurrence records provided by the British Columbia Centre for Disease Control were used to determine the corresponding environmental data at their time of collection and in the years prior to isolation. This oral presentation will show the results of these analyses, focusing on common environmental traits of areas where *C. gattii* was isolated from the environment. How did these areas (i.e. grid cells) change in the 10-15 years prior to *C. gattii*'s isolation in that area?

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Evaluation of histopathological effects of contaminated unexpired gentamicin and penicillin g injections on the kidney tissues of juvenile wistar rats

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The histo-pathological effects of contaminated gentamicin and penicillin G injections on the kidney tissues of juvenile wistar rats have been investigated using standard microbiological and histo-pathological techniques. Freeze-dried and heat fixed thin sections of wistar rats' kidney were observed under the microscope using x10, x40 and x100 magnifications. The results revealed marked necrosis and erosion of proximal borders especially the focal epithelium of proximal convoluted tubules (PCT) of the kidney, with the retention of the cyto-architecture. Plasmolysis was observed in the epithelial cells of the distal convoluted tubules (DCT) when treated with contaminated unexpired gentamicin injection sample as compared with control. Glomerular hypoplasia and fibrosis of the Bowman's space occurred in the kidney when compared with the control. Also medulla interstitial oedema leading to focal tubular fibrosis as a result of microbial activity was observed when compared with control. Interstitial hemorrhage which led to complete tubular necrosis with loss of defined tubular cyto- architecture was observed. This effect made the tissue fibrous, resulting in a non-functional or shrunken kidney as compared to control. Results obtained from this work has raised serious health concerns, considering the risk posed by contaminated drugs on patients.

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Gut microbiota and Antibiotic resistance

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Bacteria, viruses, parasites and fungi that are resistant to drug cause 700,000 death each year. By 2050 superbugs inured to treatments could cause up to 10 million deaths annually and costs the global economy US\$100 trillion. AMR (antimicrobial) resistance is regarded nowadays as a major threat to global public health. The issue is receiving high-level political attention (G7 and G20 in 2017 for first time). The list was drawn up in a bid to guide and promote research and development (R&D) of new antibiotics, as part of WHO's efforts for AMR (27th Feb 2017) Resistance to antibiotics may arise in a population of susceptible bacteria by the accumulation of mutations (e.g. point mutations in DNA gyrase conferring resistance to quinolones) or by the acquisition of resistance genes that protect the cell against antibiotics. Antibiotic resistance genes can cause phenotypic resistance through a variety of mechanisms, including the enzymatic inactivation of the antibiotic, the modification of the antibiotic target and the prevention of the accumulation of lethal intracellular concentrations of the antibiotic through efflux pumps Problem of resistance get worsened due declining number of new antibiotics and limited number of new classes direct research to look for alternatives. Additionally, antibiotics shape the ecology of the gut microbiota in profound ways, causing lasting changes to developing and mature microbiotas. The application of next-generation sequencing has enabled detailed views of the side effects these drugs have on commensal populations during treatment of infections. The human gut thus harbours a complex microbial ecosystem, which consists of hundreds of species, collectively termed the gut microbiota. This interaction between microbiota appears to be bidirectional, namely through signaling from gut-microbiota to brain and from brain to gut-microbiota by means of neural, endocrine, immune, and humoral links. Negative impact on composition and functionality microbiota given existing immune crosstalk including "innate cell immunity training" impact host immune response capacities observed in recent research. Imbalances in the gut microbiota can induce inflammation that is associated also with the pathogenesis of obesity, type 2 diabetes mellitus, and Alzheimer's disease. In conclusion, alternative directions considering strongly their role on host microbiota and immune system modulation should be strongly promoted while tackling issue of antibiotic resistance.

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Prevention of healthcare-associated infections in neonates: Room for improvement

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Infants in neonatal intensive care units (NICUs) are highly susceptible to infection due to the immaturity of their immune systems. Healthcare-associated infections (HCAIs) are majorly associated with prolonged hospital stay, and could be a potential significant risk factor for neurological development problems and death. Improving HCAI control is a priority for NICUs. Many factors contribute to the occurrence of HCAIs in neonates such as poor hand hygiene, low nurse infant ratios, environmental contamination and unnecessary use of antibiotics. Prevention of HCAIs is based on improving neonatal management, avoiding unnecessary usage of central venous catheters, restriction in usage of antibiotics and H2 blockers, and introducing antifungal prophylaxis if necessary. Quality improvement interventions to reduce HCAIs in neonates seem to be the cornerstone of infection control.

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Nurses' knowledge, behavior and compliance concerning infection prevention in nursing homes: A cross-sectional mixed-methods study of organizational influences

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Aim: To study the impact of organizational factors on nurses' knowledge, behavior and compliance concerning hygiene management and infection prevention in nursing homes.

Background: The spread of nosocomial infections is a cause of morbidity and mortality.

Methods: Mixed-methods study with concurrent triangulation strategy. 165 nurses and 27 nursing managers from nursing homes in Germany participated in survey and interviews.

Results: Most nurses and nursing managers held knowledge of effective hand hygiene measures. Hygiene standards and equipment were all available but compliance to standards also depended on availability in the immediate work area. Nursing managers did not reflect on the impact of their own consistent role modeling for nurses regarding infection prevention behaviors.

Conclusion: Improved knowledge through hygiene training is unlikely to change infection prevention behavior in nursing homes if not accompanied by a shared attitude towards compliance with hygiene standards and consistent role modeling by nursing managers.

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Effect of using collaborative quality improvement of infection prevention in tertiary Care Hospital, Bangkok Thailand

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Hospital-associated infections (HAIs) has an impact on patients, personnel and the hospital. This an interrupted time series design study aimed to assess the effect of using collaborative quality improvement (CQI) of infection prevention in tertiary care hospital. The samples were selected by purposive sampling from the patients, who were HAIs and admitted into 6 intensive care units (ICUs) and 36 general wards. Data were collected from May, 2017 to January, 2018. The study instruments were a surveillance form of HAI and impacts of HAI form developed by research. Data were analyzed using descriptive and multiple linear regression statistics. The results revealed that reduction in HAIs, from 35.7 % (1,219/3,417 patients) before implementing CQI to 27.6 % (994/3,608 patients) after implementing CQI at a 0.05 statistically significant levels. Indicated the highest infection rate was from ventilator-associated pneumonia (VAP) 5.6 per 1,000 ventilator-days, followed by catheter-associated urinary tract infection (CAUTI) 3.1 per 1,000 catheter-days and central line-associated bloodstream infection (CLABSI) 1.9 per 1,000 catheter-days. Case fatality rate from VAP, CLABSI and CAUTI were 38.4%, 31.7% and 17.3%. Cost of antibiotic treatment for VAP, CAUTI and CLABSI were 91,153.45 USD, 74,342.72 USD and 20,114.27 USD, respectively. These finding imply that the concept of CQI could be applied to reduce incidence and preventive of HAIs. However, it is interesting to see if the results are sustainable and hospital still proceed with their work.

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Synthesis, antimicrobial efficacy and structure-activity relationships of three series of benzalkonium salts

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Three series of N-alkylammonium salts (7a-c, 8a-b, 9a-b) based on quaternary ammonium compounds with a different length and type of carbon chain (C_{12} , C_{14} , C_{16}) were synthesized, characterized (EA, HRMS, NMR) and tested *in vitro* for antimicrobial (antibacterial, antifungal and antialgal) activity. Furthermore, the critical micelle concentration (CMC), capacity factors k and cytotoxicity were likewise measured to elucidate possible structure-activity relationships. The antimicrobial activity of the prepared compounds has been evaluated and compared. All compounds being tested proved high efficacy against both Gram-positive and Gram-negative bacterial strains, excluding the activity against multi-resistant *Pseudomonas aeruginosa*. Antifungal testing showed high activity of most compounds against fungal strains (yeasts and filamentous fungi) except of *Aspergillus niger*. The relationship between length of carbon chain and the efficiency has been observed. Series 7a-c proved high antialgal efficacy. Cell viability assay confirmed an expected trend that increasing carbon chain length results in higher cytotoxicity.

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Recent challenges posed by the outbreak of Listeriosis in South Africa: Lessons from this incidence

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The recent outbreak of listeriosis in South Africa was the largest in the world in recent times. As a researcher who has done work on the foodborne pathogen I found that the lack of knowledge about the pathogen led to its vast spread around the country. More than 980 cases were reported and 183 fatalities were reported by the National Institute for Communicable Diseases (NICD). Initially the source of the listeriosis outbreak was not known. It was eventually reported by South Africa's Minister of Health that the source of outbreak of listeriosis was identified. The three food processing factories were found to be the three sources of listeriosis outbreak. The processed ready to eat meat products were the source of listeriosis. The investigations took more than a year to determine the source of the outbreak. The ready-to-eat meat processed meat products that were found to be the carriers of listeriosis from the affected factories were polonies, viennas, Russians and all other cold meats. What I have learnt from this incidence was the slow response for all the role players in food safety and environmental health. We did not respond immediately when the outbreak occurred. Listeriosis was not a notifiable disease like in other countries. It was only made a notifiable disease recently after more than 176 deaths were reported. Other lessons learnt from this outbreak is that hygiene education, food safety, and public health is very crucial and should start from the household to the community at large.

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Risk factors of multi-drug resistant tuberculosis among pediatric patients: A retrospective cohort study

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Risk Factors of Multi-Drug Resistant Tuberculosis Among Pediatric Patients: A Retrospective Cohort Study: Determines the risk factors of pediatric patients diagnosed with MDR-TB. Conducted in a tertiary hospital in Quezon City and Health Centers from January 2011 to December 2016. A minimum cohort of 156 patients 0 – 18 years old, either bacteriologically – confirmed or clinically diagnosed tuberculosis were included in the study. Patients whose significant data of their charts went missing were excluded in the analysis. The following information were gathered a.) demographic profile: age, gender, nutritional status, socioeconomic status, district b.) clinical profile, history of exposure, results of laboratories, clinical presentation, delay in treatment, previous treatment with tuberculosis and outcome. 162 patients were analyzed, 12/162 had MDR – TB and 150/162 had Non MDR – TB. Results of univariate analysis showed that age and symptoms of weight loss, back pain, night sweats and fever had significant association with MDR TB. Of these factors, back pain ($p=0.001$; RR: 31.771; 95% CI: 3.801, 265.554) and fever ($p=0.020$; RR: 7.6587; 95% CI: 1.380, 42.494) were independent factors significantly related with MDR TB. Age, weight loss, back pain, night sweats and fever had significant association with MDR - TB. Larger sample population and a prospective study is recommended to assess the epidemiologic data and further identify other possible risk factors for resistance.

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Sexual risk behaviors among HIV-Negative and HIV-Positive black individuals living in miami-dade county

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Statement of Problem: Despite the widespread availability of testing and treatment opportunities, Black individuals living in the United States continue to disproportionately suffer from HIV and AIDS. It is the intention of this paper to understand this disproportionate risk.

Methodology: Community-Based HIV Testing and Awareness for Minority Populations (CHAMP) collected demographic data and information on sexual and other risk behaviors from 530 individuals living in historically Black communities of Miami-Dade County (MDC) who were subsequently tested for HIV.

Results: We identified several behaviors that increased risk of HIV transmission among our female and male populations. These behaviors include sex for drugs, money or other items, men who have sex with men, sex with an anonymous partner, sex with an HIV-positive partner, sex with an anonymous partner, a greater number of sexual partners, history of sexual abuse, spending time in jail or prison, and intravenous drug use. Roughly half of our HIV-positive population were aware of HIV status at the time of testing. Further, among previously diagnosed participants, 60% reported having anal or vaginal sex without a condom and 40% reported having sex with an anonymous partner during the last 12 months.

Discussion: CHAMP reported specific sexual behaviors placing Black females and males in MDC at risk for HIV transmission. With the information presented in the present study, it is clear that behavioral interventions that focus on HIV transmission and treatment, targeting both HIV-positive and HIV-negative individuals, needs to be a public health priority.

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E-BABE- An exploratory study of the factors influencing the acceptability of indoor residual spraying (IRS) in upper western Ghana

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Despite the implementation and good coverage of the WHO recommended malaria control program IRS, malaria continues to be a very serious public health challenge in upper west region compared to other regions of Ghana. We explored enablers and barriers of community uptake of this program in a highly malaria endemic region in Ghana. Between April and October, 2016 we conducted a qualitative inquiry, focus group discussion and semi-structured interviews with program stakeholders. Participants included community members, program operators and health system officials in upper western Ghana. 105 participants were involved in the study. Findings identified significant barriers to program uptake by communities including religious beliefs, superstition, and fear of insecticides among others. Enablers of program uptake by the communities included malaria prevention, efficacy of intervention, and incidental benefits. Program providers and health system officials detailed the following as a necessity to improve implementation: effective collaboration between stakeholders and the need to intensify public education. Despite challenges from both the program recipient and operator ends, IRS is an accepted intervention in the region. In order to improve the uptake and effective implementation, strategies to improve community uptake and streamline operations will be needed. These findings have policy and practice significance to improve community uptake and service operations of this novel public health intervention.

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Reverse Antibiotic-Resistance in ESBL *E. coli* using CRISPR technique and programmed bacteriophages

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Antimicrobial resistance of pathogens such as *E. coli* is a growing concern to the health care system. This increased concern of pathogen resistance to current therapies is encouraging the development of new antimicrobial strategies, and is reviving interest in traditional bacteriophage applications. Although therapeutic and prophylactic application of lytic phages has distinct advantages over conventional medical interventions, bacteria have evolved multiple defense barriers to interfere with nearly every step of phage life cycles. Phages counteract this selection pressure by evolving their genomes to evade bacterial resistance. The antagonism between bacteria and rapidly mutating viruses promotes the evolution and propagation of phage resistance mechanisms in bacteria. An adaptive microbial immune system, known as Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) provides for acquired immunity against viruses and plasmids. Unlike the restriction–modification anti-phage barrier that cleaves any foreign DNA lacking a protective methyl-tag in the target site, the CRISPR–Cas systems are invader-specific, adaptive, and heritable. In this study, we use bacteriophages for delivering a programmable DNA nuclease, CRISPR-associated (Cas), to reverse antibiotic resistance and to eliminate the transfer of resistance between strains. This novel approach combines CRISPR-Cas delivery with lysogen, lytic phage selection of antibiotic-sensitized bacteria. The strategy uses phages in a unique way that overcomes many of the hurdles encountered by phage therapy, and, therefore, may reduce the prevalence of antibiotic-resistant bacteria in designated facilities that may have concern for MDR strains.

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